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THE MEMPHIS DEPOT
TENNESSEE

ADMINISTRATIVE RECORD
COVER SHEET

AR File Number 575

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C.H. 575

FINAL SAFETY SUBMISSION
for
Chemical Warfare Materiel Investigation/Removal Action At Dunn Field
Former Defense Distribution Depot Memphis, Tennessee (DDMT)
Book 2
Volume III
Supporting Agency Plans

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TAB

Interim Holding Facility Plan

U.S. Army
Program Manager for
Chemical Demilitarization

Product Manager for
Non-Stockpile Chemical Materiel

Former Defense Distribution Depot
Memphis, Tennessee

Interim Holding Facility Plan

Final
Revision 2

January 2000

EXECUTIVE SUMMARY

This Former Defense Distribution Depot Memphis Interim Holding Facility (IHF) Plan provides a scope of effort that supports the investigation/removal action at the Memphis Depot chemical warfare materiel (CWM) burial sites in Memphis, Tennessee. This Plan was prepared for use in conjunction with information obtained by onsite inspection.

The U.S. Army Program Manager for Chemical Demilitarization (PMCD) is responsible for the destruction of all U.S. CWM. The Product Manager for Non-Stockpile Chemical Materiel (PMNSCM) is one of two PMCD project managers and is responsible for destroying non-stockpile chemical materiel (NSCM). The PMNSCM will support the Defense Logistics Agency (DLA), the Memphis Depot, the U.S. Army Technical Escort Unit (TEU), and the U.S. Army Engineering and Support Center, Huntsville (CEHNC) activities for remedial investigation and cleanup action at the depot. The temporary storage and final disposition of recovered CWM are the responsibility of PMCD. In the case of an emergency, this Plan will specify the onsite emergency coordinators, local emergency response agencies, and safety and environmental officials. The telephone numbers and resources will be available in the case of a chemical emergency and will be posted at every phone.

The Memphis Depot will be responsible for exchanging public affairs information with elected officials, state officials, and the general public. The Memphis Depot will keep PMCD Public Outreach and Information Office (POIO) informed of planned actions that have the potential to impart public perception. All information on this Plan will be distributed through the Memphis Depot.

The Memphis Depot was a 642-acre site owned by the Army and operated by the DLA. Prior to the Depot opening in January 1942, the site was used for producing cotton. The initial mission of the Memphis Depot was to provide stock control, storage, and maintenance services for the Army Engineer, Chemical, and Quartermaster Corps. During World War II, the depot served as an internment center for 800 prisoners of war and performed supply missions for the Signal and Ordnance Corps. Since 1963, the depot has been a principal distribution center for the DLA in shipping and receiving hazardous materials, textile products, food products, electronic equipment, construction materials, and industrial, medical, and general supplies. Chemical agent identification sets (CAIS) were known to be stored at the depot. Some of the ampules from these sets were found leaking and were disposed of by burial at Dunn Field of the depot. Chemical materiel known to have been used in these areas include phosgene (CG), chloracetophenone (CN), adamsite (DM), mustards (H, HS, and HD), lewisite (L), chloropicrin (PS), and triphosgene (a simulant for CG).

The IHF hazard analysis (HA) presented in annex A examines the risks of IHF operations. The HA encompasses the risks associated with handling, onsite transportation, and storage of recovered CWM. The HA findings conclude that the Memphis Depot IHF operations can be performed safely with adherence to the routine accident prevention measures described in annex A.

In preparation of the HA, potential incidents that could occur during handling, movement, or storage are discussed qualitatively. To assign quantitative values to potential risk, risk assessment codes (RACs) are identified for potential accident scenarios. A maximum credible event (MCE) is defined as a "worst-case" accident scenario that results in the release of agent and that has a reasonable probability of occurring. No MCE leading to the release of chemical agent was identified for handling, movement, and storage of recovered CWM at the Memphis Depot.

For additional information or comments about this IHF Plan, contact: Product Manager for Non-Stockpile Chemical Materiel, Attn: SFAE-CD-P/Mr. Bob Jones, Aberdeen Proving Ground, Maryland 21010-5401 or call 800-488-0648.

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SECTION 1
INTRODUCTION

The Department of Defense (DoD) has designated the Department of the Army (DA) as the Defense Executive Agent for the destruction of all United States chemical warfare materiel (CWM). The U.S. Army Program Manager for Chemical Demilitarization (PMCD) has, in turn, been given the responsibility for destroying CWM. Two separate PMCD project managers have been established for destroying the United States chemical weapons stockpile and the non-stockpile chemical materiel (NSCM). The Product Manager for Non-Stockpile Chemical Materiel (PMNSCM) is responsible for destroying the five categories of NSCM. One of these categories is buried CWM. Dunn Field at the Former Defense Depot Memphis, Tennessee, is a suspected CWM burial site. The temporary storage and the final disposition of CWM from these sites are the responsibility of PMCD. In case of an emergency, this Interim Holding Facility (IHF) Plan will specify the onsite emergency coordinators, local emergency response agencies, and safety and environmental officials. The telephone numbers and resources will be available in the case of a chemical emergency and will be posted at every phone.

The Memphis Depot will be responsible for exchanging public affairs information with elected officials, state officials, and the general public. The Memphis Depot will keep PMCD Public Outreach and Information Office (POIO) informed of planned actions that have the potential to impart public perception. All information on this IHF Plan will be distributed through the Memphis Depot.

1.1 Objective

This IHF Plan provides information to decision-makers and site personnel on the procedures for temporary storage of recovered CWM in a safe, secure, and environmentally sound manner.

To support the premise that CWM can be temporarily stored onsite, a hazard analysis (HA) was performed to evaluate the plans and procedures presented in this IHF Plan. The complete HA is presented in annex A.

When required, the following assumptions about site conditions and applicable regulations to CWM storage activities were made to develop this IHF Plan.

a. The recovered CWM will be identified and packaged in Department of Transportation (DOT)-approved containers called multiple round containers (MRCs).

b. The CWM is classified as a non-surety, hazardous waste.

c. All required environmental studies will be determined and completed by the Memphis Depot in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA). All required documentation will be completed and all necessary permits obtained prior to the execution of this plan.

d. IHF-related operations will be performed in a manner that provides safety for workers and the public

IHF operations will follow DA and other regulatory guidelines. An evaluation of regulatory requirements that may be applicable to IHF operations is presented in the Generic Site Scoping Study (USACMDA, 1993a). Some of the major requirements include:

a. A U.S. Environmental Protection Agency (USEPA) identification number must be obtained [40 Code of Federal Regulations (CFR) 264.11] for the Memphis Depot as a generator of the CWM. In this case, the number is TN4 210 020 570.

b. CWM hazardous waste must be characterized according to 40 CFR 264.13, then manifested, labeled, and reported in accordance with 40 CFR 264.70 through 77, and applicable state regulatory requirements.

c. Security guidelines provided in Army Regulation (AR) 190-11 must be implemented.

d. Appropriate signs must be posted restricting access to the facility (40 CFR 264.14).

e. Inspection procedures (40 CFR 264.15) for the IHF must be recorded and available onsite for inspection (40 CFR 264.74).

f. All facility personnel involved with hazardous waste management must be properly trained in Hazardous Waste Operations and Emergency Response (HAZWOPER) in accordance with 29 CFR 1910.120. The regulations 40 CFR 264.50 through 56 ensure that personnel can deal with emergency procedures and activate a facility contingency plan.

g. The IHF must be equipped with a secondary containment system (40 CFR 264.175), and incompatible wastes must be stored separately with separate containment structures (40 CFR 264.172).

1.2 Background

The Memphis Depot, located in the southern portion of the city of Memphis, is approximately 6 miles north of the Tennessee-Mississippi line and 8 miles east of the Mississippi River (see Site Location Map, figure 3-1). The Memphis Depot was originally named the Memphis General Depot, but was also known as Memphis Quartermaster Depot, Memphis Army Service Forces Depot, Memphis Army Depot, and Defense Depot Memphis. The Former Defense Depot Memphis was a

642-acre Army-owned site operated by the Defense Logistics Agency (DLA). Prior to the Depot opening in January 1942, the site was used for the production of cotton. The initial mission and function of the Memphis Depot was to provide stock control, storage, and maintenance services for the Army Engineer, Chemical, and Quartermaster Corps. During World War II, the depot served as an internment center for 800 prisoners of war and performed supply missions for the Signal and Ordnance Corps. Since 1963, the depot has been a principal distribution center for DLA in shipping and receiving hazardous materials, textile products, food products, electronic equipment, construction materials, and industrial, medical, and general supplies. The Memphis Depot is being closed under the Base Realignment and Closure Act (BRAC) and will be fully closed in the fall of 1999. Actions referenced in this IHF Plan as the responsibility of the Memphis Depot will be carried out by the Memphis Depot BRAC Office.

The primary area of concern is Dunn Field. The remains of K941, K942, K951/K952, K953/K954, and K955 chemical agent identification sets (CAIS) which were disposed of by burial may be recovered during the remediation process.

The intent of remedial activities is to safely locate, excavate, identify, characterize, and remove chemical agent contamination, chemical munitions, CWM, and associated debris. Activities may include non-intrusive field techniques and excavation; air monitoring; and the management of excavated scrap metal, contaminated soils, and CWM. The procedures to perform these activities are presented in the Memphis Depot Work Plan [U.S. Army Engineering and Support Center, Huntsville (CEHNC), 1999].

If CWM is recovered, it will be inspected, characterized, packaged, labeled, and manifested according to applicable Tennessee Department of Environment and Conservation (TDEC) requirements, and temporarily stored in an IHF. The function of the IHF is to provide safe, secure, and environmentally sound storage until the CWM can be transported offsite.

1.3 Potential Chemical Warfare Materiel

CWM reported (CEHNC, 1995) to have been possibly buried at the Memphis Depot includes components of CAIS containing small amounts of phosgene (CG), chloracetophenone (CN), adamsite (DM), mustards (H, HS, and HD), Lewisite (L), chloropicrin (PS), and triphosgene (a simulant for CG). These kits were used after the war to train soldiers on the identification of agents, primarily by smell, and contain low levels of the agents. A brief description of each follows:

a. *K941, Toxic Gas Set, M1.* Contains 24 glass bottles, each containing 3-1/2 ounces of mustard (H and HS) or distilled mustard (HD). Shipping cylinder is 38 inches long and 6-5/8 inches in diameter.

b. *K942, Toxic Gas Set.* Consists of 28 heat-sealed ampules each containing 3.8 ounces of mustard (H, HS, or HD). Each bottle is 1-7/8 inches in diameter and approximately 4-5/8 inches long. Each ampule has its own metal can. The round metal can is 2.68 inches in diameter and 6.34 inches high. The sets are contained in a steel drum containing 28 cans each. The total volume of agent contained in each set is 106.5 ounces, and the packed drum weighs 110 pounds. The drum is 14-inches in diameter, 14-inches high and 0.0375-inches thick (20 gauge). The cans are packaged in two layers (14 cans per layer) and are separated into individual compartments by fiberboard packaging.

c. *K951/952 War Gas Identification Set, Instructional M1.* Contains 48 Pyrex, flame-sealed ampules, 12 each containing 5 percent H in chloroform, 5 percent L in chloroform, 50 percent PS in chloroform, and neat CG.

d. *K955 Gas Identification Set, Instructional, M1 (Navy Set).* Contains seven glass bottles; four contain 3 ounces of activated charcoal on which agent is absorbed. Of the seven bottles, one bottle contains L, one bottle contains PS, and two bottles contain mustard (HS). In addition, one bottle contains 6 grams of triphosgene (a simulant for CG), one contains 15 grams of CN, and one contains 15 grams of DM.

For additional CAIS descriptions see the CAIS Information Package (PMCD, 1995).

SECTION 2
ORGANIZATION

The primary organizations that will participate in IHF activities are presented in figure 2-1. Specific details of each organization's roles and responsibilities are provided in section 7.

2.1 U.S. Army Program Manager for Chemical Demilitarization

PMCD is responsible for the proper storage, transportation, and disposal of all recovered CWM; it will coordinate activities with supporting agencies. PMCD has the program responsibility for ensuring that the storage of CWM at the Memphis Depot is accomplished in a safe and environmentally acceptable manner.

2.2 Former Defense Distribution Depot Memphis, Tennessee

The Memphis Depot will have overall responsibility for the remediation effort and have direct oversight of its contractor. PMNSCM will coordinate with the Memphis Depot to ensure that recovery activities are conducted in a safe and environmentally acceptable manner. The Memphis Depot will provide for or make arrangements for medical support and backup emergency response at the site. If CWM is discovered during the excavation activities, the Memphis Depot will become the generator of the CWM but will allow the Technical Escort Unit (TEU) to perform the recovery of CWM. The TEU will then take physical custody of the CWM during onsite transportation. Once the removal effort is complete, the TEU will transfer physical custody of the CWM to the Memphis Depot The Memphis Depot will assume responsibility to arrange for periodic monitoring and maintenance of the IHF. The Memphis Depot will not enter the IHF at any time while CWM is being stored.

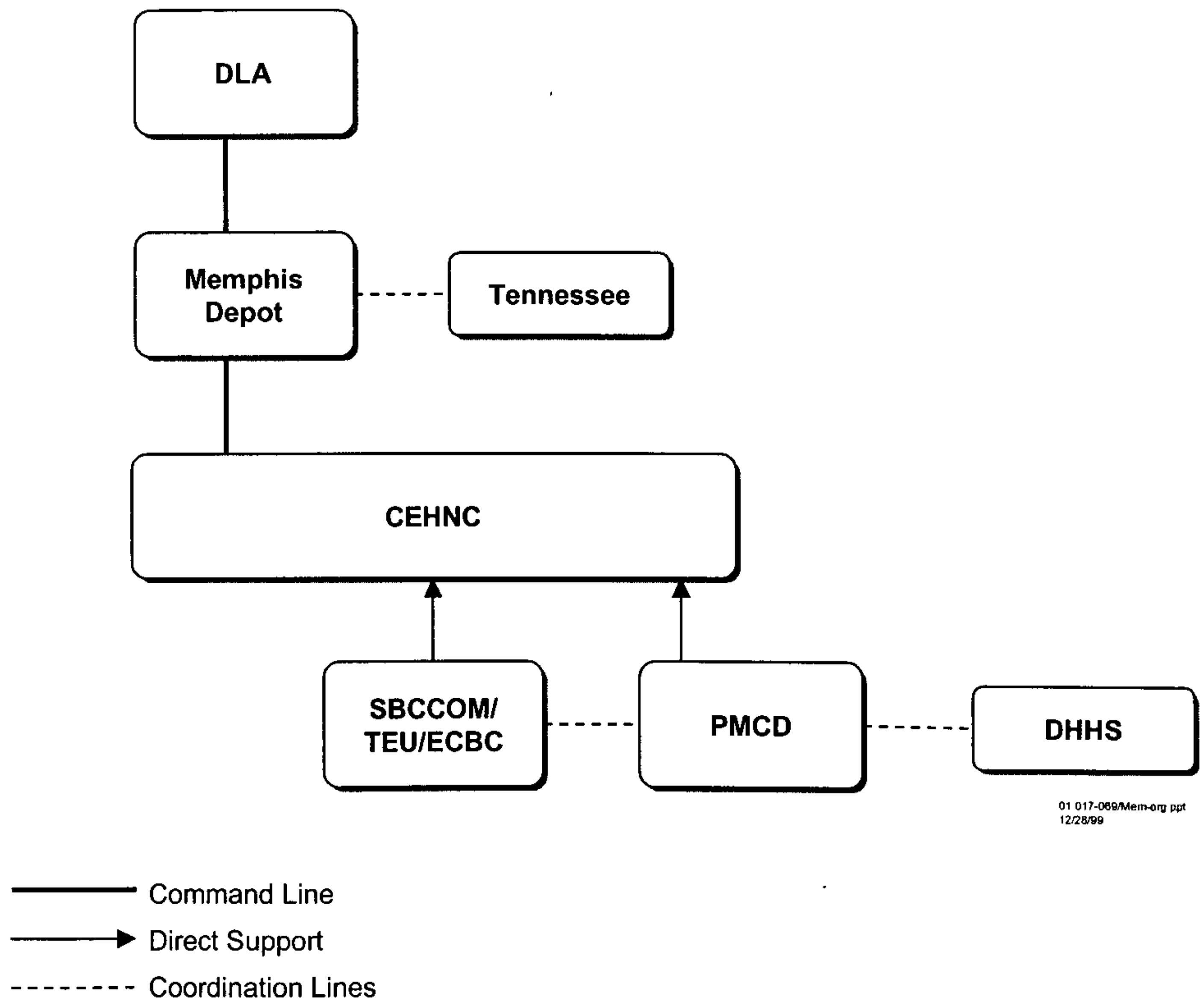

Figure 2-1. Primary Organizations for Former Defense Depot Memphis IHF Plan

2.3 U.S. Army Engineering and Support Center, Huntsville

CEHNC is responsible for the planning and execution of site characterization and remediation operations at Dunn Field. CEHNC is responsible for all policy implementation, project execution, and coordination of the support agencies. CEHNC will make management decisions based on recommendations from U.S Army Soldier and Biological Chemical Command (SBCCOM) [TEU and Edgewood Chemical Biological Center (ECBC)], and UXB. CEHNC will procure the necessary Rights of Entry and Memoranda of Agreement in order to accomplish the projects objectives. CEHNC, in conjunction with UXB and SBCCOM, will provide for the safety of all project personnel as well as the local community. The public will be protected through the use of engineering controls to contain any hazardous chemicals and air monitoring to provide warning of any releases. During operations, the CEHNC Safety Specialist will be onsite to oversee contractor operations and provide overall site control. The Safety Specialist will coordinate all supporting agencies, monitor the work, and provide feedback.

2.4 U.S. Army Soldier and Biological Chemical Command/U.S. Army Technical Escort Unit/Edgewood Chemical Biological Center

The TEU and ECBC are units of the SBCCOM. The ECBC will conduct air monitoring for chemical agents at the work site.

TEU will be responsible for intact CWM hazard containment and neutralization during excavation, identification, and recovery operations. In the event that intact CWM is encountered, or a "ring off" occurs while air monitoring is being conducted, UXB will don the appropriate personal protective equipment (PPE) and continue to excavate until the hazard is identified. If an intact item suspected to be CWM is located, TEU will assume control of the site and will recommend a course of action to the CEHNC Safety Specialist. TEU will be responsible for IHF operations (handling, onsite transport, and storage of recovered CWM) per this plan. In an emergency situation, TEU will be the first responders initiating actions in accordance with this plan, as well as the Site Safety and Health Plan and the Protective Action Plan contained in the Memphis Depot Work Plan (CEHNC, 1999)

2.5 . Defense Logistics Agency

DLA is the higher headquarters for the Memphis Depot.

SECTION 3
ACTIVITIES

An IHF will be operated at the Memphis Depot to temporarily store the CWM and suspected CWM that could be recovered during an intrusive remedial investigation at Dunn Field.

3.1 Location

The location of the IHF, selected by the Memphis Depot, is Dunn Field. The location of the Memphis Depot is shown in figure 3-1. The IHF location (see figure 3-2) is contiguous to the remediation site.

3.2 Description

The purpose of the IHF is to provide temporary safe, secure, and segregated storage of CWM.

3.2.1 Storage Area. The IHF is a prefabricated, single-story, modular unit constructed of insulated metal panels and equipped with an integral leaktight sump beneath the metal grating floor. Its external dimensions are approximately 24 feet long by 9 feet wide by 8 feet high. A door at each end of the unit provides easy flowthrough handling of containers. This facility is refrigerated and weatherproofed to ensure the integrity of stored materials. The unit is designed to withstand a Zone 4 (0.4) seismic loading. Figure 3-3 shows the modular construction of the basic storage facility. For simplification, the existing under-floor containment is not shown. The facility conforms to generally accepted safety codes and standards, such as National Fire Protection Association (NFPA) 7, Uniform Building Codes, Standard Building Codes, and Building Officials and Codes Administration.

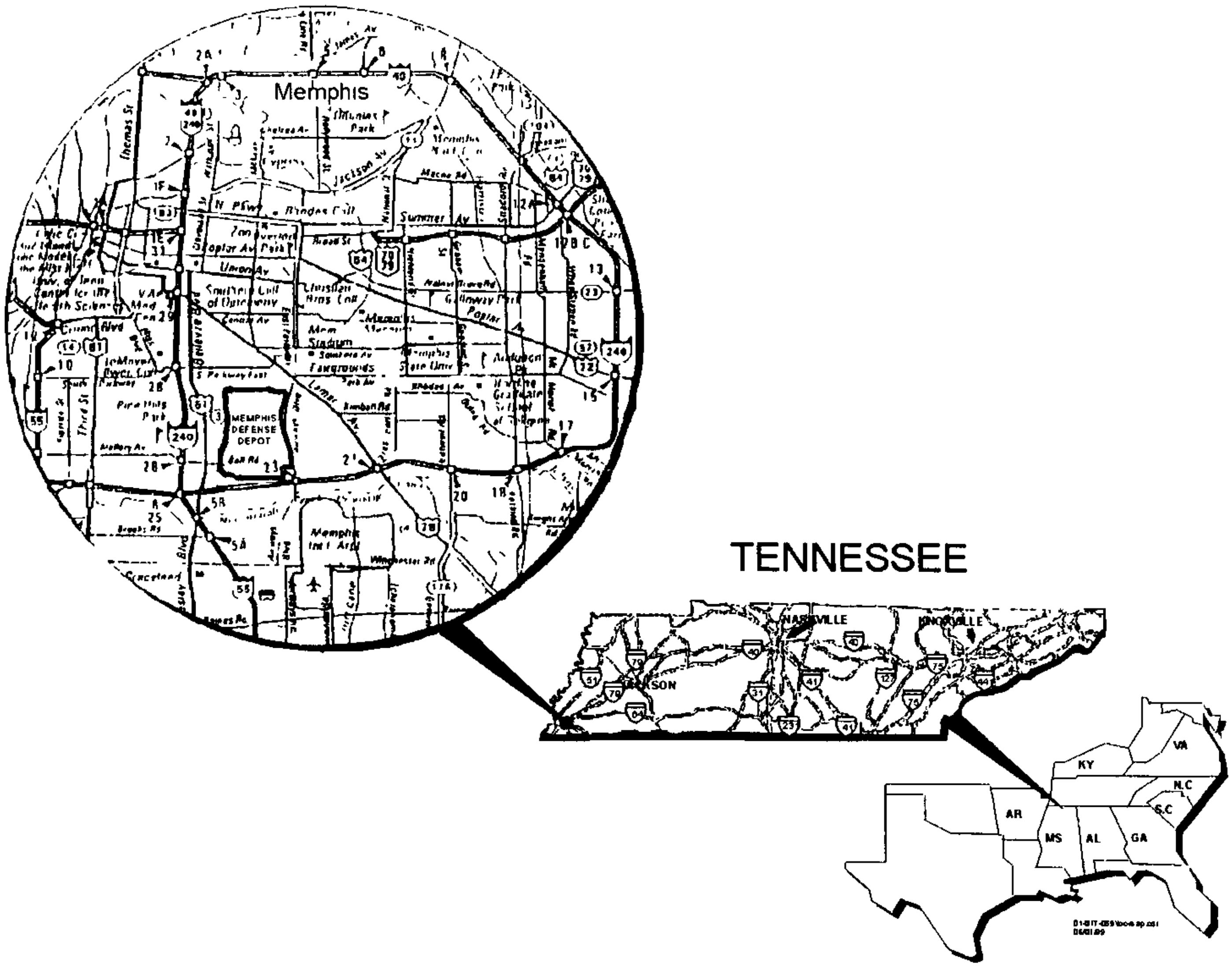

Figure 3-1. Location of Former Defense Distribution Depot, Memphis, Tennessee

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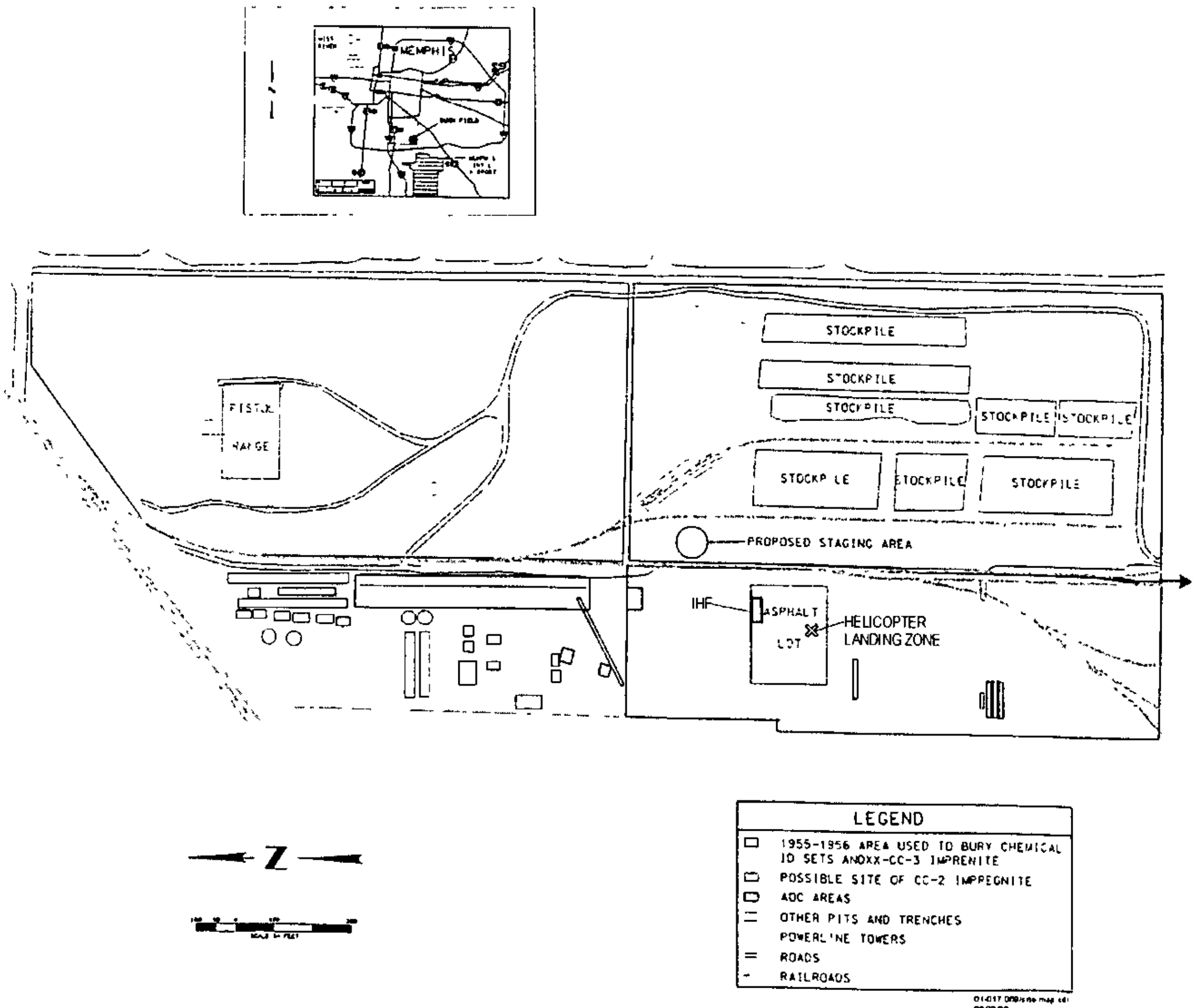

Figure 3-2. Location of the Interim Holding Facility Storage Area and Remediation Site

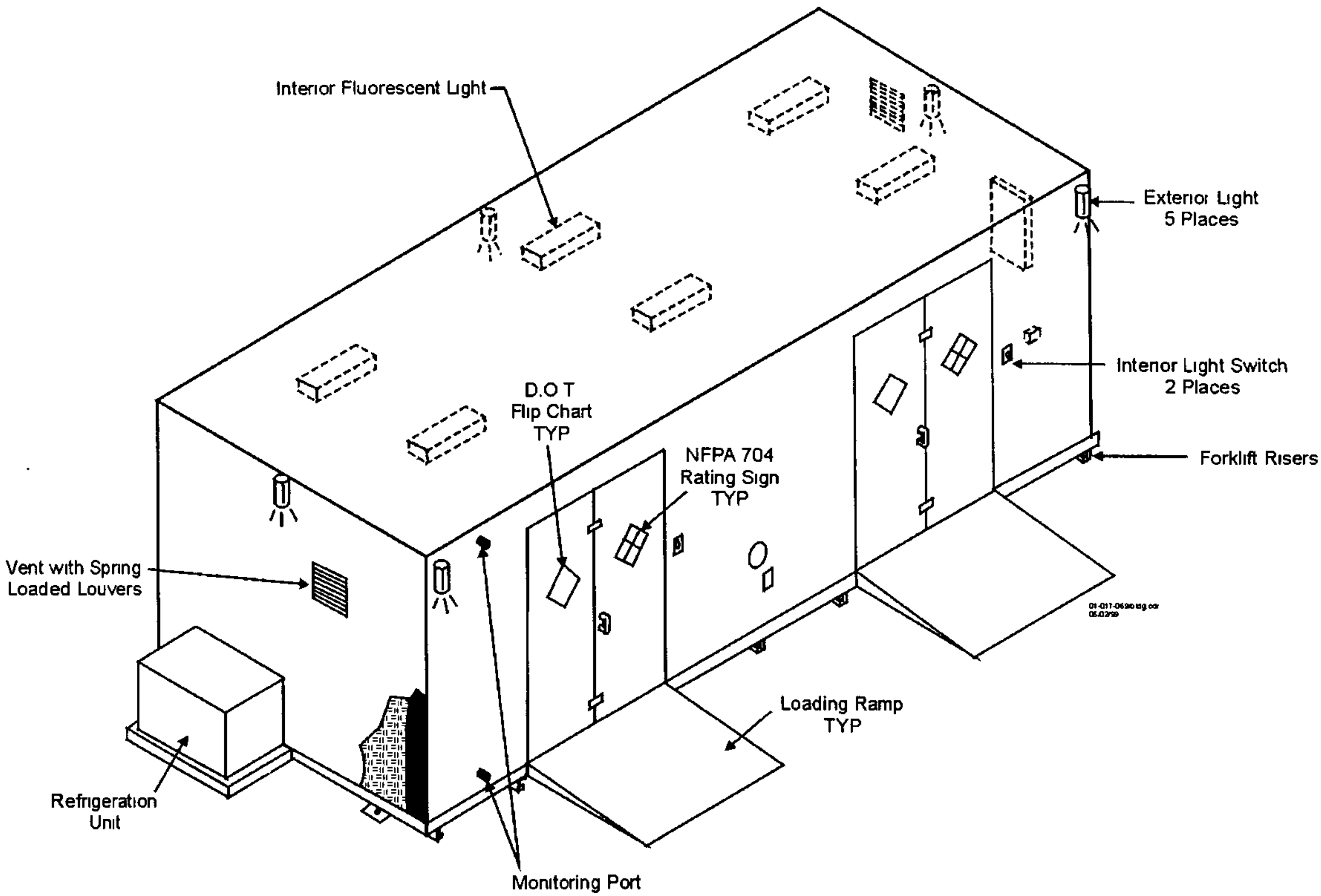

Figure 3-3. Interim Holding Facility

3.2.2 Floor. The floor is constructed of materials resistant to absorption, corrosion, and dissolving, providing a smooth and easily decontaminated surface. The floor is designed to support 300 pounds per square foot live load and is elevated to prevent stored materiel and containers from contacting with spilled materiel in the secondary containment (steel underfloor).

3.2.3 Walls. The wall panels are sheathed in smooth, painted metal inside and out and joined together with straps and locks, forming a continuous unit around the perimeter for structural strength. The interior surfaces are smooth and easily cleaned. The walls are insulated to R-34 for maximum cooling efficiency. All wall penetrations are sealed and finished with Underwriters Laboratory (UL)-classified fire barrier calk. The interior dimensions of the IHF are approximately 23 feet long by 8 feet wide by 7 feet high.

3.2.4 Doors. There are two double doors located on the front of the IHF. Each double door is 54 inches wide by 82 inches high and self-closing with a magnetic core. The doors are insulated, equipped with thermoplastic gaskets for superior seal, and include cylinder locks. Metal shielding above each door diverts rain and snow from the door opening. Each entrance is equipped with a 54 inch wide loading ramp for push carts.

3.2.5 Roof. The roof is constructed of corrosion-resistant metal and lined with asphalt felt for weather protection. The roof will support a live load of 30 pounds per square foot and wind load of 90 miles per hour.

3.2.6 Facility Layout. The IHF is not divided into rooms or compartments. The two double doors of the unit will facilitate flowthrough material handling on carts. CWM containers will be stored so that access to each container is maintained and container labeling is clearly visible. Containers will not be stacked in the IHF.

3.2.7 Refrigeration System. The IHF is equipped with a self-contained refrigeration system adequate to maintain internal temperatures at or below 32°F in ambient temperatures to 95°F and to prevent condensation inside the facility at 100 percent relative humidity outside. The refrigeration unit is mounted externally for easy access during servicing.

3.2.8 Thermostat Control. The IHF is equipped with an automatic thermostat control with an audible and visual alarm system to warn of cooling system failure. The alarm system has a manual silencing switch located on a control panel on the exterior of the IHF.

3.2.9 Monitoring Ports. Two monitoring ports, one 6 inches from the floor and one 6 inches from the ceiling, have been installed for sampling the interior air quality of the IHF. Each monitoring port is fitted with a female quick-connect shutoff bulkhead fitting. The interior air quality of the IHF will be monitored before personnel entry at the beginning of each operational shift. First entry monitoring procedures are discussed further in section 5.

3.2.10 Ventilation. The IHF is equipped with a passive ventilation system. The system includes dual louvered vents, which can be closed in the event of a chemical leak to prevent gross agent discharges to the atmosphere. The IHF design also includes a filter connector port with a replaceable plug that is capable of hooking up to the filter system that can treat agent-contaminated air.

3.2.11 Electrical Power. A weather-protected distribution panel is located on the exterior of the IHF for connection of 40-ampere, 240-volt, single-phase electrical service. The distribution panel is on the exterior to give maintenance personnel access without entering the IHF. The panel accommodates external outlets. All branch circuits are detailed inside the distribution panel.

The facility is provided with one weather-protected external outlet positioned near the monitoring port. The outlet has ground fault interrupter circuit protection to prevent operator injury.

The IHF is equipped with at least one waterproof interior light. The light fixture is UL-listed for class 1, division 1 hazardous locations. The light is rated for a minimum of 100 watts and protected with metal guards. There is one interior light switch.

There are externally mounted, photocell-activated exterior lighting fixtures around the perimeter of the IHF. Two fixtures are located on the front, one on the rear, and one on each side. During periods of darkness, the illumination intensity will be no less than 1.0 foot-candle at any point to a height of 8 feet on the vertical, and to a horizontal distance of 8 feet from the entrance.

3.2.12 Fire Protection. The storage buildings are equipped with internal self-actuating fire suppression systems. The storage buildings have 2-hour fire-rated walls. Emergency response to fires is provided for under the site work plans by U.S. Army Corps of Engineers (USACE).

3.2.13 Lightning Protection. Each storage building is equipped with a ground rod and a lightning rod. The USACE shall ensure that the lightning rod and ground rod are appropriately installed at the site to conform to local lightning protection requirements for equipment and structures.

3.2.14 Physical Security Requirements. The Memphis Depot IHF has the following physical security requirements to reduce potential vulnerabilities associated with storage of CWM at the Memphis Depot:

a. *Guard Force.* A guard force will be provided in accordance with AR 190-11. Periodic surveillance of the IHF will be provided by a CEHNC surveillance force once each 8-hour shift, checking to see if IHF gate and locks are secured. Any out-of-the-ordinary circumstances will immediately be reported to the Memphis Depot.

b. *Barriers.* In addition to the the Memphis Depot facility access control, stated above, a chain link fence surrounding the IHF area will be constructed. The fence will be 2-inch square mesh 9-gauge, 6-feet high, with 2 feet underground and a 12-foot clear zone. Access gates to the IHF storage area will be left open when work is being conducted within the area.

c. *Lighting.* Security lighting is supplied by a fixture that is mounted over the entrance to the IHF and is switch protected.

d. *Signs.* Warning signs will be placed that will indicate the area is restricted, dangerous, and unauthorized entry is illegal. A sign with the legend "Danger--Unauthorized Personnel Keep Out" will be posted at the entrance gate and at other locations on the perimeter fence, in sufficient numbers to be seen from any approach. The legend will be legible from a distance of at least 25 feet. The sign will be approximately 12 inches by 14 inches and will comply with 29 CFR 1910.145. A chemical agent placard will be placed on the front of the IHF to identify the presence of a particular agent or agents.

e. *Access Control.* When the IHF is being operated immediate access controls will be implemented. Direct access to recovered CWM will be limited to personnel knowledgeable in the safety, security, custody, and accountability of chemical agents, and emergency support equipment such as fire and ambulance vehicles. During CWM storage the TEU will be the only personnel allowed to enter the IHF. A personnel roster will be maintained. A background check will be performed for personnel having access to the IHF.

f. *Communications.* Primary and backup forms of communication will be provided; two-way radios and/or cellular phones will be available at the IHF and in the transport vehicles.

g. *Locks and Keys.* The gate to the IHF storage area will be locked, and the IHF entrance door will have two locks. Using the proper locking hardware will provide significant delay time for unauthorized entrance, leading to detection of any intruder, and ultimately causing the intruder to be defeated.

h. *Planning Measures.* A site-specific physical security plan, prepared by CEHNC, and supporting contingency plans, or reference to existing plans, will be prepared to ensure a comprehensive and integrated security program for the interim storage area. This site physical security plan will address a range of protective matters including: access control measures, lock-and-key control, guard duties and responsibilities, response force arrangements, barriers, lighting, procedures to identify authorized personnel during access control activities, and communications. Contingency planning and coordination procedures with local officials will also be included. Guard post orders, notification procedures, emergency actions taken by the security force, and similar activities will be described.

i. *Containment.* The CWM will be packaged in MRCs. Secondary containment will consist of the structure of the IHF and integrated underfloor containment.

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SECTION 4
INTERIM HOLDING FACILITY ACTIVITIES

4.1 General

4.1.1 Personal Protective Equipment. Occupational Safety and Health Administration (OSHA) Level D PPE with a slung mask, leather work gloves, and safety shoes will be warn by TEU personnel provided the following conditions are met. If these conditions are not met, the TEU officer will determine the level of PPE necessary for the situation.

a. CWM is packed in an MRC.

b. MRC and first entry monitoring were conducted in accordance with section 5 and agent concentrations were below 1.0 time-weighted average (TWA)

4.1.2 Training. Each agency participating in IHF activities will provide an employee training program complying with, but not limited to, the requirements of 29 CFR 1910.120 and Department of the Army Pamphlet (DA Pam) 385-61. Training will be provided on hazardous waste operations, PPE use, heavy equipment operation (if needed), hazards of the chemicals that may be encountered, and any other topics of concern to the IHF activities. By the time this plan is implemented, all personnel will have completed at least 40 hours of training in health and safety issues associated with hazardous substance site work. Documentation of training will be the responsibility of each agency.

4.1.2.1 Health and Safety Training. Health and safety training will be conducted prior to job start up to ensure that personnel have a through understanding of the Emergency Response Contingency Plan of the IHF activities (section 6), standing operating procedures (SOPs), and physical and chemical hazards of the site. The following topics will be addressed.

a. Names and titles of employees and their duties

b Persons responsible for safety and health

c. Acute and chronic effects of exposure to hazardous substances that may be present, potential routes of exposure for these substances, exposure limits, and the level of personal exposure that can be anticipated.

d. Monitoring procedures and the functions, limitations, and maintenance of monitoring equipment

e. SOPs

f. Site control measures

g. PPE

h. Emergencies.

4.1.2.2 Site-Specific Training. Site-specific training will be provided for all employees, contractors, and subcontractors who have met the requirements of 29 CFR 1910.120. Site-specific training will include operations training and safety meetings.

4.1.2.3 Operational Training. Operations training will include procedures related to the storage of CWM. Topics addressed will include:

a. Handling CWM containers
b. Storing CWM
c. Storage emergency measures.

4.1.2.4 Safety Meetings. Personnel involved in the storage activities must attend a safety meeting at the beginning of the IHF operations. This meeting, conducted by the TEU, will include items such as specific health and safety issues, planned storage activities, changes in plans, PPE, personnel and equipment decontamination, potential chemical and physical hazards, and contingency actions.

4.1.2.5 Hazard Information Training.

a. *Hazard Communication Training.* In accordance with the OSHA Hazard Communication Standard (29 CFR 1910.1200 and 1926.59), copies of material safety data sheets (MSDSs) will be available for each of the suspected hazardous chemical that are to be stored or handled. Hazard communication training will be conducted in accordance with 29 CFR 19110.1200 and 1926.59. Training will include, but not be limited to, all hazards and potential hazards associated with transportation activities and any hazardous chemical materials stored.

b. *Chemical Warfare Materiel Training.* All personnel involved with storage of CWM will receive training concerning the CWM. The intent of this training is to inform personnel of the hazards associated with CWM. All site activity involving CWM or contamination resulting from CWM will be performed by the TEU. TEU personnel have undergone U.S. Army training required to qualify, and to maintain, proficiency in their respective military and civilian occupational specialties.

4.1.3 Contingency Planning. If conditions are observed that threaten the health of the public, the workers, or the environment or if an agent leak is confirmed that requires immediate remedial action, a response will be performed in accordance with the Emergency Response Contingency Plan described in section 6 and in the Memphis Depót Work Plan (CEHNC, 1999). The TEU will implement decontamination procedures as described in section 6. The site coordinator will notify the regulatory, supervisory, emergency response, and contingency personnel who are not already positioned at the storage facility to respond to an accident or incident. Only the TEU will enter the IHF once CAIS are stored there.

4.2 Preactivation Activities

Prior to activation of the IHF Plan, the IHF storage facility manager will be responsible for ensuring that sufficient space is available for storage as planned. The facility manager will perform a preactivation storage facility inspection of the IHF internal and external structure, IHF equipment, and IHF paperwork. The preactivation inspection procedures described below will be used in conjunction with the IHF inspection checklist (figure 4-1), which provides a more specific listing of the things that should be examined during inspection. The results of the inspection will be reviewed with TEU, supervisors, and the Site Safety Coordinator, who is responsible for ensuring compliance with the storage area operations.

4.2.1 Preactivation Storage Facility Inspection. Prior to arrival of the CWM, the IHF storage facility manager (Memphis Depot) will be responsible for ensuring that sufficient space is available for storage, as planned. The IHF will also be inspected to ensure that all equipment used during storage is operable. Preparation and use of a checklist will simplify the inspection. These procedures should be used hand-in-hand with the IHF Inspection Checklist (see figure 4-1). The items listed in the checklist provide a more specific listing of what should be examined during an inspection.

Internal inspections will be performed and documented daily by TEU, when the IHF is in use. External inspections and monitoring, when TEU is not present, will be performed and documented monthly by the Memphis Depot.

Interim Holding Facility Inspection Checklist

Period Covered: From ________ to ________

	MON		TUES		WED		THUR		FRI		SAT		SUN	
Inspector: Date: Time:														
	Pass	Fail	Pass	Fail	Pass	Fail	Pass	Fail	Pass	Fail	Pass	Fail	Pass	Fail
Outside														
Signs posted on IHF entrance gate	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Area secure, gate closed and locked, IHF door closed and locked	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Storage Area														
Building structurally sound	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Area clean of debris	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Aisle space adequate for emergency response	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
All containers on pallets	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
All containers sealed	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
No leaks, spills, leaking containers, or residue	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Containers turned so that labels are visible	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Inspect container labels														
composition of waste	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
quantity of waste	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
generator	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
date of acceptance	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Inspect secondary containment sumps	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

Figure 4-1. Interim Holding Facility Inspection Checklist (Sheet 1 of 3)

Interim Holding Facility Inspection Checklist (Continued)

Period Covered From ________ to ________

	MON		TUES		WED		THUR		FRI		SAT		SUN	
Inspector														
Date														
Time.														
	Pass	Fail	Pass	Fail	Pass	Fail	Pass	Fail	Pass	Fail	Pass	Fail	Pass	Fail
Equipment														
Emergency shower/eyewash operable	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Absorbent available	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Inspect fire extinguishers	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Gloves available	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Eye protection available	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Respirators available	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Protective clothing available	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Spill kit available and complete	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Records/Reports														
Tool kit available and complete	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Waste logs complete, accurate and up-to-date	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Manifests logged and filed	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Copies of returned manifests	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Emergency Response Contingency Plan on file	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Sample records on file	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Discrepancy reports prepared and filed	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Incident reports for spills on file	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

Comments:

____

____

Figure 4-1. Interim Holding Facility Inspection Checklist (Sheet 2 of 3)

Interim Holding Facility Inspection Checklist (Continued)

Corrective Action:

Mon.	Item:	______	Action Taken	______
	Date.	______	Signature.	______
Tue	Item	______	Action Taken	______
	Date	______	Signature:	______
Wed	Item:	______	Action Taken	______
	Date	______	Signature	______
Thur	Item	______	Action Taken	______
	Date	______	Signature:	______
Fri:	Item	______	Action Taken	______
	Date	______	Signature:	______
Sat	Item	______	Action Taken	______
	Date	______	Signature	______
Sun	Item:	______	Action Taken:	______
	Date.	______	Signature:	______

Figure 4-1. Interim Holding Facility Inspection Checklist (Sheet 3 of 3)

The procedures to perform an inspection of the IHF are as follows:

a. Prepare IHF Procedures.

(1) Inspect outside of the IHF for sound structure and ensure there are no water leaks or cracks.

(2) Inspect inside the IHF for sound structure and ensure there are no water leaks or cracks. Note any nonstandard conditions or deficiencies.

(3) Confirm that debris or prohibited materials (for example, paint, oil, rags, or tools) are not present.

(4) Confirm that aisles are adequate for CWM handling equipment and inspection.

4.2.2 Inspect Equipment.

a. Inspect emergency shower and eyewash station. Water should be clear and flowing steadily.

b. Confirm serviceability of radios and cellular phones. All features should be operational.

c. Inspect supply of absorbent material available for spill cleanup. Spill kit and other emergency items, including decontamination supplies, will be clearly visible and accessible.

d. Check lights for serviceability.

e. Check that safety equipment, eye protection, gloves, personal protective gear, and respirators are available.

f. Inspect fire extinguishers. Each fire extinguisher inspection tag will be up-to-date.

g. Ensure adequate tools are available (to include hammer, variety of sizes of screwdrivers, pliers, and duct tape).

4.2.3 Inspect Records/Reports. Review the following recordkeeping items. If there are any discrepancies, action must be taken to correct problems cited.

a. Review last inspection report.

b. Inspect any outstanding deficiencies from last report.

c. Ensure that all waste log data are complete and up-to-date.

d. Confirm the status of the hazardous waste manifest file for completeness.

e. Check that the TEU Emergency Response Contingency Plan is posted in a clearly visible place near the telephone.

f. Check that sample records are on file.

g. Check that discrepancy reports with corrective actions taken are kept at the IHF.

h. Check that any history of spills, action taken, and spill containment plans/reports are on file at the IHF.

Review the results of the inspection with the TEU, and the Memphis Depot, who is responsible for ensuring compliance of the storage area operations prior to arrival of CWM at the IHF.

4.2.4 Transportation Route. The IHF is located within the confines of the recovery site at Dunn Field. Recovered CWM will be moved to the IHF by the most direct route taking advantage of the paved access road as much as possible. At no time will it be necessary to transport the recovered CWM on or across public roads or outside the fenced confines of Dunn Field.

4.3 Predeparture Activities

Prior to commencement of onsite transportation, recovered CWM will have been placed inside a DOT-approved overpack container and the container monitored/ decontaminated to verify that it is not leaking and that there is no contamination on the outside of the container. The TEU will notify the TEU personnel at the IHF and the CEHNC of the pending shipment. IHF personnel will prepare to receive the material and CEHNC will notify emergency response personnel and other required agencies.

4.3.1 Cargo Configuration and Order of Movement. The TEU will determine cargo configuration based on the number of containers to be moved and the design of the cargo vehicle.

4.3.2 Safety Briefing and Route Plan. All personnel participating in the transportation operation will receive a safety briefing by the TEU. Vehicle operators and assistant operators will have clear instructions identifying the route they will follow.

4.3.3 Verify Contingency Personnel and Systems in Place. The TEU will verify that emergency response personnel are available, and that spill response kits and monitoring equipment are operational before execution of loading procedures.

4.3.4 Execute Loading Procedures. Pre-approved procedures will be executed to load the overpack(s) onto the cargo vehicle at the recovery site.

4.3.5 Inspect and Monitor Containers. Each overpack will be inspected and monitored to verify its integrity. Tie-downs and bracing will be inspected to ensure containers are adequately secured.

4.3.6 Verify Hazardous Waste Manifest. The TEU will inspect each overpack with the Memphis Depot accountable officer to verify information on the hazardous waste manifest. The TEU and Memphis Depot representatives will both sign the manifest and certify its accuracy.

4.3.7 Perform Communications Check. A communications check will be made with each piece of communications equipment on each vehicle before departure in accordance with the TEU operations plan.

4.3.8 Give Notification of Departure. Upon departure of the transport vehicle, notification will be made to the CEHNC, the Memphis Depot, and the PMCD.

4.4 En Route Activities

En route activities from the recovery site to the storage area will be performed by the TEU. TEU personnel at the IHF will be in contact with the transport vehicle and will be aware of the location and status of the move. The maximum speed for the transport vehicle will be 25 miles per hour. Halting procedures will be established and used when the transport vehicle is required to stop for the following circumstances.

4.4.1 Mechanical Problems. Procedures will be in place to stop the vehicle as safely and quickly as possible. Escort personnel will attempt to move the disabled vehicles so as not to impede other traffic. The PMNSCM and the CEHNC will be notified of the situation. The cargo will be secured until a vehicle can be repaired or replaced. Before restarting transportation, the TEU will account for all personnel and cargo.

4.4.2 Accident without Damage to Cargo. Procedures will be in place for the transport vehicle to stop as safely and quickly as possible and for TEU personnel to inspect the cargo for leaks, secure loose cargo, and administer first aid. The Memphis Depot, PMNSCM, and the CEHNC will be notified of the situation.

4.4.3 Accident with Damage to Cargo. Emergency response procedures for leaking CWM are addressed in section 6.

4.4.4 Public Disturbance or Traffic Obstruction. Procedures will be developed to allow the transportation team to respond to an unexpected blockage of the transportation route. If necessary, the transport vehicle and escorts will stop, the TEU will communicate their status to the Memphis Depot, CEHNC, and PMNSCM, choose an alternate route, and react according to the situation.

4.5 Prearrival Activities

Prearrival activities will occur at the IHF before the CWM is delivered. They include the following:

4.5.1 Inspection. TEU personnel will be responsible for opening the IHF prior to arrival of the CAIS items and for performing IHF operations. The TEU will perform daily internal inspection of the IHF whenever new material enters the IHF or when material is removed from the IHF for transport or destruction. The IHF inspection will be conducted to ensure that the storage operations are conducted in accordance with this IHF Plan.

a. *Equipment Inspection.* All equipment used to unload the CWM and transfer it from the vehicle to the storage facility will be inspected to ensure that the needed equipment is available and operational. A list of

CWM handling equipment to be available at the IHF and a description of how the equipment may be used are presented as follows:

(1) *Forklift, 500-pound Capacity:* To be used for larger objects, picking up, removing from the vehicle, and placing on ground.

(2) *Dolly, Handcart:* To move MRCs and large containers into and around the inside of the IHF.

(3) *Ramp:* To transfer CWM from or to the transport vehicle (use forklift to transfer MRCs out of the back of truck). A ramp is used to load into and out of the IHF and can be used to maneuver MRCs over changes in elevation.

(4) *Tool Kit:* Hammer, screwdrivers, pliers, and other various small tools for minor repairs that may be expected.

b. *Monitoring Equipment.* The TEU will calibrate the agent monitoring equipment and appropriate detectors for all possible agents to be discovered at the Memphis Depot.

c. *Safety Equipment Inspection.* The following equipment will be inspected to ensure operability and availability to all site personnel. Those safety items that are necessary include telephone communications (may be portable), lighting, and power for the IHF. Other safety equipment requirements are spill-containment materials, protective clothing, air monitoring supplies, first aid supplies, and fire suppression supplies. All safety equipment will be conveniently located for use at the IHF and will be clearly marked.

(1) *Personal Protective Clothing.* Protective clothing will be available in the TEU response vehicle. The following list of items will be provided:

- Level B OSHA PPE
- Gloves
- Eye protection
- Respirators.

(2) *Eyewash.* An eyewash station will be located outside the entrance to the IHF. Additionally, an emergency shower will be available outside of the IHF to handle any emergencies.

(3) *First-Aid Supplies.* A first-aid kit will be located outside the IHF. It will be easily accessible, clearly displayed, and marked. A kit will be available in the TEU response vehicle, as well.

(4) *Fire Extinguisher.* Two A-, B-, and C-rated fire extinguishers will be available, one of each mounted inside and the other mounted outside of the IHF. These are to be inspected monthly and recharged/replaced, as necessary.

(5) *Spill Kit.* A spill kit will be available to provide quick and easy access in case of a materiel spill. Contents of the spill kit are provided in the specific site work plans.

4.5.2 Open and Close Procedures with CWM (TEU personnel only). TEU personnel will be responsible for opening the IHF and performing IHF operations. Likewise, when the operations are finished for the day, TEU personnel will secure and close the facility. Coordination with other TEU members will be maintained to ensure the facility is open and ready to receive CWM, and prepare and stage CWM when offsite transportation is required. The IHF open/close procedures are as follows:

a. *Open IHF Procedures.*

(1) Notify the Memphis Depot and security of pending opening.

(2) Establish site access controls at IHF.

(3) Notify and position emergency response personnel for the pending arrival of the CWM as required by the contingency plans.

(4) Open the IHF gate.

(5) Inspect the IHF.

(6) Perform first-entry monitoring. Follow instructions in air monitoring procedures (section 5).

(7) If monitoring indicates no agent present, begin IHF operations.

(8) If monitoring indicates agent contamination, begin contingency response as required by the contingency plans.

b. *Close IHF Procedures.*

(1) Confirm that CWM is stored in designated areas and labeled. The label should be filled out completely and easily visible.

(2) Observe materiel for signs of agent leakage. If agent leakage is suspected, all operators will exit the IHF. In case of an emergency,

TEU will follow emergency response contingency plan procedures or appropriate SOPs

(3) Turn off interior lights. Turn on exterior lights.

(4) Secure IHF door and locks.

(5) Secure and lock IHF gate.

c *Exit Procedures.* When exiting the IHF for the last time of the day, perform close IHF procedures then, upon exiting the IHF area, call the Memphis Depot and security and inform them that the IHF has been secured for the day.

4.6 Arrival Activities

4.6.1 Pretransfer Activities.

a. *Inspect Containers.* The TEU will inspect the transport containers for damage during transit.

b. *Conduct Gross-Level Monitoring on CWM.* Monitoring will be performed as specified in the monitoring procedures (section 5).

c. *Unload CWM From the Transportation Vehicle.* The CWM will be placed at the entrance of the IHF.

d. *Conduct Inventory.* The TEU will transfer accountability to the Memphis Depot IHF supervisor by documenting a courier materiel receipt using the DD Form 1911 (figure 4-2) and container information form (figure 4-3). There is a sign-off to indicate accountability transfer by the TEU. The

MATERIEL COURIER RECEIPT

MATERIEL COURIER RECEIPT	SHIPPER S CONTROL/DOCUMENT NO
SHIPPER	SUPPLY ACCOUNT NUMBER
DESTINATION	SUPPLY ACCOUNT NUMBER

PRIVACY ACT STATEMENT

AUTHORITY 5 U S C Sec 552a (PL 93 579)

PRINCIPLE PURPOSES To provide a receipt for transfer of controlled materiel The use of the SSAN is required and is necessary to provide positive identification of the individuals receipting for the materiel

ROUTINE USES To document transfer of materiel from a shipper to a courier courier to courier and/or receiver

DISCLOSURE IS VOLUNTARY Since the SSAN must be used refusal to provide SSAN may be grounds for action to remove the individual concerned from duties involving the materiel transferred by use of this form

I certify by my signature that I have received the materiel listed on this form and am aware of the applicable safety and security requirements

SHIPMENT TRANSFERS

FIRST	LOCATION OF TRANSFER	DATE(YR/MO/DAY)
RECIPIENT'S PRINTED NAME (LAST, FIRST, M I)	ORGAN OR ACCOUNT NO	
SIGNATURE	SOCIAL SECURITY NUMBER	
SECOND	LOCATION OF TRANSFER	DATE (YR/MO/DAY)
RECIPIENT'S PRINTED NAME (LAST, FIRST, M I)	ORGAN OR ACCOUNT NO	
SIGNATURE	SOCIAL SECURITY NUMBER	
THIRD	LOCATION OF TRANSFER	DATE (YR/MO/DAY)
RECIPIENT'S PRINTED NAME (LAST FIRST, M I)	ORGAN OR ACCOUNT NO	
SIGNATURE	SOCIAL SECURITY NUMBER	
FOURTH	LOCATION OF TRANSFER	DATE (YR/MO/DAY)
RECIPIENT'S PRINTED NAME (LAST FIRST, M I)	ORGAN OR ACCOUNT NO	
SIGNATURE	SOCIAL SECURITY NUMBER	
FIFTH	LOCATION OF TRANSFER	DATE (YR/MO/DAY)
RECIPIENT'S PRINTED NAME (LAST, FIRST, M I)	ORGAN OR ACCOUNT NO	
SIGNATURE	SOCIAL SECURITY NUMBER	

SHIPMENT DESCRIPTION

LINE NUMBER	QUANTITY	SERIAL NUMBERS	REMARKS

DD FORM 82 MAY 1911

PREVIOUS EDITION MAY BE USED UNTIL 31 DEC 82

Figure 4-2. DD Form 1911

CONTAINER INFORMATION
for the
Memphis Depot CWM Site

Generator Information:

Container No. ____________________

Contents: 1)____________________

2)____________________

3)____________________

4)____________________

5)____________________

Date: __________ Certified: ____________________
Signature

CONTAINER INFORMATION
for the
Memphis Depot CWM Site

Generator Information:

Container No. ____________________

Contents: 1)____________________

2)____________________

3)____________________

4)____________________

5)____________________

Date: __________ Certified: ____________________
Signature

Figure 4-3. Container Information Form

Memphis Depot IHF supervisor will initial and date this form. These forms and the IHF Inventory Log (figure 4-4) will serve as a chain of custody inventory and ensure that CWM has been accounted for as required.

4.6.2 Transfer Activities. The procedures for transferring the CWM into the IHF are as follows:

a. Move containers into the IHF by the use of a handcart, and a forklift for heavy containers.

b. Date the MRCs when the TEU finishes packaging the item.

c. Place containers so that labels are clearly visible and stack only one high.

d. Leave sufficient aisle space (36 inches) so that emergency access to any of the containers in the IHF is possible.

e. Perform physical inventory of all CWM containers in the IHF. Compare total quantity in stock with shipping forms on file.

f. File shipping form with others previously received.

4.6.2 1 Personal Protective Equipment. During handling activities at the IHF, the TEU will dress in OSHA Level D PPE, including leather work gloves and safety shoes. This approach assumes that the CWM was characterized and monitored during recovery operation and has been periodically monitored in storage. If the recovered CWM cannot be fully characterized or identified, it will be considered and managed as the most toxic materiel anticipated to be recovered. In this case, that will be H, HS, or HD. The recovered CWM will be placed into an MRC and marked as CWM with unknown fill. Once inside the MRC, the overpack CWM can be considered adequately contained and under engineering control.

Interim Holding Facility Inventory Log

Date Rec'd	Rec'd By	Container Number	Date Shipped	Shipped By

Figure 4-4. Interim Holding Facility Inventory Log

4.6.3 Post-Transfer Activities. Following the transfer of CAIS from the transportation vehicle to the IHF, the TEU will verify that the transport vehicle or handcart is not contaminated or will be certified uncontaminated before being released from the storage facility. This can be accomplished by physically checking the cargo bay, by collecting vapor samples, or by using low-level monitors and detectors listed in section 5.

4.6.4 Contingencies. If an agent leak is confirmed and if personnel, equipment, vehicles, or the environment become contaminated, then the TEU will implement decontamination procedures. The Memphis Depot will notify the appropriate regulatory. supervisory, emergency response, and contingency personnel who are not already positioned at the IHF or the remediation site.

4.7 Support Activities

Some activities or plans are applicable during all phases of the Memphis Depot interim holding operations. Some of the key support activities are presented in the following paragraphs.

4.7.1 Contingency Personnel and Systems. All emergency response personnel must be notified of the pending arrival of the CWM and will be standing by as required by the contingency plans. The TEU will inspect all necessary equipment, including PPE, to verify its presence and ensure that it is operable. OSHA Level B (Army Level A) PPE may be used to respond to contingencies.

4.7.2 Security. The IHF must be secure at all times. The IHF storage area doors must be secure when the facility area is unoccupied.

a. *Security Patrol.* A security guard service will provide roving security 24 hours a day while CWM is stored in the IHF. Visual inspections to verify if the IHF is secured will be performed by the security service guards once each 8-hour shift. The IHF gate and locks will be checked. Any unusual circumstances will immediately be reported to the Memphis Depot.

b. *Control of Site Access.* Access to the storage site must be controlled to ensure that no personnel, beyond the minimum necessary, are exposed to potential hazards from CWM transfer and storage operations. Prior to arrival of the CWM, the IHF area will be checked to ensure that no unauthorized persons are onsite. The area will be controlled to prevent access by unauthorized or unnecessary personnel. Only authorized personnel (those with permits or badges or approved, escorted visitors) will be given access to the facility.

c. *Contingency Planning.* If conditions are observed that threaten public or worker health, or the environment, the Contingency Plan will be implemented. These contingency response procedures are described in section 6 and in the Memphis Depot Work Plan (CEHNC, 1999).

4.7.3 Maintenance and Repair. Maintenance and repair of the IHF or equipment will be performed in a timely manner. If the structure or equipment cannot be repaired, a suitable replacement will be provided by PMCD. Maintenance and repair of the IHF and equipment will be the responsibility of the Memphis Depot in accordance with established maintenance schedules.

SECTION 5
MONITORING

The possible chemical agents and industrial chemicals of concern that may be recovered during excavation activities include HS, HD, L, CG, PS, and chloroform. Monitoring for the chemical agents (HS, HD, and L) and industrial chemicals (CG, PS, and chloroform) will be performed using the sampling devices at the concentration levels specified in this IHF Plan. The frequency and location of the sampling described by this IHF Plan are based on the type of monitoring required by DA Pam 385-61.

5.1 Types of Monitoring

5.1.1 First Entry Monitoring. First entry monitoring will be conducted only by the TEU prior to entering the IHF (see figure 5-1) using low-level, near real-time (NRT) air monitoring equipment to ensure that interior airborne chemical agent concentrations are below the TWA levels. The appropriate monitor(s) will be used for the chemical(s) of concern being stored in the IHF and monitoring will be performed at all monitoring ports described in section 3. First entry monitoring procedures will be based on AR 385-61, DA Pam 385-61, and AR 50-6.

5.1.2 Surveillance Monitoring. Surveillance monitoring of the IHF containing recovered chemical agents will be conducted by TEU to check the integrity of the overpack containers and to identify any chemical leakage. Surveillance monitoring will begin once the recovered CWM are stored in the IHF, and will be performed monthly until the site operations at the IHF are completed. The appropriate monitors will be used for surveillance monitoring, and surveillance monitoring will not negate the requirements for first entry monitoring.

The Memphis Depot, the CEHNC, and PMCD will be contacted immediately if a reading over the workplace exposure level is obtained from the surveillance monitoring.

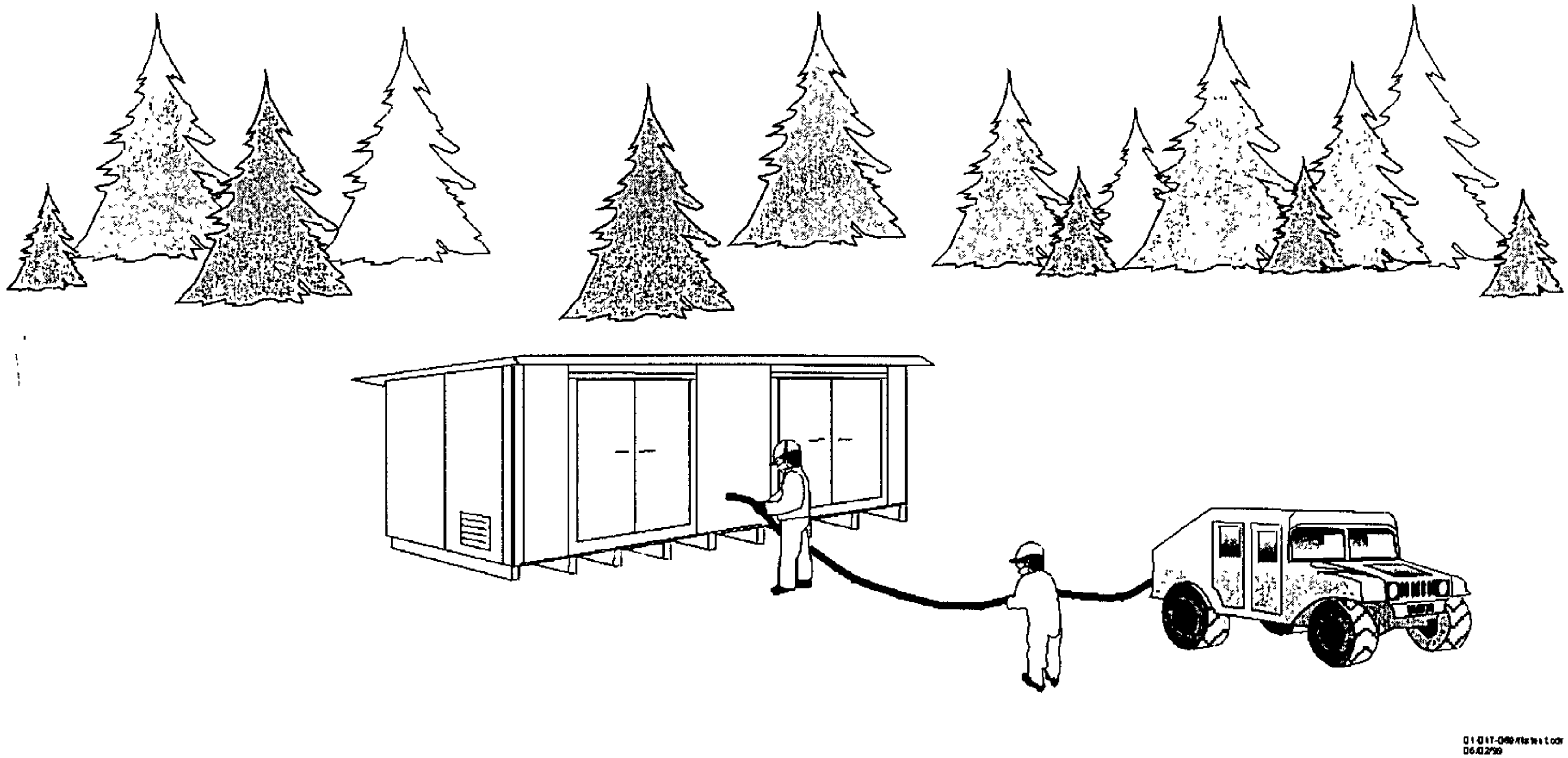

Figure 5-1. First Entry Monitoring

5.1.3 Contingency Monitoring. Contingency monitoring will be conducted during an emergency response contingency action (section 6). The action will be the result of detection of a release in the IHF during first entry monitoring, periodic surveillance monitoring, or as a result of a catastrophic event (damage to the IHF from external sources or an accident during onsite transportation) indicating a potential release.

5.1.3.1 Release During Storage. Upon detection of a release in the IHF by first entry or the periodic surveillance monitoring, the TEU, dressed in OSHA Level B, will conduct confirmation monitoring using the appropriate monitoring instrument to confirm the release. The TEU will enter the IHF, identify the source of the release, and contain the leaking item in accordance with TEU operating procedures.

Once the leakage has been contained, the area will be decontaminated by the TEU according to DA Pam 385-61 or Army Technical Manual (TM) 60A-1-1-11. Continuous monitoring will occur until readings fall below the TWA (table 5-1) for a minimum of three consecutive sampling periods.

5.1.3.2 Potential Release after Catastrophic Event. If a potential release is suspected in the general area of the IHF as the result of a catastrophic event (that is, integrity of IHF structure and/or contents is in question) or if a potential release is suspected at the scene of an accident during onsite transportation, downwind monitoring will be initiated in accordance with emergency response procedures.

An example array for monitoring at the IHF is shown in figure 5-2. Example arrays for situations involving transport of CWM are shown in figures 5-3 through 5-6. The appropriate monitors (table 5-1) will be used at each monitoring station in the monitoring array. Specific monitoring locations will be determined based on the maximum credible event (MCE).

Table 5-1. Monitoring Equipment and Levels

Chemical of Concern	Type of Monitoring Instrument	Workplace Exposure Level[a] TWA	Workplace Exposure Level[a] mg/m³	Estimated Limit of Quantification[b] mg/m³
Chemical Agent:				
Mustard (H, HD,HS)	First Entry: MINICAMS®	1.0	0.003	0.0006
	First Entry Confirmation: DAAMS	1 0	0.003	0 0006
	Surveillance: DAAMS	1 0	0 003	0 0006
	Contingency: MINICAMS®	1.0	0.003	0.0006
	Contingency Confirmation. DAAMS	1.0	0 003	0.0006
Lewisite (L)	First Entry MINICAMS®	1 0	0 003	0.0015
	First Entry Confirmation. DAAMS	1 0	0 003	0 0006
	Surveillance. DAAMS	1 0	0 003	0 0006
	Contingency MINICAMS®	1 0	0 003	0 0015
	Contingency Confirmation. DAAMS	1.0	0 003	0 0006
Industrial Chemical				
Phosgene (CG)	First Entry. MINICAMS® or MONITOX® plus	1 0	0.4	≤0 4
	First Entry Confirmation: Colorimetric Tube (8101521)	1 0	0 4	0 1
	Surveillance Colorimetric Tube	1.0	0.4	0.1
	Contingency: MINICAMS® or MONITOX® plus	1.0	0.4	≤0 4
	Contingency Confirmation Colorimetric Tube (8101521)	1 0	0 4	0 1
Chloropicrin (PS)	First Entry MINICAMS®	1 0	0 7	≤0 7
	First Entry Confirmation: Colorimetric Tube (8101021)	Gross Level		6 8
	Surveillance: Colorimetric Tube	Gross Level		6 8
	Contingency MINICAMS®	1 0	0 7	≤0.7
	Contingency Confirmation: Colorimetric Tube (8101021)	Gross Level		6.8

575 57

Table 5-1. Monitoring Equipment and Levels (Continued)

Chemical of Concern	Type of Monitoring Instrument	Workplace Exposure Level[a] TWA	Workplace Exposure Level[a] mg/m³	Estimated Limit of Quantification[b] mg/m³
Industrial Chemical (Continued)				
Chloroform ($CHCl_3$)	First Entry MINICAMS®	1 0	9 7	≤9 7
	First Entry Confirmation. Colorimetric Tube (67-28861)	1 0	9 7	1 94
	Surveillance Colorimetric Tube (67-28861)	1 0	9.7	1 94
	Contingency. MINICAMS®	1 0	9.7	≤9 7
	Contingency Confirmation: Colorimetric Tube (67-28861)	1 0	9 7	1.94

Notes:

[a] Workplace exposure level is an umbrella term encompassing all such levels, including the 8-hour time-weighted average, the permissible exposure limit (for industrial chemicals only), the threshold limit value (for industrial chemicals only), and other levels developed to protect the worker during normal operations The term TWA is used in place of AEL because the concentration output of the MINICAMS® is expressed in TWA terms

[b] The lowest level that can be reliably quantified based on sampling and analytical procedures and calibration of the monitor.

DAAMS = Depot Area Air Monitoring System
mg/m³ = milligram per cubic meter
TWA = time-weighted average

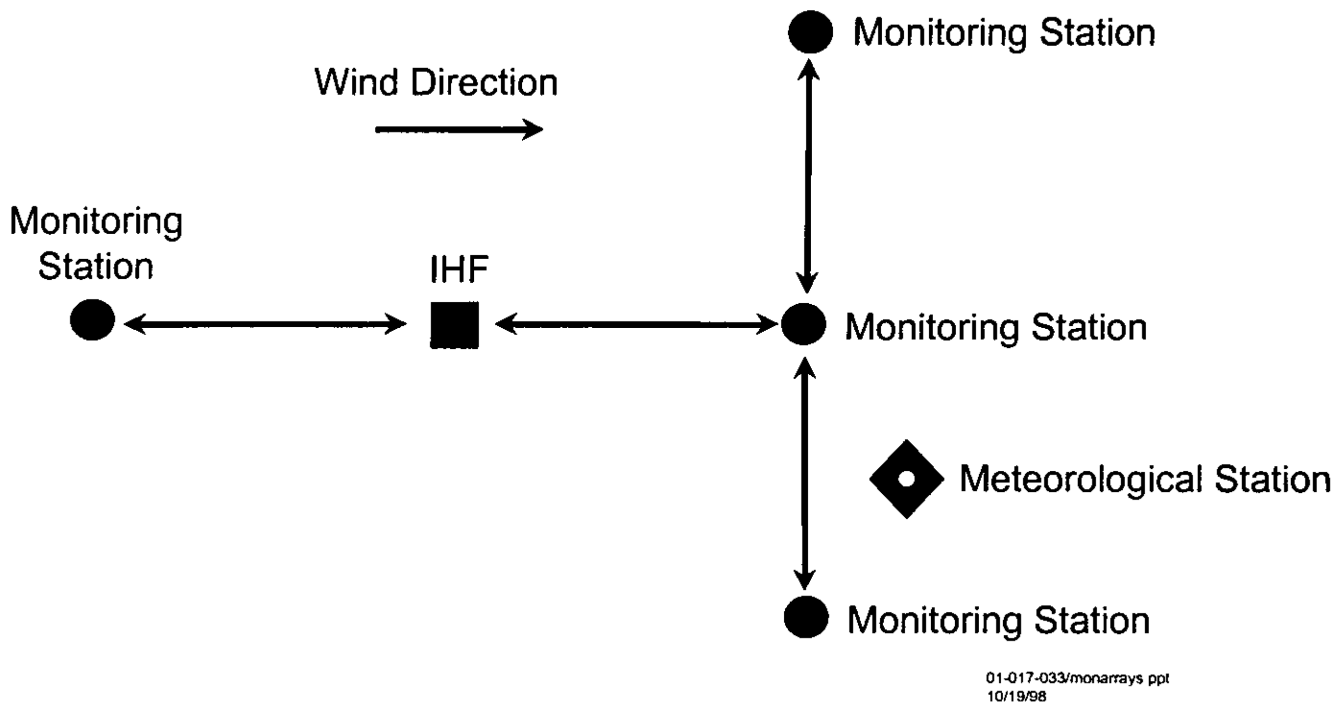

Figure 5-2. Example of a First Level Contingency Monitoring Array

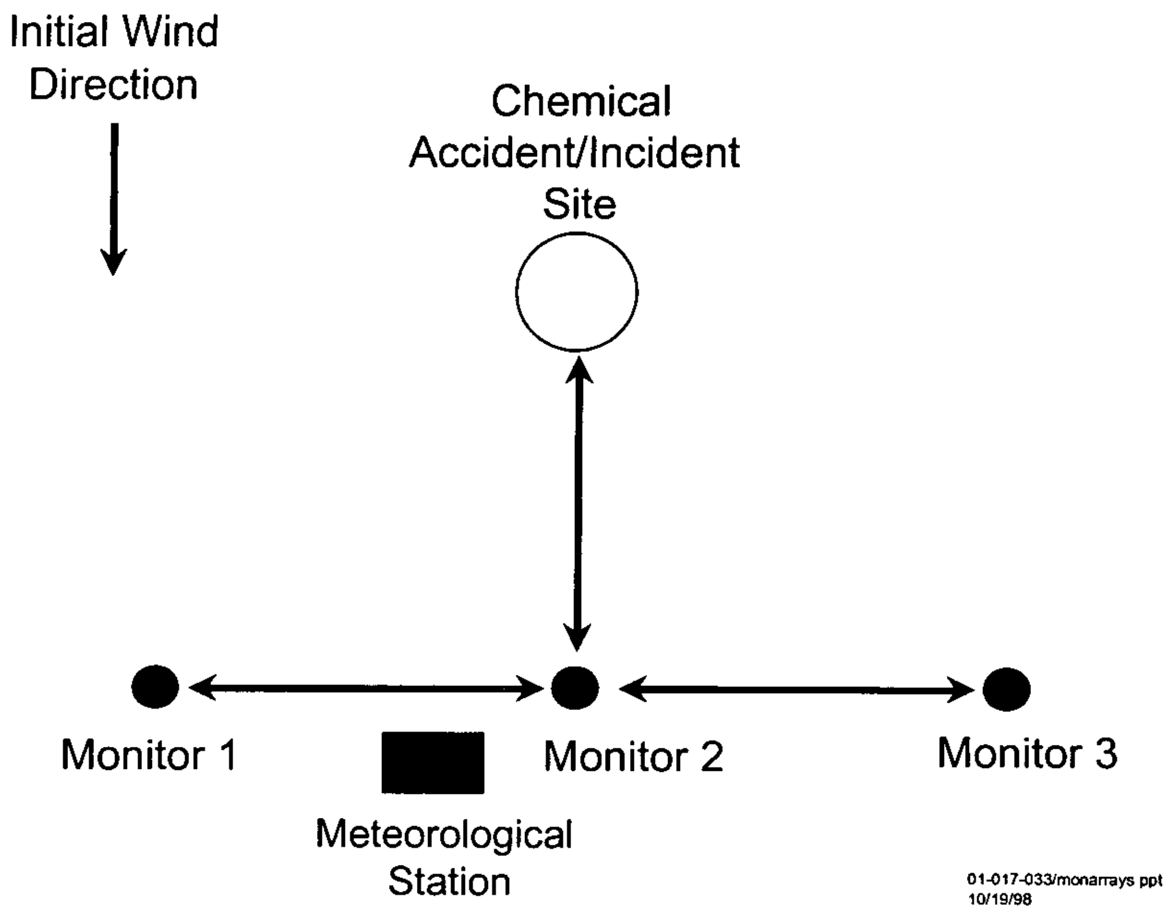

Figure 5-3. Initial Monitoring During Emergency Response

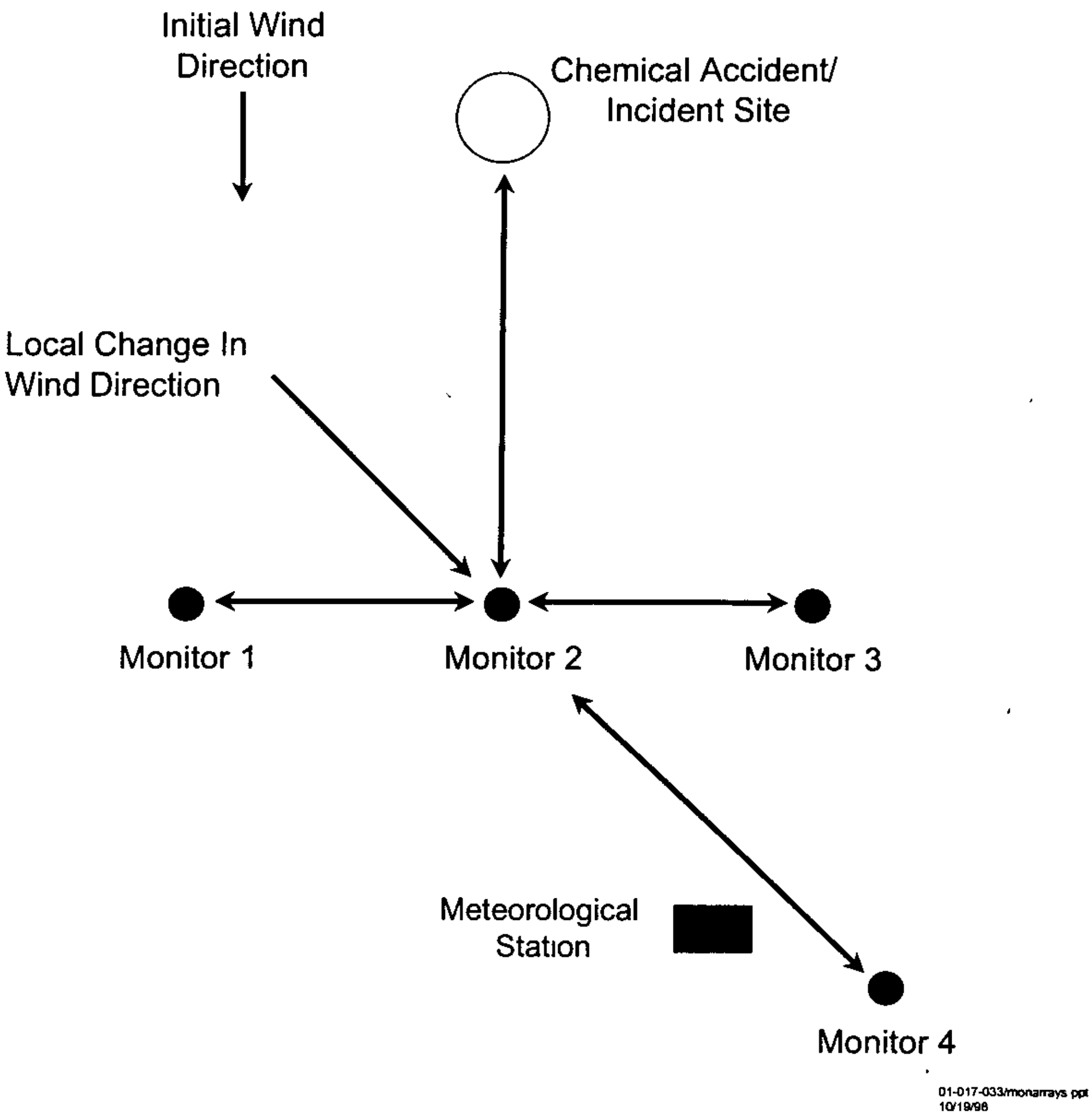

Figure 5-4. Second Array Monitoring During Emergency Response

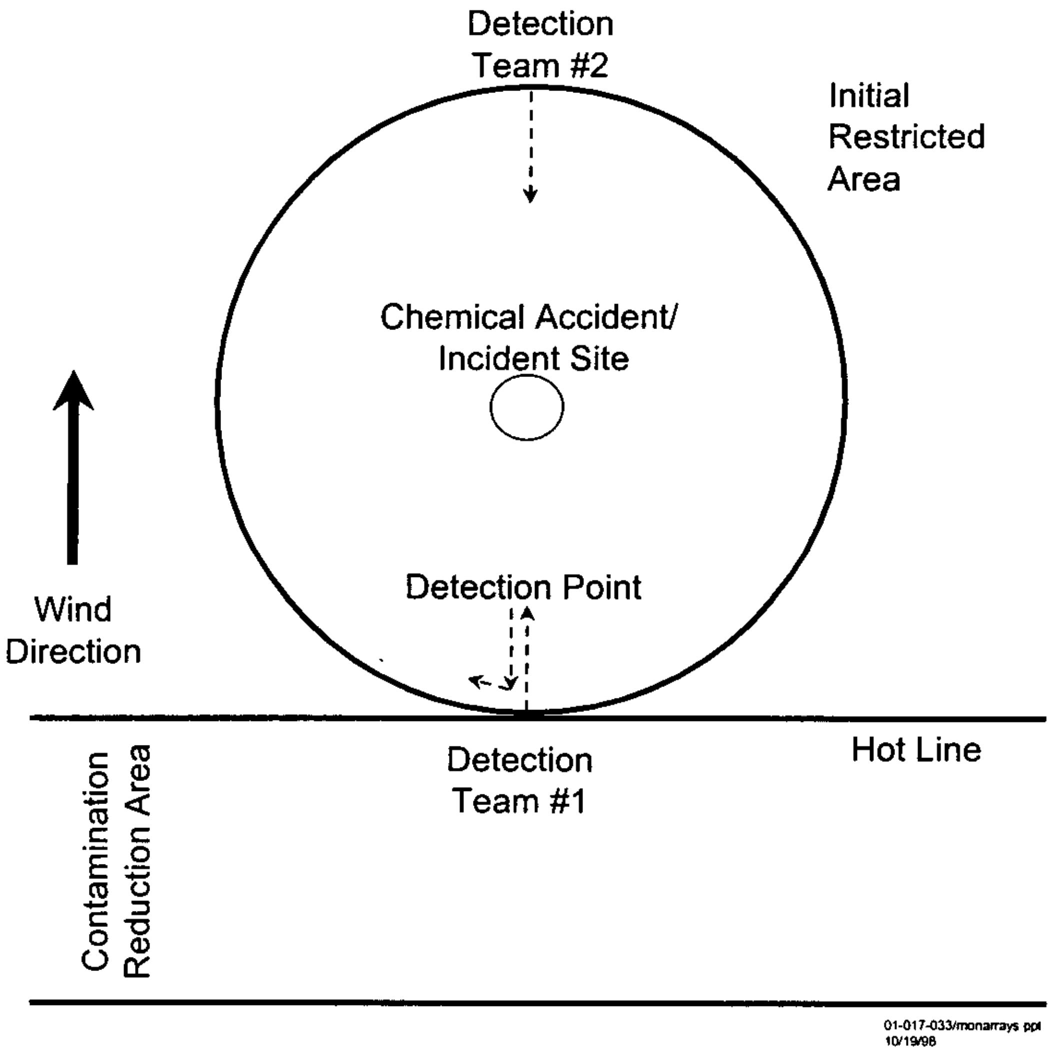

Figure 5-6. Surveillance Monitoring of the Restriction Area

5.1.4 Monitoring During Onsite Transportation. Onsite transportation consists of movement of the overpacked and inspected CWM from the recovery site to the IHF. Monitoring of overpacks will not be required during short-term onsite transportation unless a serious accident occurs. Once the item has arrived at the IHF and has been unloaded, the overpacks will again be visually inspected. If the integrity of the overpacks does not appear to be sufficient, or if any evidence of leakage is observed, the item contained in the overpack will be repackaged by TEU (wearing appropriate PPE) and monitored with the appropriate equipment (see table 5-1) to ensure the overpack is properly sealed. If an accident occurs during onsite transportation, monitoring will be conducted as described in paragraph 5.1.3.

5.2 Roles and Responsibilities

The TEU will provide qualified personnel to perform chemical agent monitoring during recovery and onsite transportation operations. TEU will:

a. Provide and configure monitoring equipment such as the MINICAMS®, MONITOX® plus, and Depot Area Air Monitoring System (DAAMS) to conduct monitoring operations for chemical agents.

b. Obtain agent standards as necessary for all chemicals to be monitored.

c. Obtain appropriate colorimetric tubes for detection of industrial chemicals.

d. Record calibration data, instrument parameters, and agent standards (when used) in instrument logbooks.

e. Maintain daily printouts of calibration data and monitoring results, including hard copy MINICAMS® monitoring results.

Other TEU responsibilities associated with monitoring are to:

a. Perform D2PC[1] hazard prediction modeling prior to commencing daily operations.

b. Provide the required personnel, equipment, and support vehicles to conduct the operation.

c. Provide logistical support and resupply assets to sustain continuous operation throughout the duration of the project.

d. Coordinate with the Memphis Depot, CEHNC, and other onsite organizations to ensure that the monitoring plan is understood and that actions to be taken are known in the event agent is detected.

e. Ensure MINICAMS®, MONITOX® plus, and DAAMS are tested and serviceable prior to commencing daily operations.

5.3 Monitoring Chemicals of Concern

5.3.1 Chemical Agents.

5.3.1.1 Mustard (H, HS, and HD). The TEU will use a MINICAMS® (see paragraph 5.4.1 for description) for first entry and contingency monitoring. The workplace exposure level for H, HS, and HD is 1.0 TWA [0.003 milligram per cubic meter (mg/m^3)]. DAAMS tubes (see paragraph 5.4.2 for description) will be collected for surveillance monitoring and confirmation monitoring of a MINICAMS® alarm. The estimated limit of quantification for H, HS, and HD using DAAMS or MINICAMS® is 0.0006 mg/m^3.

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1 D2PC is a U.S Army-approved personal computer program for chemical hazard prediction

5.3.1.2 Lewisite. L will be monitored using a Lewisite MINICAMS® (see paragraph 5 4 1 for description) for first entry and contingency monitoring. The workplace exposure level for L is 1.0 TWA (0.00? mg/m^3). DAAMS tubes (see paragraph 5.4.2 for description) will be collected for surveillance monitoring and confirmation monitoring of a MINICAMS® alarm. The estimated limit of quantification for L using DAAMS is 0.0006 mg/m^3 and less than 0.0015 mg/m^3 for MINICAMS®.

5.3.2 Industrial Chemicals.

5.3.2.1 Phosgene (CG). CG will be monitored using a MINICAMS® (see paragraph 5.4.1 for description) or MONITOX® plus (see paragraph 5.4.4 for description) for first entry and contingency monitoring. The workplace exposure level is 1.0 TWA (0.4 mg/m^3). The MINICAMS® estimated quantification limit is less than or equal to 0.4 mg/m^3. A Draeger colorimetric tube (81-01521) (see paragraph 5.4.3 for description) will be used for surveillance monitoring and confirmation of a MINICAMS® alarm. The estimated quantification limit for the Draeger tube is 0.1 mg/m^3.

5.3.2.2 Chloropicrin (PS). PS will be monitored using a MINICAMS® (see paragraph 5.4.1 for description) for first entry and contingency monitoring. The workplace exposure level is 1.0 TWA (0 7 mg/m^3). The MINICAMS® estimated limit of quantification is less than or equal to 0.7 mg/m^3. A Draeger colorimetric tube (8101021) (see paragraph 5.4.3 for description) will be used for surveillance monitoring and confirmation of a MINICAMS® alarm. The estimated limit of quantification for the Draeger tube is 6.8 mg/m^3.

5.3.2.3 Chloroform. Chloroform will be monitored using a MINICAMS® (see paragraph 5 4.1 for description) for first entry and contingency monitoring. The workplace exposure level for chloroform is 1.0 TWA (9.7 mg/m^3). The MINICAMS® estimated limit of quantification is less than or equal to 9.7 mg/m^3. A Draeger colorimetric tube (67-28861) (see paragraph 5.4.3 for description) will be used for surveillance monitoring and confirmation of a MINICAMS® alarm. The estimated limit of quantification for the Draeger tube is 1.94 mg/m^3.

5.4 Monitoring Devices

5.4.1 MINICAMS®. Air samples for first entry and contingency monitoring of HD, L, CG, PS, and chloroform will be collected and analyzed with a MINICAMS®. The MINICAMS® is a low-level, NRT vapor monitor that has been designed to detect chemical agents and industrial compounds. The MINICAMS® uses a preconcentration sampler that passes air through a solid sorbent, such as a coarse mesh Tenax®, to collect the sample. The sample is collected over a timed sampling cycle, and the sample is desorbed and carried into a gas chromatograph (GC) temperature-programmed capillary column. The appropriate detector is configured for the chemical that is to be monitored. The MINICAMS® can also be configured to monitor for using a sample loop in place of a sorbent tube.

5.4.2 Depot Area Air Monitoring System. The DAAMS is an air sampling and analysis method that provides surveillance sampling data by using sorbent tubes. The system consists of small, glass, sorbent-packed tubes, a vacuum pump, and flow control hardware. Sorbent tubes will be used for sampling all chemical agents. In the DAAMS method, air is drawn through the tube at a specified flow rate, for a specified length of time and contaminant is adsorbed onto the tube packing. After sample collection, the contaminants are thermally desorbed from the tube into the carrier stream of a GC, and subsequently detected using the appropriate detector.

5.4.3 Colorimetric Techniques. Colorimetric techniques are based on specific chemical reactions that lead to the formation of colored reaction products when agents are present above threshold concentrations. Colorimetric tubes, such as Draeger tubes, are available for the detection of the chemical agent and industrial chemicals during surveillance monitoring and confirmation of MINICAMS® alarms.

5.4.4 MONITOX® plus. MONITOX® plus is a portable gas warning system for the detection of CG. It continually measures the actual gas concentration by reacting specifically to the substance being monitored. It responds to the hazard by emitting an audible alarm and a visible (LED) alarm. Two alarms can easily be set in the field to any value within the measuring range of the instruments.

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SECTION 6
EMERGENCY RESPONSE CONTINGENCY PLAN

6.1 Introduction

This IHF Plan outlines those procedures to be taken in the unlikely event of an accident, emergency, or release of toxic chemical or agent while CWM is being recovered, transported onsite, or in storage at the IHF. These procedures deal specifically with the CWM stored in the IHF; however, they rely heavily on those emergency response procedures already prepared by the Army. They include the following:

a. Work Plan for Chemical Warfare Materiel Investigation/Removal Action, Dunn Field, Defense Distribution Depot Memphis (DDMT)

b. "Chemical Weapons and Materiel Escorts," Technical Escort Unit SOP 50-1

c. U.S. Navy Explosive Ordnance Disposal Procedures, "Chemical/Biological Agents and Related Materials: Characteristics, Leak Sealing, Disposal, and Decontamination" (TM 60A-1-1-11)

d. "Chemical Accident or Incident Response and Assistance (CAIRA) Operations" (DA Pam 50-6).

In addition, this IHF Plan will consider the Emergency Response Guidebook developed by the Research and Special Programs Identification of DOT. It will also consider DA Contingency Plans and Procedures, including Oil and Hazardous Substance Spill Contingency Planning Control and Emergency Response, which is detailed in Chapter 8 of AR 200-1, Environmental Protection and Enhancement.

6.2 Background

CWM is to be transported from the remediation site at Dunn Field to an IHF co-located at the recovery site. The CWM will be stored temporarily in a portable IHF. Transportation of any CWM is under the control of the TEU. If an emergency develops during the storage of CWM in the IHF, TEU will respond to mitigate the situation.

6.3 Objective

The primary concern of emergency response to a chemical incident will be to protect human health by controlling the release and protecting the environment. It is essential that personnel be prepared in the event of an emergency. All emergency response operations should be performed in the safest manner and in accordance with preapproved contingency plans as stated in paragraph 6.1. The three major types of emergencies that can be encountered are: (1) spills that may include exposure to chemical or hazardous materials, (2) incidents requiring medical help, or (3) fire.

This Emergency Response Contingency Plan complies with 29 CFR 1910.120(1) and addresses the following elements:

- Planning
- Emergency recognition
- Personnel, authority, and communications
- Emergency alerting, reporting, and evacuation routes
- PPE and emergency equipment
- Procedures for decontamination and medical treatment.

As recommended by the USEPA and TDEC, this Emergency Response Contingency Plan also includes sections that address procedures to protect the local affected population in the event of an accident or emergency. These sections are:

- First responders involving the IHF (TEU only)

- First responders not involving the IHF
- First aid and medical information
- Air monitoring plan
- Spill control and countermeasures plan.

6.4 Communications

The Memphis Depot has jurisdiction during onsite transportation of CWM at the Memphis Depot. In situations where the public is threatened by a release of a potentially hazardous chemical, emergency response actions will be preapproved by an agreement between Federal and local authorities.

The TEU personnel should assume control of any immediate incident scene and take necessary steps to save lives, protect property, and in coordination with the Memphis Depot, notify local and regional authorities in accordance with this IHF Plan. Once the Memphis Depot authorities arrive at the scene, the TEU personnel should assume a technical advisor role and cooperate fully with the Memphis Depot representatives (for example, advise on need for evacuation, size of hazard area, and need for PPE).

6.5 Interim Holding Facility Operations

These procedures outline operational tasks to be performed prior to storing CWM and the Contingency procedures in the event of an incident involving the overpacked CWM.

6.5.1 Contingency Planning. The Memphis Depot representative and the TEU officer responsible for responding to emergency conditions will review the emergency procedures and ensure that all necessary notifications are made and emergency equipment is ready for use. All personnel training will have been accomplished prior to operations. All personnel will be briefed on their roles in emergencies. This includes leak seal procedures, perimeter monitoring, personnel and equipment decontamination, fire suppression, evacuation, cleanup, and first aid.

Medical support will be required to respond to chemical accidents or incidents that may affect workers or the public during the transportation or interim storage of the recovered CWM. It is anticipated that the procedures provided for in the Memphis Depot Work Plan will address any situation that could occur during onsite recovery, transportation, and storage of recovered CWM.

6.5.2 Personnel. The daily operations of the CWM IHF will be conducted by the Memphis Depot. The TEU will respond in the event of an accident during onsite storage of CWM. The TEU personnel are trained and will be equipped for responding to any type of incident that may occur. The TEU will have the capabilities of implementing the primary public safety measures as part of their Emergency Response Program. The TEU will have the proper tools to handle unexpected situations, such as monitoring contamination, first aid, decontamination, fire protection, and leak control.

a. *Training and Certification.* All personnel who participate in the emergency response to a chemical incident will be trained and certified in emergency procedures, use of first aid, use of PPE, and cardiopulmonary resuscitation (CPR), and will have the basic knowledge of agent exposure symptoms. This will include, at a minimum, 29 CFR 1910.120, Hazardous Waste Operations training. All emergency response organizations should have their supervisory and team members familiarize themselves with the Memphis Depot Work Plan, and TEU operations procedures and SOPs applicable to CWM decontamination and spill cleanup. Site personnel should have this documentation filed onsite.

b. *TEU Coordination with Support Personnel.* The TEU personnel should have the capability to coordinate responses with other participating key organizations and local emergency response personnel, who should provide them with response management expertise in areas such as public alert, notification, traffic and access control, assistance to affected populations, and initial medical intervention and care.

6.5.3 Emergency Response Resources.

a. *Local.* The Memphis Depot Work Plan will be reviewed prior to acceptance of the first CWM at the IHF. This IHF Plan will specify the onsite emergency coordinators, local emergency response agencies, and safety and environmental officials. The telephone numbers and resources will be available in the case of a chemical emergency and will be posted at every phone.

(1) *Technical Escort Unit.* The TEU will support emergency response in two ways:

(a) During CWM transport and storage of CWM, the TEU will be the first responders during an emergency situation.

(b) During storage of the CWM, the TEU will respond to an emergency situation at the IHF resulting from a CWM leak, fire, or any other situation involving the release or potential release of chemical agent.

(2) *Medical Support Vehicle.* An ambulance will be available at a nearby facility to transport injured personnel to the identified emergency medical facilities.

(3) *Fire Truck Vehicle.* A fire truck will be available onsite during the recovery and transportation of the CWM.

Phone contacts for local response resources are presented in the Memphis Depot Work Plan. This plan should be referred to for specific instructions and protocol for contacting emergency response organizations.

b. *State Emergency Response Resources.* State emergency response resources may be needed to provide secondary supporting activities such as medical and evacuee care and security. These resources should be identified and used as necessary.

6.6 Contingency Plans

Immediate emergency response actions are required in response to an incident. Emergency procedures would begin upon the detection of chemical agent from a monitor or an alarm, the presence of smoke, or the suspicion of CWM contamination. These hazards may include, but are not limited to, the following:

- Hazards associated with CWM
- Fire
- Medical emergencies
- Hazardous material handling.

Mitigating actions in response to an incident are addressed in the following sections. Resources and support services have been identified in paragraph 6.5.3. Additional details with regard to protocol, responsibilities, and points of contact in the event of an emergency are available in the Memphis Depot Work Plan for the areas where CWM transportation will occur. The Memphis Depot Work Plan will be used as a source of reference for emergency planning and implementation.

During storage, emergency response will be provided by the TEU. The TEU has SOPs in place that address response procedures, decontamination methods, and spill cleanup. Highlights of those procedures are provided in the following paragraphs, which outline the personnel, equipment, and procedures to be taken in the event of an incident.

6.6.1 Responding To a Chemical Warfare Materiel Incident. Detailed procedures for responding to a CWM incident will be addressed in the TEU operations plan. Key elements of those procedures are discussed in the following paragraphs.

a. *Isolation.* The following steps are to be taken to isolate and mitigate a container:

(1) Upon observing a spill (or leakage or discharge of the contents of a container) of any size, workers will immediately proceed to a safe distance upwind and direct other personnel away from the spill.

(2) Until determined otherwise, any unidentified spilled material will be assumed to be hazardous.

(3) Sources of ignition, including vehicles, will be extinguished immediately within 50 feet.

(4) Workers who may have been in contact with spilled materials will undergo decontamination consistent with the extent and nature of the contact.

(5) The TEU will, if possible, mitigate leaking CWM and segregate it from surrounding containers.

b. *Notification.* The following steps are to be taken to notify the appropriate authorities of a situation which requires implementation of the Emergency Contingency Plan:

(1) The Memphis Depot is responsible for the Memphis Depot area where the incident occurred and will be contacted.

(2) If necessary the Memphis Depot may declare an emergency, initiate remediation, request assistance, and make offsite notifications following the Memphis Depot Work Plan.

c. *First Aid.* The following actions will be taken, as appropriate:

(1) If workers are unable to evacuate themselves, their rescue will be the responders' first priority.

(2) Responders will wear the appropriate PPE to conduct rescues.

d. *Characterization.* The following characterization steps may be performed:

(1) The TEU members will investigate the incident site to determine the conditions of the involved cargos and areas of possible contamination. Reentry to the area will be conducted in the appropriate level of PPE.

(2) The following three hazard categories will apply, unless evidence indicates otherwise: oxidizing, corrosive, and acutely toxic by skin contact or inhalation (material will be presumed to volatilize significantly unless proven otherwise).

(3) At the discretion of the TEU, samples from the accident/incident area will be collected for field or laboratory testing. This may include ambient air, soil, and/or water samples.

(4) The area of the spill will be determined and documented. The quantity will be estimated. The area will be marked with stakes and barrier tape. Members of the security police will assist in appropriate traffic control to block all traffic around the explosion

zone until responders arrive. The National Response Center will be notified.

(5) Air monitoring will be conducted around the breathing zone of the responders and upwind and downwind of the spill. Bag and sorbent tube air samples will be collected for subsequent analysis.

(6) The spread of material will be contained as soon as circumstances permit. Dikes, berms, loose sorbent, or sorbent pads may be used to prevent the spread of spilled materiel.

(7) Vapor-suppressing foams may be applied if it has been verified that the spill material is not reactive.

(8) Clay and inorganic sorbent should be used on material not fully identified. Sorbents made from organic materials and neutralizers should not be applied to materials not fully identified.

e. *Cleanup/Disposal.* Damaged containers will be repackaged into a new MRC (or drums of compatible construction) containing suitable loose sorbents. Empty drums will be maintained near the IHF. Saturated sorbents, soil, spill-control pads, etc. will be collected in compatible containers using appropriate equipment. Contaminated tools and equipment for decontamination or disposal will be collected. Disposal will depend on the identity of the spilled materiel. Unidentified overpacked materiel will be stored in a segregate area of the IHF, pending identification.

6.6.2 Fire. In the event that a fire during CWM transport or storage occurs, procedures are as follows:

a. *Isolation.* Upon detecting a fire, the TEU will determine whether the fire is small enough to extinguish with a portable extinguisher or with water that is immediately available with the TEU. Nonessential personnel will be directed away. The TEU will attempt to extinguish the fire provided that:

   (1) They are able to approach the fire from the upwind side or opposite to the direction of the fire's progress.

   (2) An extinguisher containing the appropriate extinguishing agent is readily available.

   (3) No known complicating factors are present, such as the likelihood of rapid spread, imminent risk of explosion, or gross contamination. Conditions and common sense may dictate changes in sequence of actions.

   (4) Personnel leaving a fire area will account for all other employees in the area as soon as possible.

b. *Notification.* The Memphis Depot will be notified as soon as possible of the location, size, and nature of the fire/explosion. As conditions dictate, the TEU or the CEHNC Safety Specialist will declare an emergency, initiate the remedial procedures, request assistance from the local fire department, and make necessary notifications as listed in the emergency response notification list. The Memphis Depot Work Plan will provide additional details of notification requirements.

c. *Rescue.* Rescue of employees unable to evacuate themselves will be the first priority of responders.

d. *Firefighting Procedures.* The procedure to perform firefighting involves:

- Stopping the transporter (if during movement)
- Sounding the alarm
- Using the fire extinguisher
- Requesting assistance from the fire department.

The following are guidelines to be followed during a response to a fire:

(1) No attempt should be made to extinguish large fires. These should be handled by the fire department.

(2) If human life appears to be in danger or the spread of fire appears to be rapidly progressing, personnel should be moved further upwind, away from the fire.

e. *Fire Extinguishing.* The three possible classes of fire and recommended extinguishing media follow:

(1) Class A (wood, cloth, paper, rubber, many plastics, and ordinary combustible materials) example extinguishing materials are:

- Water
- Water with 1-percent Aqueous Film Forming Foam (AFFF)
- Water with 5-percent AFFF or fluoroprotein
- Foam
- ABC dry chemical
- Halon 1211.

(2) Class B (flammable liquids, gases, and greases) example extinguishing materials are:

- ABC dry chemical
- Purple K
- Halon 1211
- Carbon dioxide
- Water with 6-percent AFFF.

(3) Class C (energized electrical equipment) example extinguishing materials are:

- ABC dry chemical
- Halon 1211
- Carbon dioxide.

f. *Protective Clothing.* Based on the conditions, CEHNC Safety Specialist will determine appropriate distances. Firefighting turn-out gear may be required. The TEU will determine when other protective gear will be worn depending on the potential for chemical agent release.

g. *Decontamination.* At the conclusion of firefighting activities, the TEU, CEHNC, or the Memphis Depot will determine, to the extent practicable, the nature of the contaminants encountered during the incident; arrange for equipment to be processed through decontamination; or label and isolate equipment for further action.

6.6.3 Medical Emergencies. Seriously injured or ill personnel should not be moved, unless their lives are endangered, until an assessment has been made by a person trained in emergency medicine. If a chemical incident injury or illness is minor, full decontamination should be completed and first aid administered before transportation. If the person's condition is serious, at least partial decontamination should be completed. First aid should be administered while awaiting an ambulance or paramedics. Paramedics and emergency personnel must be made aware if a victim is contaminated with chemical agent prior to handling the victim or beginning treatment. All injuries and illnesses must be reported to the Memphis Depot. Any person transporting an injured/exposed person to a clinic or hospital for treatment should take along directions to the hospital and information concerning the nature of the injury or illness. Coordination with medical facilities is described in the Memphis Depot Work Plan.

6.6.4 Local Hospitals. The following hospitals (with telephone numbers) will be contacted for emergency care.

Baptist Central	(901) 227-2727	899 Madison Avenue Memphis, TN 38146
Methodist Central	(901) 726-7000	1265 Union Street Memphis, TN 38104

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SECTION 7
ROLES AND RESPONSIBILITIES

The primary participating organizations include CEHNC, the Memphis Depot, PMCD, and SBCCOM/TEU. The organization is shown in figure 2-1.

Many of the participating organizations involved with onsite transportation of recovered CWM and onsite storage at the IHF have both shared and individual roles and areas of responsibilities. For example, the IHF is operated under the direction of the Memphis Depot in close coordination with PMNSCM. The TEU will initially provide the personnel and equipment to perform the investigation/removal of CWM, and move recovered CWM to the IHF. Close coordination between all organizations will be maintained.

Common responsibilities for some organizations include:

- Coordinating with other organizations
- Performing duties in accordance with accepted health and safety procedures
- Using established supply procedures and providing supplies necessary to support their operations
- Providing emergency response support
- Developing training plans for use by emergency response teams.

Specific responsibilities for each key organization associated with IHF operations are presented in the following paragraphs.

7.1 U.S. Army Program Manager for Chemical Demilitarization

a. Responsible for the proper recovery, storage, transportation, and disposal of all recovered CWM at the Memphis Depot. Coordinates activities with supporting agencies to transport CWM from remediation site to the IHF and store CWM at the IHF. Has program responsibility for ensuring that storing CWM is accomplished in accordance with Federal and state environmental regulations.

b. PMCD IHF Coordinator has responsibility to ensure that CWM is handled in a safe and environmentally acceptable manner from the point at which it is received from the remediation site through to completion of IHF operations.

c. In coordination with TEU, will safely store, on an interim basis in preparation for final disposition, suspect CWM recovered during site remediation.

d. Accomplish the following aspects of the operation:

(1) *Risk Assessment*. The risk assessment (annex A, also known as an HA) addresses the relative risk of CWM storage. Information on health hazards associated with CWM is provided in annex C.

(2) *Quality Assurance (QA)*. Implement a QA program where all work is accomplished with an acceptable level of internal controls and review procedures, and technical accuracy exists during applicable tasks.

e. Develop and oversee CWM handling programs, such as monitoring (section 5), inspecting, storing, transporting from storage, and emergency response (section 6).

f. Coordinate standby decontamination and medical support during all phases.

g. Coordinate personnel and equipment to ensure that CWM is properly packaged and repackaged, if required.

h. Provide or ensure the following during CWM storage:

- Compatibility of items stored
- Accessibility to items within storage for both surveillance and movement purposes
- Supervisory control
- Surveillance procedures
- Inventory and inventory procedures.

i. Ensure safe environmentally acceptable storage, transportation, and disposal of CWM in close coordination with the Memphis Depot. The TEU provides direct support to the Memphis Depot.

j. Will ensure accountability through proper documentation at the Memphis Depot.

7.2 Former Defense Distribution Depot Memphis, Tennessee

a. The Memphis Depot is the supported organization and will coordinate with the Tennessee Department of Environment and Concern (TDEC) representatives, the USEPA, and local government agencies as required.

b. Exercises site control during all phases of the CWM recovery operations.

c. In close coordination with PMCD, exercises control of CWM after receipt from the remediation site until CWM is removed from IHF and exported for final disposition.

d. At the time of recovery, and immediately transfers physical custody of CWM to the TEU. As generator of the waste, retains accountability until waste is destroyed.

e. Oversees site operations conducted by the remediation contractor and the TEU to safely manage CWM.

f. Supports routine maintenance of the IHF.

g. Responsible for providing emergency response as required.

h. Provides medical and public affairs support for the Memphis Depot operations.

i. Coordinates with the TDEC and local agencies.

j. Immediately corrects failure of the IHF structure or major components. Should major structural repair be impractical, coordinates with PMNSCM to replace IHF and ensure that CWM is transported following procedures developed for receipt and storage of CWM.

k. Provides radios or cellular phones to be used by the TEU supervisor, site safety officer (SSO), and the Memphis Depot; permitting communication between key organizations and to emergency services.

l. Conducts public outreach program in coordination with PMNSCM POIO. All requests for information about the IHF and recovery activity will be conducted through the Memphis Depot.

m. Ensures monthly monitoring is performed using DAAMS tubes and reports all results to PMCD.

7.3 U.S. Army Soldier and Biological Chemical Command/U.S. Army Technical Escort Unit/Edgewood Chemical Biological Center

a. Provides support to CEHNC, the Memphis Depot, and PMCD.

b. Performs recovery operations of CWM.

c. The TEU (representing SBCCOM), when directed by the Memphis Depot/PMCD, assumes physical custody of CWM when recovered at the remediation site; performs initial characterization tests to determine contents of the fill; and overpacks the recovered CWM in MRCs.

d. Provides direct support (monitoring equipment and personnel) to perform monitoring. The IHF will be monitored prior to opening (first-entry monitoring) by the TEU and then monthly while CWM is in storage.

e. Inspects the IHF periodically for signs of deterioration or other damage that could lead to a release of chemical agent.

f. Provides first response during emergency situations during recovery, overpacking, transportation, and storage operations.

g. Conducts training for IHF operations including proper lifting techniques.

h. Provides initial decontamination during emergency response.

i. Provides personnel to perform QA duties as required.

j. Provides support to the Memphis Depot during storage of CWM in case of emergency within the IHF.

7.4 U.S. Army Corps of Engineers, Huntsville Division

a. CEHNC is responsible for the planning and execution of site characterization and remediation operations at Dunn Field.

b. CEHNC is responsible for all policy implementation, project execution, and coordination of the support agencies.

c. CEHNC will make management decisions based on recommendations from SBCCOM particularly the TEU and ECBC.

d. CEHNC will procure the necessary Rights of Entry and Memoranda of Agreement in order to accomplish the projects objectives. CEHNC will also arrange for support services such, as site security, that are not available at the Memphis Depot.

e. CEHNC in conjunction with UXB and SBCCOM will provide for the safety of all project personnel as well as the local community.

f. During operations, the CEHNC Safety Specialist will be onsite to oversee contractor operations and provide overall site control. The Safety Specialist will coordinate all supporting agencies, monitor the work, and provide feedback.

7.5 State and Local Agencies

Other public agencies are expected to provide standby medical and firefighting capabilities, if required.

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SECTION 8
PUBLIC OUTREACH

The PMCD and the PMNSCM are committed to public input and to timely and accurate information exchange with all stakeholders. This commitment includes a continuing pro-active public outreach and involvement program. The PMCD POIO has initiated a national strategy that encompasses exchanging information with partners at the national, regional, and local levels.

The Memphis Depot has overall responsibility for public outreach involving recovery of CWM at the Memphis Depot and will be the focal point for public inquiries into this project. The Memphis Depot will coordinate with all participating agencies to obtain information for public release and to ensure all agencies are aware of the public's concerns. Outreach efforts containing information about the storage or transportation of recovered CWM will be coordinated with PMCD POIO before implementation. Likewise, any public concerns relating to the storage or transportation of recovered CWM will be shared with PMCD POIO. PMCD/PMNSCM will support the Memphis Depot by preparing fact sheets, arranging for experts to answer questions, and integrating site-specific outreach activities into national and regional programs.

Public outreach activities will be planned to accommodate the degree of public interest and to address the specific concerns that are voiced. Public outreach plans for activities at Dunn Field are described in the Memphis Depot Work Plan (CEHNC, 1999). Specific outreach activities will include:

a. Making information available at a public repository

b. Conducting public availability sessions

c. Issuing press releases or notices prior to key events (such as advertising an availability session or announcing the conclusion of operations)

d. Interacting with interested individuals, elected officials, and special interest groups

e. Maintaining a list of interested parties and ensuring that these parties receive information that addresses their concerns

f. Maintaining an outreach presence at the work site or other designated location as warranted.

Annex I contains answers to questions that might be asked about this plan.

For more information or to comment about this plan, contact:

Product Manager for Non-Stockpile Chemical Materiel
Public Outreach and Information Office
ATTN: SFAE-CD-P/Mr. Bob Jones
Aberdeen Proving Ground, Maryland 21010-5401

Phone: 800-488-0648 or 410-436-7439
FAX: 410-436-7442
E-mail: *rjones@c-pmcd.apgea.army.mil*

Telephone numbers and points of contact for other public affairs offices that can assist in obtaining answers to questions about this plan are listed below:

Former Defense Depot Memphis
Public Affairs Office
Mr. Shawn Phillips
901-544-0611.

SECTION 9
CONCLUSIONS

This Memphis Depot IHF Plan provides a scope of effort intended to support removal activities at the Dunn Field Memphis Depot CWM burial site. In the event that CWM is recovered during the investigation/removal process, this plan describes procedures and resources to safely handle, transport, and store recovered CWM. The CWM will be managed as a hazardous waste.

As part of the effort to determine if the proposed IHF operations could be performed in a safe manner, an HA was conducted to identify and evaluate hazards associated with the proposed IHF activities. The HA that evaluates the risks associated with handling, onsite transportation, and storage of recovered CWM at the Memphis Depot. Accident scenarios were identified from review of the concept of operations and from historical information. Risk assessment codes (RACs) were assigned to these scenarios on the basis of estimated consequence severity and likelihood of occurrence. Eleven accident scenarios were identified and classified as RAC 3. The 11 accident scenarios are summarized in table A-4. No MCE is defined for this IHF Plan.

On the basis of the HA, the movement of recovered CWM from the potential recovery site on Dunn Field to the IHF, also located on Dunn Field, and storage of the recovered CWM in the IHF can be safely performed provided the following actions are taken:

a. Implement SOPs to require the use of proper lifting techniques and the wearing of safety shoes and work gloves.

b. Develop an SOP to require the use of ground guides or backup alarms on trucks and forklifts and to require the use of ground guides to direct vehicles as they operate near the IHF. This action will minimize the chances of equipment accidentally striking a worker or the IHF.

c. Do not store any items in the aisles of the IHF; do not store any materials in the IHF that are not directly related to the storage of the recovered CWM.

d. Do not store any unknown or flammable materials in or around the IHF.

e. Inspect electrical circuits, lights, outlets, and lightning protection regularly.

f. Create a firebreak around the IHF by removing combustible material including dry grass and brush. Prohibit the parking of vehicles, other than CWM transfer vehicles within 50 feet of the IHF.

g. Make fire extinguishers available at the IHF.

h. Perform monthly surveillance monitoring of the IHF.

ANNEX A

INTERIM HOLDING FACILITY HAZARD ANALYSIS

FORMER DEFENSE DISTRIBUTION DEPOT MEMPHIS, TENNESSEE

ANNEX A

INTERIM HOLDING FACILITY HAZARD ANALYSIS
FORMER DEFENSE DISTRIBUTION DEPOT MEMPHIS, TENNESSEE

1. INTRODUCTION

This hazard analysis (HA) was developed to support plans for interim storage of chemical warfare materiel (CWM) recovered at the Former Defense Distribution Depot, Memphis, Tennessee. The Memphis Depot is located on a 642-acre site in the south central portion of Memphis, Tennessee. The Depot is operated by the Defense Logistics Agency (DLA). The Memphis Depot site was used for producing cotton prior to the opening of the Depot in 1942. The initial mission of the Memphis Depot was to provide stock control, storage, and maintenance services for the Army Engineer, Chemical, and Quartermaster Corps. During World War II, the Depot served as an internment center for 800 prisoners of war and performed supply missions for the Signal and Ordnance Corps. Since 1963, the Memphis Depot has been a principal DLA distribution center for hazardous materials; textile products; food products; electronic equipment; construction materials; and industrial, medical, and general supplies.

Chemical agent identification sets (CAIS) were stored at the Memphis Depot. Some ampules from these sets were found to be leaking and were buried at Dunn Field. The extent to which these ampules were decontaminated prior to burial is not known.

Suspect portions of the Dunn Field area of the Depot will be excavated following completion of a site-specific work plan/safety submission to address the potential presence of CWM at the site.

Any CWM recovered during the excavation of the Dunn Field area will be stored in an interim holding facility (IHF) at the Memphis Depot pending onsite treatment. The purpose of the IHF is to provide safe, secure, environmentally sound storage of recovered CWM or suspected CWM until the U.S. Army Program Manager for Chemical Demilitarization (PMCD) can field an onsite treatment capability.

To support the IHF Plan for the Memphis Depot, this HA documents an analysis of hazards associated with the onsite movement and storage of CWM. The HA was performed in accordance with the requirements of Military Standard (MIL-STD) 882C and the Non-Stockpile Chemical Materiel (NSCM) Program System Safety Management Plan (SSMP) [U.S. Army Chemical Materiel Destruction Agency (USACMDA) 1994]. Accidents that could occur during movement of CWM to the IHF and during storage in the IHF are discussed qualitatively. Risk assessment codes (RACs) are identified for each accident scenario as a means of categorizing the potential risk.

This HA encompasses only the risks associated with onsite movement and storage of CWM at the Memphis Depot. Neither the possible recovery of CWM during excavation of the Dunn Field area or the disposal of recovered CWM is addressed.

Recommendations for preventing or mitigating the identified accident scenarios are presented in section 3 of this annex. Recommendations for limiting personnel and public exposures in the event of an agent release are presented in section 5.

2. CONCEPT OF OPERATIONS

The IHF will provide temporary safe, secure, segregated storage of CWM. The U.S. Army Corps of Engineers (USACE) is responsible for the management and disposal of all other hazardous waste. Any CWM found will be overpacked in multiple-round containers (MRCs) and transported to the IHF.

A description of the MRCs and the testing that they have undergone is provided in paragraph 2.2. Containers will be visually inspected, inventoried, and placed in spill pans. Sufficient aisle space will be maintained to facilitate inspection and handling. All handling of MRCs will be done using hand carts.

Low-level, near real-time monitoring will be conducted each day prior to operations beginning in the IHF. If no activity is conducted, the IHF will be monitored with low-level, near real-time equipment once per month. Monitoring will include visual inspection of the containers.

Personal protective equipment (PPE), decontaminants, and safety equipment will be readily available while operations are being conducted within the IHF, but these items will not be stored in the IHF.

2.1 Chemical Warfare Materiel Characterization

Burial in Dunn Field of six CAIS has been confirmed. The specific type of CAIS buried is not known with certainty. The buried CAIS are believed to be Type K951/952 because records show that shipments of this type of CAIS were received at the Memphis Depot. Each of these sets contains 48 1.4-ounce Pyrex ampules, 12 each of mustard solution (H; 5 percent by volume in chloroform), lewisite solution (L; 5 percent by volume in chloroform), chloropicrin (PS; 50 percent by volume in chloroform), and phosgene (CG). On a mass basis, each CAIS contains 1.1 ounces of H, 1.7 ounces of L, 14.5 ounces of PS, and 25.0 ounces of CG. Other possible CAIS types include the following (PMCD, 1995):

a. Type K941 - contains 24 3.5-ounce bottles of neat H

b. Type K942 - contains 28 3.8-ounce ampules of neat H

c. Type K945 - contains eight bottles, each containing 0.7 ounce of agent absorbed on plastic pellets (one bottle each of L, triphosgene, potassium cyanide, and H, plus four bottles of GB) and three vials of agent simulants

d. Type K955 - contains one bottle with 0.2 ounce of triphosgene, one bottle with 0.5 ounce of chloroacetophenone (CN), one bottle with 0.5 ounce of adamsite (DM), plus four bottles with agent absorbed on activated charcoal [one with L, one with PS, and two with sulfur mustard (HS)].

The extent of decontamination performed on the sets prior to burial is not known.

2.2 Containment Equipment

Any recovered CAIS ampules or intact CAIS will be overpacked in MRCs and stored in the IHF. MRCs are designed to provide a safe and logistically sound overpack for CWM including those that may be leaking.

2.2.1 Multiple Round Containers. A design, fabrication, and testing program has been completed for MRCs. With the addition of many tests that simulated the temperature and vibration conditions MRCs are likely to experience during their serviceable life, the test procedures exceeded Department of Transportation (DOT) requirements. The goal of the testing was to ensure leak integrity, survivability, and serviceability of the containers after multiple reuses. At a minimum, the MRCs were subjected to tests in accordance with the following standards:

- American Society for Testing and Materials (ASTM) E-499-73 Method A, Helium Leak Testing
- MIL-STD-453C and MIL-STD-1264B, Radiographic Testing
- Technical Provision (TP)-94-01, Transportability Testing
- MIL-STD-810E Method 514.4, Low and High Frequency Tests
- United Nations (UN) Performance Oriented Packaging (POP) tests in accordance with 49 Code of Federal Regulations (CFR) Section 178.600

- MIL-STD-1660 Tests, First Article Tests (compression, vibration, drop and incline plane).

2.2.2 Multiple Round Container Description. MRCs are constructed of stainless steel and consist of a cylinder closed at one end by a base plate and with a removable lid at the other. The lid bolts onto the cylinder flange to make a leak proof seal. The MRC design includes handles or rings, depending on the size of the container, to aid in lifting. The MRCs tested were the MRC 7 x 27, MRC 9 x 41, MRC 12 x 56, MRC 21 x 79, and MRC 16.5 x 5.5. The size of MRC used depends on the size and shape of the item(s) to be packaged. Usually an MRC 7 x 27 is used to overpack individual CAIS items. Figure A-1 illustrates the various MRCs.

2.3 Onsite Transportation

Ground transportation of recovered CWM to the Memphis Depot IHF will be by the U.S. Army Technical Escort Unit (TEU). This HA considers the maximum amount of CWM to be six CAISs, each containing 1.1 ounces of H, 25.0 ounces of CG, 1.7 ounces of L, and 14.5 ounces of PS. All recovered CWM will be inspected, decontaminated and leak-sealed as necessary, and overpacked in MRCs prior to loading on the cargo vehicle.

2.4 Facility Description

The IHF is a prefabricated, single-story, modular unit constructed of insulated metal panels and equipped with an integral leaktight sump beneath the metal grating floor. Its external dimensions are approximately 24 feet long by 9 feet wide by 8 feet high. A door at each end of the unit provides easy flowthrough handling of containers. This facility is refrigerated and weatherproofed to ensure the integrity of stored materials. The unit is designed to withstand a Zone 4 (0.4) seismic loading. The facility conforms to generally accepted safety codes and standards, such as National Fire Protection Association (NFPA) 7, Uniform Building Codes, Standard Building Codes, and Building Officials and Codes Administration.

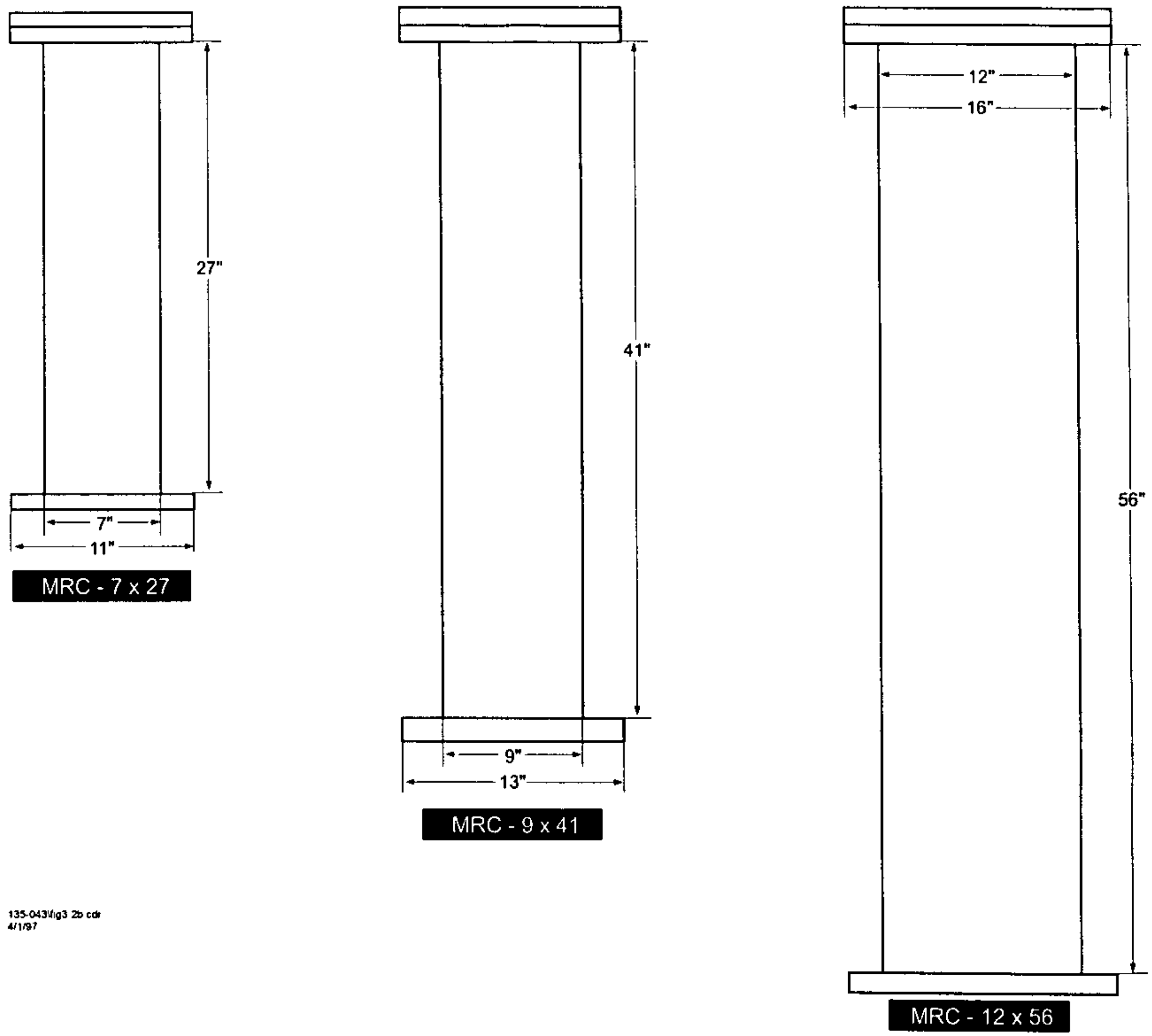

Figure A-1. Multiple Round Containers (Sheet 1 of 2)

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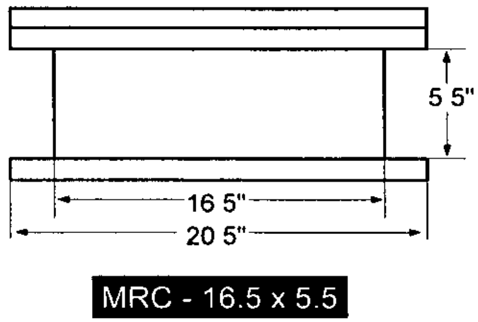

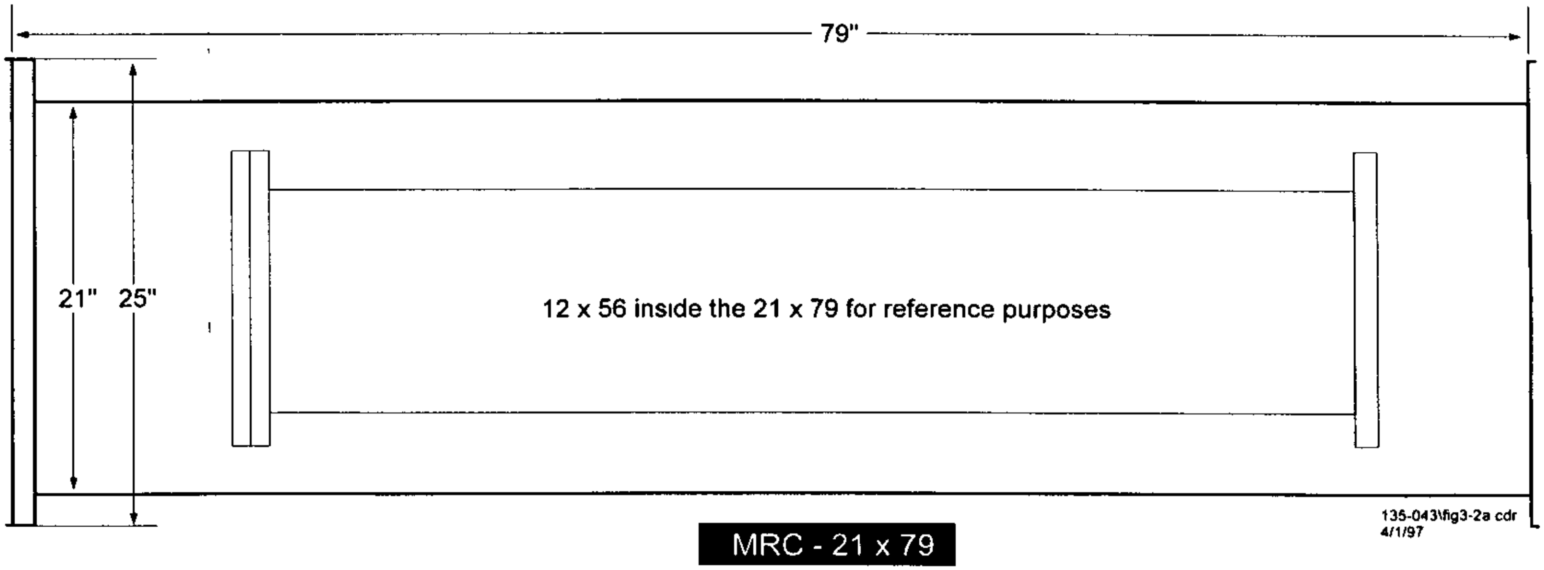

Figure A-1. Multiple Round Containers (Sheet 2 of 2)

There are two double doors located on the front of the IHF. Each double door is 54 inches wide by 82 inches high and self-closing with a magnetic core. The doors are insulated, equipped with thermoplastic gaskets for superior seal, and include cylinder locks. Metal shielding above each door diverts rain and snow from the door opening. Each entrance is equipped with a 54-inch wide loading ramp for push carts. The floor is constructed of materials resistant to absorption, corrosion, and dissolving, providing a smooth and easily decontaminated surface. The floor is designed to support 300 pounds per square foot live load and is elevated to prevent stored materiel and containers from contacting with spilled materiel in the secondary containment (steel underfloor).

The IHF is equipped with at least one waterproof interior light. The light fixture is UL-listed for class 1, division 1 hazardous locations. The light is rated for a minimum of 100 watts and protected with metal guards. There is one interior light switch.

There is one externally mounted, photocell-activated exterior lighting fixture at each door. During periods of darkness, the illumination intensity will be no less than 1.0 foot-candle at any point to a height of 8 feet on the vertical, and to a horizontal distance of 8 feet from the entrance.

The IHF is equipped with a passive ventilation system. The system includes dual screened vents, which can be closed in the event of a chemical leak to prevent gross agent discharges to the atmosphere. The IHF design also includes a filter connector port with a replaceable plug that is capable of hooking up to the filter system that can treat agent-contaminated air.

Two monitoring ports, one 6 inches from the floor and one 6 inches from the ceiling, have been installed for sampling the interior air quality of the IHF. Each monitoring port is fitted with a female quick-connect shutoff bulkhead fitting. The interior air quality of the IHF will be monitored before personnel entry at the beginning of each operational shift.

The area around the IHF structure will be cleared of combustible vegetation to a distance of 50 feet or more on all sides. The IHF has lightning protection equipment. The lightning protection equipment will be in accordance with AR 385-64.

Handling equipment to be used in the IHF includes a hand cart and miscellaneous hand tools.

2.5 Facility Location

The IHF is located at the recovery site at Dunn Field. Dunn Field is completely surrounded by a security fence and there is no public access to Dunn Field. The IHF is located on a paved area approximately in the center of Dunn Field just off of a paved access road

Access to the IHF is controlled by fences, signs, and a guard force. These features preclude unauthorized access.

2.5.1 Surroundings. The area around the Memphis Depot is primarily residential and commercial. Residential areas are located all along the eastern edge of Dunn Field and about 75 yards from the northwestern boundary of Dunn Field, approximately 150 yards from the CAIS burial site.

2.5.2 Weather. The Memphis, Tennessee, climate is characterized by warm, humid summers and mild winters. The average January nighttime low temperature is 30.9°F, and the average July daytime high temperature is 91.5°F. Annual average precipitation is 51.6 inches.

3. HAZARD ANALYSIS

To aid in the evaluation of identified hazards, potential incidents and accident scenarios have been defined and RACs assigned in accordance with the NSCM SSMP (USACMDA, 1994). The RACs are based on the combination of hazard severity category and hazard likelihood category. The definitions of the hazard severities and hazard likelihoods are listed in tables A-1 and A-2, respectively, and the RAC matrix is shown in table A-3. Hazard Control Log worksheets were used to record identified hazards and to track recommendations and resolutions. The worksheets are found in attachment A-1. Postulated accident scenarios associated with the present hazards, the controls currently in place to mitigate each hazard, and recommendations for reducing the severity or likelihood of the scenarios (and, hence, the RAC) are described in paragraphs 3.1 through 3.6. A summary of the accident scenarios identified, along with the RACs assigned, is given in table A-4. Accident scenarios assigned RAC 1 require corrective action prior to acceptance of the plan. Accident scenarios assigned RAC 2 also require corrective action but are of lower priority than RAC 1 scenarios. If resolutions do not lower the RAC to 3 or 4, the RAC 1 and RAC 2 accident scenarios must be formally accepted by the designated authorities in accordance with the SSMP.

3.1 Fire

The consequences from fires within the IHF are judged to be catastrophic (hazard severity I), and fires are judged to be improbable (likelihood category E). Therefore, a RAC 3 ranking is assigned. Possible sources of ignition are improperly installed or maintained electrical equipment, lightning strikes, and vehicle fires that begin just outside the IHF and propagate inside. Mitigating factors exist. Only approved electrical equipment is to be installed in the IHF, and very little combustible material will be present inside the IHF. The wooden pallets that are used to allow ventilation to flow under stored containers are not expected to sustain combustion long enough to jeopardize CWM within the overpacks. The following actions will be taken to further lower the risks from internal fires:

a. Do not store any unknown or flammable materials in the IHF.
b. Regularly inspect electrical circuits.

Table A-1. Hazard Severity Categories

Description	Category	Accident Consequences
Catastrophic	I	May cause death, system loss, or severe environmental damage
Critical	II	May cause severe injury, severe occupational illness, or major system or environmental damage
Marginal	III	May cause minor injury, minor occupational illness, or minor system or environmental damage
Negligible	IV	May cause less-than-minor injury, occupational illness, or less-than-minor system or environmental damage

Source NSCM SSMP (U.S. Army 1994)

Table A-2. Hazard Likelihood Categories

Occurrence Likelihood	Level	Description
Frequent	A	Will be continuously experienced
Probable	B	Will occur frequently in the life of the system
Occasional	C	Will occur several times in the life of the system
Remote	D	Unlikely, but can reasonably be expected to occur in the life of the system
Improbable	E	Unlikely, but possible to occur in the life of the system

Source NSCM SSMP (U.S Army 1994)

Table A-3. Risk Assessment Codes (RACs)

Hazard Likelihood Category	Hazard Severity Category I Catastrophic	II Critical	III Marginal	IV Negligible
A - Frequent	1	1	1	3
B - Probable	1	1	2	3
C - Occasional	1	2	3	4
D - Remote	2	2	3	4
E - Improbable	3	3	3	4

Hazard Risk Index	Risk Assessment Code	Action Required
IA, IB, IC, IIA, IIB, IIIA	1	Unacceptable - immediate corrective action required; Asst. Secretary of Army decision
ID, IIC, IID, IIIB	2	Undesirable - reduced priority, corrective action required, Program Manager NSCM decision
IE, IIE, IIIC, IIID, IIIE, IVA, IVB	3	Acceptable - low priority for corrective action (may not warrant action); System Safety Program Manager decision
IVC, IVD, IVE	4	Acceptable - no corrective action required

Source NSCM SSMP (U S. Army 1994).

Table A-4. Assigned RACs for Postulated Accident Scenarios

Accident Scenario	Controlled RAC
Storage operations	
Fire from electrical malfunction	3
Fire from lightning strike	3
Motor vehicle fire with propagation to IHF	3
Earthquake or severe weather with damage to IHF and CWM packaging	3
Aircraft crash into IHF	3
Dropping of CWM overpack resulting in agent release	3
Leak of overpacked CWM container with improper sealing of overpack	3
Pinching injury from drop of CWM overpack or other causes	3
Improper lifting of MRC resulting in personal injury	3
Tripping/falling resulting in personal injury	3
Improper handling of decontaminants	3

A transportation vehicle fire at the IHF could threaten CWM. The consequences of such a fire are judged to be catastrophic (hazard severity I), and these events are judged to be improbable (likelihood category E). Therefore, a RAC 3 ranking is assigned. To reduce the probability of a vehicle fire, it is recommended that all vehicles operating around the IHF be inspected to ensure that they are mechanically sound and have safety equipment installed. To mitigate the effects of vehicle fires, fire extinguishers should be available at all times.

3.2 External Events

The IHF could be damaged by severe natural phenomena such as earthquakes or severe weather. Memphis, Tennessee, lies near the southern segment of the New

Madrid seismic zone, which is regarded as the most hazardous zone in the eastern United States. The city is also in an area of high tornado hazard. However, because of the structural rigidity of the MRCs, release of CWM is unlikely even if the IHF is damaged. Release of CWM as a result of an earthquake or severe weather is judged to have catastrophic consequences (hazard severity I) and to be improbable (likelihood category E). Therefore, a RAC 3 ranking is assigned. MRCs will not be stacked while in storage to ensure that they do not fall in the event of an earthquake.

An aircraft accident could severely damage the IHF and release CWM. The Depot is located about 1.1 miles northwest of Memphis International Airport. An aircraft crashed into the Memphis Depot several years ago. Nevertheless, the likelihood of an accident involving the IHF is judged to be improbable (likelihood category E). However, the consequences of such an event are judged to be catastrophic (hazard severity I). Therefore, a RAC 3 ranking is assigned.

3.3 Leak or Rupture of Overpack

Any CAIS ampules that are recovered from Dunn Field and contain or are suspected of containing CWM will be overpacked in MRCs and stored in the IHF. CAIS ampules could leak or break inside their overpacks during storage if the overpack is dropped during handling or if the ampules deteriorate. Some items may be in a deteriorated state when recovered. However, any ampules that are leaking when recovered will be decontaminated and leak sealed prior to placement in an overpack. Any leakage from overpacked items would be into the sealed MRC. Only if the overpack is improperly sealed or is itself breached by an impact could any CWM be released into the IHF. Tests of the MRCs (paragraph 2.2) demonstrated the ruggedness of these containers. Breaching of an MRC by a drop during handling is highly unlikely.

The consequences of an overpack leak or rupture are judged to be catastrophic (hazard severity I). Overpack leak or rupture because of a drop during handling is judged to be improbable (likelihood category E) because of the rugged construction of these containers. Therefore, a RAC 3 ranking is assigned to the overpack drop scenario.

3.4 Slow Leak of Chemical Agent

A leaking or contaminated overpack container could be received at the IHF from Dunn Field. Any significant vapor leaks would be detected by low-level, near real-time monitoring equipment before entry into the IHF. Liquid leaks from the MRCs are possible but unlikely. These overpack containers have sufficient volume to contain any liquid that spills into them from leaking CWM containers. If a leak from an overpack container is detected, U.S. Army TEU personnel are trained for spill response and are onsite during first-entry monitoring.

CG released from leaking CAIS ampules may react with moisture in the air and create a corrosive environment inside an MRC. Such corrosive material could damage the overpack's seal or wall.

The consequences of a slow leak are judged to be critical (hazard severity II). Such leaks are judged to be improbable (likelihood category E). Therefore, a RAC 3 ranking is assigned.

3.5 Physical Hazards

The greatest potential for worker injury is posed by common industrial accidents such as back injuries from lifting heavy objects, foot injuries from dropping objects, injuries from tripping and falling, and pinching injuries from being caught between objects.

These accident scenarios are assigned a RAC 2 ranking. The following actions are required to reduce the risks associated with these scenarios to a RAC 3 ranking:

a. Train workers in proper lifting techniques to avoid back injuries

b. Require workers to wear safety shoes to reduce the potential for foot injuries from dropping objects

c. Require workers to wear work gloves to help protect their hands from pinching injuries

d. Do not store MRCs in the aisles; do not place any other materials in the aisles or store them in the IHF.

3.6 Improper Handling of Decontaminants

Decontaminants are available onsite for use during contingency operations. The possible decontaminants as listed in table 4-2 of TM 60A-1-1-11 [Department of the Army (DA), 1992] are as follows:

a. Supertropical bleach (STB)
b. Decontaminating solution (DS2)
c. Sodium hydroxide (caustic soda)
d. Calcium hypochlorite (HTH)
e. Sodium carbonate (washing soda)
f. Sodium hydroxide in alcohol-water solution (alcoholic caustic solution).

Most of these materials are hazardous chemicals and require special handling. Exposure of workers may occur during the mixing of decontaminants, or containers may be broken during handling, thereby exposing workers to health hazards. TM 60A-1-1-11 (DA, 1992) specifies the use of PPE to reduce personnel exposure while mixing decontaminants. Because TEU personnel are trained in proper mixing techniques and in the selection and donning of PPE, the potential consequences of improper handling of decontaminants are judged to be marginal (hazard severity III), and the likelihood of mishandling is judged to be remote (likelihood category D). Therefore, a RAC 3 ranking is assigned.

4. MAXIMUM CREDIBLE EVENT

Army Regulation (AR) 385-61 defines a maximum credible event (MCE) as a "worst-case" accident scenario that results in the release of agent and that has a reasonable probability of occurrence. Release scenarios that are assigned to likelihood category D or higher can be reasonably expected to occur. Scenarios assigned to likelihood category E are not considered appropriate for an MCE. No release scenarios are assigned, in all likelihood, to category D or higher. Therefore, no MCE is defined for the Memphis Depot.

5. MITIGATION OF HAZARDS

The IHF will be within the confines of the remediation site. Fences, signs, and guards will prevent accidental entry into the IHF; however, members of the public could be exposed to agent in the event of a significant agent release (as in an IHF fire or an external event). Persons in the vicinity should be briefed on evacuation routes that would be followed in the event a warning is sounded. TEU personnel are trained in spill response procedures for the chemical agents involved. The use of PPE will protect workers from hazards resulting from release of agent. The location is served by roads that provide response personnel easy access to the IHF. Radio communication is available in the event of an accident. Emergency Response Plans require TEU personnel to be onsite during the recovery and storage operations.

First-entry monitoring will be conducted in accordance with the IHF Plan and will include a visual inspection of the storage containers. This monitoring will ensure the early detection of incipient container leaks and will prevent workers from entering a dangerous atmosphere unknowingly.

6. SUMMARY

An HA that evaluates the risks associated with the onsite movement and storage of recovered CWM has been performed for the IHF at the Memphis Depot. Accident scenarios are identified from review of the concept of operations and from historical information, and RACs are assigned to these scenarios on the basis of estimated consequence severity and likelihood of occurrence. Eleven accident scenarios are identified and classified as RAC 3, and are acceptable with review. The RACs assigned to the accident scenarios are summarized in table A-4. No MCE is defined for this installation.

On the basis of the HA, the movement of CWM to the IHF and storage of the CWM at the IHF can be performed safely, provided the following actions are taken:

a. Develop SOPs to require the use of proper lifting techniques and the wearing of safety shoes and work gloves

b. Do not store MRCs in the aisles; do not place any other materials in the aisles or store them in the IHF.

ATTACHMENT A-1

HAZARD CONTROL LOG WORKSHEETS

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HAZARD CONTROL LOG

Program: Defense Depot Memphis, Tennessee

Engineer: Randy Kirchner

Date: 4/3/95

System/Subsystem: Interim Holding Facility

Item	Hazardous Condition	Cause	Effect	RAC	Recommendation	Resolution	Controlled RAC	Remarks
001	Fire	Improperly installed or poorly maintained electrical equipment	Damaged overpack seals and ruptured CAIS ampules result in release of agent	3 (IE)	Regularly inspect electrical circuits	IHF was built to code All wiring is explosion proof	3 (IE)	
002	Fire	Lightning strike	Damaged overpack seals and ruptured CAIS ampules result in release of agent	3 (IE)	Provide lightning protection	Lightning protection will be installed IAW AR 385-64.	3 (IE)	
003	Fire	Transportation vehicle fire propagates to IHF	Damaged overpack seals and ruptured CAIS ampules result in release of agent	2 (ID)	Inspect vehicles to ensure they are mechanically sound Have fire extinguishers readily available	Inspections are performed in accordance with TM 9-1300-206. Fire extinguishers are available	3 (IE)	
004	Uncontrolled release of chemical agent	Earthquake or severe weather	Damaged overpack seals and ruptured CAIS ampules result in release of agent	3 (IE)	To prevent toppling, do not stack containers inside the IHF	MRC will only be stacked one high per 4.6.2.	3 (IE)	
005	Uncontrolled release of chemical agent	Aircraft crash	Damaged overpack seals and ruptured CAIS ampules result in release of agent	3 (IE)				
006	Uncontrolled release of chemical agent	Overpack container is dropped during handling	Damaged overpack seals and ruptured CAIS ampules result in release of agent	3 (IE)	Minimize handling of loaded overpacks to reduce the likelihood of dropping one.			

HAZARD CONTROL LOG

Program: Defense Depot Memphis, Tennessee

Engineer: Randy Kirchner

Date: 4/3/95

System/Subsystem: Interim Holding Facility

Page 2 of 2

Item	Hazardous Condition	Cause	Effect	RAC	Recommendation	Resolution	Controlled RAC	Remarks
007	Slow release of chemical agent	CAIS ampule leaks and overpack is improperly sealed	Release of agent	3 (IIE)	Perform low-level, near real-time monitoring of CWM prior to loading in overpacks.	CWM is inspected for leakage and decontaminated/ sealed as necessary prior to loading in an overpack.	3 (IIE)	
008	Pinching injury	CWM overpack is dropped on foot Hand is caught between two objects	Physical injury	2 (ID)	Require workers to wear safety shoes Require workers to wear work gloves	Workers will wear safety shoes and work gloves per section 4 6 2.1.	3 (IE)	
009	Weight of MRC	Improper lifting of MRC	Back injury	2 (IID)	Train workers in proper lifting techniques	TEU personnel are trained in proper handling techniques per section 7.3.g.	3 (IIID)	
010	Tripping/ falling injury	Insufficient aisle space inside IHF	Physical injury	2 (IID)	Do not store overpack containers in aisles Do not place materials other than overpack containers in the aisles or store such materials in the IHF	36-inch aisles will be maintained around containers per section 4.6.2.	3 (IIE)	
011	Chemical injury (burns or inhalation exposure)	Improper handling of decontaminant chemicals	Physical injury	2 (IID)	Train personnel in proper handling procedures Require personnel to use PPE	TEU personnel are trained in proper handling techniques and in the use of PPE	3 (IIID)	

ANNEX B

CHEMICAL AND PHYSICAL DATA

Table B-1. Chemical and Physical Properties of Chemical Agents of Concern

Chemical Name	Levinstein Mustard (H) 70% bis (2-Chloroethyl) sulfide 30% Higher Molecular Weight Polysulfides	Distilled Mustard (HD) Diethyl, 2,2-dichloride sulfide [bis(2-Chloroethyl) sulfide]	Lewisite (L) Dichloro (2-chlorovinyl) arsine
Short Name	Levinstein Mustard (H)	Distilled Mustard (HD)	Lewisite (L)
Chemical Formula	$C_4H_8Cl_2S$	$C_4H_8Cl_2S$	$C_2H_2AsCl_3$
Molecular Weight	159 08 (pure mustard)	159 08	207 32
Physical State	Amber to brown oily liquid	Pale yellow oily liquid	Colorless to brownish liquid
Vapor Density (relative to air)	Generally exceeds 5 5	5 5	7.2
Liquid Density	1.27 g/mL at 25°C	1 27 g/mL at 25°C	1 89 g/mL at 20°C
Solid Density	N/A	Crystal, 1 37 g/cm^3 at 0°C	N/A
Normal Freezing Point	8°C	14 45°C	-18°C ± at 0 1°C
Boiling Point	Decomposes at about 180°C	217°C extrapolated	190°C
Vapor Pressure	Impurities tend to lower vapor pressure below 0 11 mm Hg	0 11 mm Hg at 25°C	0 394 mm Hg at 20°C
Volatility	Approximately 920 mg/m^3 at 25°C (reported for HD)	610 mg/m^3 at 20°C 920 mg/m^3 at 25°C	4,480 mg/m^3 at 20°C
Viscosity	3 95 centistokes at 25°C (HD)	3 95 centistokes at 25°C	2.05 centipoise at 77°F
Solubility	0 092 g/100 g H_2O at 22°C Completely soluble in acetone, CCl_4, CH_3Cl tetrachloroethane, ethyl benzoate, and ether Completely soluble in 92 5% ethanol above 28 6°C	0 092 g/100 g H_2O at 22°C Completely soluble in acetone, CCl_4, CH_3Cl tetrachloroethane, ethyl benzoate, and ether Completely soluble in 92 5% ethanol above 28 6°C	Insoluble in water and dilute mineral acids Soluble in organic solvents and oils Miscible with other chemical warfare agents
Heat of Combustion	4,500 cal/g	756 03 kcal/mole	N/A
Latent Heat of Vaporization	94 cal/g	94 cal/g	58 cal/g
Latent Heat of Fusion	26 5 cal/g	26 5 cal/g	Unknown
Special Properties			
Flash Point	105°C	105°C (Can be ignited by large explosive charges)	Does not flash
DOT Classification	Poison A	Poison A	Poison A
Corrosivity	Brass rapidly corroded Cast iron poor	Brass rapidly corroded at 65°C; 0 0001 inch/month at 65°C on steel	None if dry
Decontaminants	Bleaching powder, sodium hypochlorite	Bleaching powder, sodium hypochlorite, fire	Bleach powder, sodium hypochlorite, fire, caustic soda
Stabilizers Commonly Used	Can be stabilized with acridine or naphthoquinoline	Can be stabilized with acridine or naphthoquinoline	

Notes

cal/g = calorie per gram
DOT = Department of Transportation
g = gram
g/cm^3 = gram per cubic centimeter
g/mL = gram per milliliter
kcal = kilocalorie
mg/m^3 = milligram per cubic meter
mm Hg = millimeters of mercury
N/A = not available

Table B-2. Chemical and Physical Properties of Industrial Chemicals of Concern

Chemical Name	Phosgene (CG) Carbonyl Chloride	Chloropicrin (PS)	Adamsite (DM) Phenarsazine chloride	Chloroacetophenone (CN)
Short Name	Phosgene (CG)	Chloropicrin (PS)	Adamsite (DM)	Chloroacetophenone (CN)
Chemical Formula	CCl_2O	Cl_3CNO_2	$C_{12}H_9AsClN$	C_8H_7ClO
Molecular Weight	98 92	164 38	277 57	154 59
Physical State	Colorless gas at room temperature	Slightly oily liquid	Light yellow to green crystals	Colorless to gray solid
Vapor Density (relative to air)	3 4	5 6	9 6 Does not vaporize at normal temperatures	5 2
Liquid Density	1 37 g/mL at 20°C	1 66 g/mL at 20°C	N/A	1 187 g/mL at 20°C
Solid Density	N/A	N/A	1 65 g/cm^3 at 20°C	1 32 g/cm^3 at 20°C
Normal Freezing Point	-128°C	-69 2°C	195°C	59°C
Boiling Point	7 6°C	112°C	410°C	247°C
Vapor Pressure	1,400 mm Hg at 25°C 1,173 mm Hg at 20°C	18 3 mm Hg at 20°C	2×10^{-13} at 20°C	0 012 mm Hg at 20°C
Volatility	4,300,000 mg/m^3 at 7 6°C	165,000 mg/m^3 at 20°C	0 02 mg/m^3	34 3 mg/m^3 at 20°C
Viscosity	0 27 centistokes at 0°C	N/A	N/A	N/A
Solubility	Very slight solubility in water and decomposed by it Freely soluble in benzene, toluene, glacial acetic acid, and most organic solvents	Insoluble in water Soluble in organic solvents, liquid organophosphorus compounds, mustards, phosgene, diphosgene, and Cl_2	0 0064 g/100 g H_2O at room temperature Slightly soluble in common organic solvents, soluble in furfural and acetone Not readily soluble in liquid chemical agents	Insoluble in water Soluble in chloroform, chloropicrin, and other organic solvents
Heat of Combustion	41 8 kcal/mole	N/A	N/A	N/A
Latent Heat of Vaporization	59 cal/g	57 3 cal/g	90 cal/g	98 cal/g
Latent Heat of Fusion	N/A	N/A	N/A	N/A
Special Properties	Decomposes at 800°C Reacts with water to form HCl and CO		Stable in steel when pure	CN must be vaporized or dispersed by some means rather than depend on its own volatility
Flash Point	Does not flash	Not flammable, but with strong ignition-heated material in confinement will detonate	Does not flash	118°C
DOT Classification	Poison A	Poison A	Irritating material	N/A
Corrosivity	Not corrosive when dry, no appreciable corrosion of steel Extremely corrosive in presence of moisture	If dry, has little or no effect on metals	Slightly corrosive when dry After 3 months, causes extensive corrosion of aluminum, anodized aluminum, and stainless steel	Slightly tarnishes steel, corrosive vapors produced when combined with water or steam

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Table B-2. Chemical and Physical Properties of Industrial Chemicals of Concern (Continued)

Chemical Name	Phosgene (CG) Carbonyl Chloride	Chloropicrin (PS)	Adamsite (DM) Phenarsazine chloride	Chloroacetophenone (CN)
Decontaminants	Water followed by 10% solution of caustic soda or sodium carbonate	Large amounts of water or rinse with 5% solution of bisulfite	None needed in field, bleach or DS2	Sodium carbonate solution or alcoholic caustic soda
Stabilizers Commonly Used	Stable when dry		None	

Notes

cal/g = calorie per gram
DOT = Department of Transportation
DS2 = decontaminating solution number 2
g = gram
g/cm^3 = gram per cubic centimeter
g/mL = gram per milliliter
kcal = kilocalorie
mg/m^3 = milligram per cubic meter
mm Hg = millimeters of mercury
N/A = not available
NaOH = sodium hydroxide
TSPP = tetrasodium pyrophosphate

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ANNEX C

MATERIAL SAFETY DATA SHEETS

ANNEX C
MATERIAL SAFETY DATA SHEETS

The following pages provide examples of Material Safety Data Sheets (MSDSs) for the chemical agents discussed in this document. Preference was given to Department of Army data sheets prepared by Edgewood Chemical Biological Center (ECBC), formerly Edgewood Research, Development and Engineering Center (ERDEC).

Adamsite (DM) – Department of the Army, Special Report EO-SR-74001, DM Chemicai Agent Data Sheet, Volume 1, pp. 119 through 127, December 1974.

Chloroacetophenone (CN) - DEF-TEC MSDS, 18 January 1988.

Chloropicrin (PS) – U.S. Department of Health and Human Services, Occupational Health Guideline for PS, September 1978.

Distilled Mustard (HD) - Edgewood Research, Development and Engineering Center (ERDEC) Material Safety Data Sheet (MSDS), 22 February 1996.

Levinstein Mustard (H) - Department of the Army, Special Report EO-SR-74001, Chemical Agent Data Sheet, Volume 1, pp. 29 through 31, December 1974.

Lewisite (L) - ERDEC MSDS, 27 March 1996.

Phosgene (CG) - Liquid Air Corporation MSDS, 1 January 1987.

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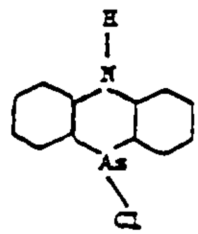
1. Chemical Code or EA Number: DM

2. Chemical Name: 10 chloro- 5, 10 dihydrophenarsazine, Adamsite.

3. Chemical Formulae:

   a. <u>Empirical</u>. $C_{12}H_9AsClN$

   b. <u>Structural</u>.



4. Biological Type Compound: Incapacitating sternutator.

5. Principal Pharmacological Action:

DM produces strong pepper-like local inflammation of the upper respiratory tract, the nasal accessory sinuses, with irritation of the eyes and lacrimation. It causes violent uncontrollable sneezing, coughing, nausea, vomiting, and a general feeling of malaise.

6. Characteristic Odor: No pronounced odor; irritates nasal passages similar to pepper.

7. Effective Routes of Administration: Inhalation, percutaneous, injection, oral.

8. Median Lethal Dosage, Man (LCt_{50}'s):

   a. <u>Inhalation</u>. (Single exposures of 4 hours or less.)

   11,000 mg min/m^3 - pure DM dispersed by laboratory methods (as a dry dust, form solvent sprays or by volatilization-condensation).

   35,000 mg min/m^3 - dispersed from Federal Laboratories No. 113 Spedeheat Grenade.

   44,000 mg min/m^3 - dispersed from M6A1 military grenade.

Adamsite

9. Median Lethal Dosage, Animal:

a. Inhalation (LCt_{50}'s).

Species	Pure DM	M6A1 Grenade	No. 113 Grenade
		mg min/m^3	
Monkey	17,837	19,563	22,814
Dog	7,888	28,193	28,428
Swine	56,364	36,011	35,888
Goat	12,135	8,076	11,723
Rabbit	2,903	41,159	46,959
Rat	19,234	66,856	48,217
Guinea Pig	4,623	12,591	29,888
Mouse	46,245* (1918-1965)		
All rodents	10,951	83,380	37,980
Nonrodents	10,233	24,462	30,063
All species	12,306	43,808	34,683
No. of animals	407	473	656

*These animals are not included in the total number of animals listed below for pure DM.

b. Intraperitoneal. Dog. 10 mg/kg body weight kills a dog.

10. Median Incapacitating Dosage, Man.

a. Inhalation, ICt_{50}: 370 mg min/m^3 (nausea and vomiting).

11. Threshold Limit Value: No data.

12. Miniumum Effective Dosage, Man:

Lowest intolerable concentration.

Concentration mg min/m^3	Time of Exposure minute
22	1
3.6	5
3.45	15
8.40	60

The lowest concentrations (sprayed from alcoholic solutions) that are irritating to the throat and lower respiratory tract are 0.38 and 0.5 mg/m^3, respectively. The lowest concentration causing cough is 0.75 mg/m^3.

13. Acute Physiological Effects:

a. Single Exposures.

DM produces a feeling of pain and a sense of fullness in the nose and sinuses, accompanied by a severe headache, intense burning in the throat, and tightness and pain in the chest. Irritation of the eyes and lacrimation are produced. Coughing is uncontrollable, sneezing violent and persistent. Nasal secretion is greatly increased, and quantities of ropy saliva flow from the mouth. Nausea and vomiting are prominent. Mental depression may occur during progression of symptoms.

Mild symptoms, caused by exposure to very low concentrations, resemble those of a severe cold. The onset of symptoms may be delayed for several minutes after initial exposure, and effective exposure may, therefore, occur before the presence of the smoke is suspected.

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If the mask is then put on, symptoms will increase for several minutes in spite of adequate protection. As a consequence, the victim may believe his mask is ineffective and by removing it cause himself to be further exposed.

Symptoms of exposure to field concentrations usually disappear in 20 minutes to 2 hours, leaving no residual injury. A few instances of severe pulmonary injury and death have occurred due to accidental exposures to high concentrations in confined spaces.

b. Repeated Exposures.

Monkeys, dogs, and guinea pigs were exposed to DM aerosols (No. 113 grenade) on 10 consecutive days. The daily doses were approximately at the LCt_5 level. A similar group of animals was exposed to approximately the LCt_{20} to 25 level on each of 10 days. In both cases, the accumulated doses would be expected to kill all animals if the total dose were given in a single exposure.

The lower dose level killed five out of eight monkeys. This is more than would be expected from any one of the exposures alone, but less than would be expected from the total accumulated dose. The deaths among the dogs and guinea pigs at the low dose level were less than would have been expected from any of the single exposures and far less than would be expected from the accumulated dose.

The deaths in monkeys and guinea pigs at the high dosage level are slightly greater than that which would have been expected for the greatest single dose. The deaths in dogs were less than would have been expected of the greatest single dose. There was little indication of cumulative toxicity due to the repeated exposures.

14. Chronic Physiological Effects:

a. A survey was made at Edgewood Arsenal of 39 women exposed to various concentrations.

Thirty-one workers who had been subjected to DM dust from 4 to 6 weeks were studied. Most of these workers had become entirely free of the initial eye and nose symptoms. This hardening process took several days to a week and the tolerance was readily lost within several days away from DM. Exposure to a much heavier concentration usually led to a return of symptoms. Epistaxis was observed in two workers after heavy exposures. Chronic hoarseness was present in one-quarter of the patients, burning of the skin in one-third, and hyperpigmentation of the skin in one-third of the subjects studied. Acute dermatitis was present in one-quarter of the patients.

Eight patients with moderately heavy chronic exposure had become tolerant to the action on the respiratory tract except for slight chronic conjunctivitis and persistent hoarseness in a few cases. Posterior cervical lymph node enlargement was noted in two cases and enlargement of the parotid gland in one. The vital capacity was reduced between 40 and 80% of normal in 70%. X-ray of the lungs showed no change attributable to DM exposure.

b. Dermatitis.

By far the most disturbing result of prolonged exposure to DM is the dermatitis which appears in a quarter of the workers so exposed.

(1) Individual variations in tolerance are very large and undoubtedly play a part in the development of dermatitis.

(2) The effect of concentration of DM. Dermatitis may develop in workers exposed to only a very light concentration. Heavy concentrations certainly play a part in the precipitation of frank dermatitis in certain workers.

(3) Effect of moisture and heat. These factors probably increase the sensitivity of the skin and certainly precipitate dermatitis.

(4) Incubation period. Almost every case of dermatitis began three weeks after the beginning of exposure.

(5) Avoidance of DM after dermatitis developed did not result in improvement in the severe cases. In a very mild early case, avoidance of DM was sometimes followed by remission.

(6) Effect of prolonged exposure. Many subjects continued to work with a severe dermatitis. In some of these the dermatitis improved despite continued exposure. In most of the cases the dermatitis persisted.

15. Onset Time of Symptoms: See Items 13 and 14.

16. Self Aid and First Aid:

Put on mask and wear it in spite of coughing, sneezing, salivation, and nausea. Lift the mask from the face briefly if necessary to permit vomiting or to drain saliva from the facepiece. Carry on duties as vigorously as possible; this will help to lessen and shorten the symptoms. Combat duties usually can be performed in spite of the effects of sternutators.

Adamsite

17. Tolerable Environmental Concentrations to Uncontrolled Population: No data.

18. Molecular Weight: 277.57

19. Purity Range:

    a. Laboratory Sample. 95 to 99%.

    b. Plant Sample.

20. Physical Appearance: Light yellow to dark yellow-green solid, depending on crystal phase.

21. Vapor Density, Relative to Air: 9.6. Does not vaporize at ordinary temperatures; must be dispersed as an aerosol through application of heat.

22. Liquid Density: Not applicable.

23. Solid Density:

    a. Bulk Density. Less than 1 g/cm^3.

    b. Crystal Density. 1.65 g/cm^3 @ 20° C.

24. Normal Freezing Point or Melting Point: 195° C.

25. Boiling Point: 410° C with decomposition.

26. Vapor Pressure: 4.5×10^{-11} mm Hg @ 25° C.

27. Volatility: Not of practical significance.

28. Viscosity: NA

29. Flash Point: Does not flash.

30. Autoignition Temperature: Unknown.

31. Latent Heat of Sublimation: 134 cal/g @ 170° to 195° C.

    Latent Heat of Vaporization: 80 cal/g @ 200° to 250° C.

32. Latent Heat of Fusion:

33. Vapor-Air Explosive Hazard Range: Not available.

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Adamsite

34. Relative Persistency:

<u>a.</u> <u>Soil</u>. Persistent.

<u>b.</u> <u>Surface (Wood, Metal, Masonry, Rubber, Paint)</u>. Persistent.

<u>c.</u> <u>Water</u>. Persistent. When material is covered with water, an insoluble film forms which prevents further hydrolysis.

35. Solubility (g/100 g solvent):

<u>a.</u> <u>Water (distilled)</u>. 0.0064 at room temperature.

<u>b.</u> <u>Other</u>.

Tetrachlorethane	1.16 @ 17° C
Chlorobenzene	1.06 @ 16° C
Benzene	2.3 @ 15° C

<u>c.</u> <u>Best Solvent</u>.

Acetone	13.03 @ 15° C

36. Thermal Decomposition Rate (half-life): Not available.

250° C, 0.15% per minute.

37. Heat of Combustion: Unknown.

38. Products of Combustion: Unknown.

39. Rate of Hydrolysis:

<u>a.</u> <u>Acidic (pH)</u>. 0.5% HCl; prevents hydrolysis at room temperature. 0.3% HCl; prevents hydrolysis at 70°C.

<u>b.</u> <u>Basic (pH)</u>. Slowly hydrolyzes in water; see Item 34.

40. Hydrolysis Products: $[NH(C_6H_4)_2AS]_2O$ & HCl.

41. Corrosive Properties:

Titanium 71° C, 6 months, appeared good.
Stainless Steel 43° C, 30 days, slight discoloration.
Common Steel 43° C, 30 days, covered with rust.
Aluminum Anodized 43° C, 30 days, minor corrosion & pitting.
Aluminum 43° C, 30 days, severe corrosion.

42. Detection Methods and Equipment: For vapor or solid, M19 kit, DPT test.

43. Decontaminants:

    a. Personnel. Soap and water.

    b. Equipment. Slurry or DS2. Bleaching Powder or DS2 in confined spaces. Aeration is sufficient in the field.

    c. Areas.

    Terrain: Earth moving equipment. STB slurry applied by M9 or M12A1 Decontaminating Apparatus.

44. DOT Classification: Irritating Material.

45. Stabilizer Utilized: None.

46. Types of Containers Required for Storage: Heresite, Teflon, Kynar unaffected, 3 months at 71° F.

Stable in steel when pure. After 3 months, caused extensive corrosion of aluminum, anodized aluminum, and stainless steel. Will corrode iron, bronze, and brass when moist.

47. Q-D Classification: 8
    Compatibility Group: A
    Chemical Group: B

Occupational Health Guideline for alpha-Chloroacetophenone

INTRODUCTION

This guideline is intended as a source of information for employees, employers, physicians, industrial hygienists, and other occupational health professionals who may have a need for such information. It does not attempt to present all data; rather, it presents pertinent information and data in summary form.

SUBSTANCE IDENTIFICATION

• Formula: $C_6H_5COCH_2Cl$
• Synonyms: Phenyacyl chloride; omega=chloroacetophenone; chloroacetophenone; chloromethyl phenyl ketone; phenyl chloromethyl ketone; "tear gas"; CN
• Appearance and odor: Colorless to gray solid with a sharp, irritating odor.

PERMISSIBLE EXPOSURE LIMIT (PEL)

The current OSHA standard for alpha-chloroacetophenone is 0.05 part of alpha-chloroacetophenone per million parts of air (ppm) averaged over an eight-hour work shift. This may also be expressed as 0.3 milligram of alpha-chloroacetophenone per cubic meter of air (mg/m^3).

HEALTH HAZARD INFORMATION

• **Routes of exposure**
alpha-Chloroacetophenone can cause irritation of the eyes and skin upon contact and irritation of the lungs if it is inhaled. It can also cause difficulty if it is swallowed.
• **Effects of overexposure**
alpha-Chloroacetophenone vapors may cause a tingling or runny nose, burning and/or pain of the eyes, blurred vision, and tears. Burning in the chest, difficult breathing, and nausea may occur. Skin irritation, rash, or burns may occur.
• **Reporting signs and symptoms**
A physician should be contacted if anyone develops any signs or symptoms and suspects that they are caused by exposure to alpha-chloroacetophenone.
• **Recommended medical surveillance**
The following medical procedures should be made available to each employee who is exposed to alpha-chloroacetophenone at potentially hazardous levels:
1. Initial Medical Screening: Employees should be screened for history of certain medical conditions (listed below) which might place the employee at increased risk from alpha-chloroacetophenone exposure.

—Chronic respiratory disease: In persons with impaired pulmonary function, especially those with obstructive airway diseases, the breathing of alpha-chloroacetophenone might cause exacerbation of symptoms due to its irritant properties or psychic reflex bronchospasm.

—Skin disease: alpha-Chloroacetophenone is irritating to the skin, especially if moist. Persons with pre-existing skin diseases may be more susceptible to the effects of alpha-chloroacetophenone.

—Eye disease: alpha-Chloroacetophenone is a potent lacrimator and eye irritant and may cause corneal damage. Persons with pre-existing eye diseases may be at increased risk from exposure.

2. Periodic Medical Examination: Any employee developing the above-listed conditions should be referred for further medical examination.
• **Summary of toxicology**
alpha-Chloroacetophenone is a highly irritating substance. Exposure to low concentrations produces lacrimation and irritation of the eyes and upper respiratory tract. Exposure to high concentrations produces marked conjunctivitis and may cause corneal damage. Pulmonary edema may occur, often delayed for some 12 hours after exposure. No chronic effects are reported.

These recommendations reflect good industrial hygiene and medical surveillance practices and their implementation will assist in achieving an effective occupational health program. However, they may not be sufficient to achieve compliance with all requirements of OSHA regulations

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Public Health Service Centers for Disease Control
National Institute for Occupational Safety and Health

U.S. DEPARTMENT OF LABOR
Occupational Safety and Health Administration

September 1978

CHEMICAL AND PHYSICAL PROPERTIES

- **Physical data**
  1. Molecular weight: 155
  2. Boiling point (760 mm Hg). 247 C (477 F)
  3. Specific gravity (water = 1). 1.32
  4. Vapor density (air = 1 at boiling point of alpha-chloroacetophenone): 5.2
  5. Melting point: 59 C (138 F)
  6. Vapor pressure at 20 C (68 F): 0.012 mm Hg
  7. Solubility in water, g/100 g water at 20 C (68 F): Insoluble
  8. Evaporation rate (butyl acetate = 1): Very much less than 1
- **Reactivity**
  1. Conditions contributing to instability: Heat
  2. Incompatibilities: Water or steam
  3. Hazardous decomposition products: Toxic and corrosive vapors are produced when combined with steam or water.
  4. Special precautions: None
- **Flammability**
  1. Flash point: 118 C (244 F)
  2. Autoignition temperature: Data not available
  3. Flammable limits in air, % by volume: Not applicable
  4. Extinguishant: Carbon dioxide or dry chemical
- **Warning properties**
  1. Odor Threshold: According to the *Documentation of TLVs*, the odor threshold is 0.1 mg/m³.
  2. Irritation Levels: According to the *Documentation of TLVs*, "irritation thresholds range from 0.15 to 0.4 mg/m³, lacrimation thresholds from 0.3 to 0.4 mg/m³. . ."
  3. Evaluation of Warning Properties: Through its odor and irritant effects, alpha-chloroacetophenone can be detected below the permissible exposure limit; therefore, it is considered to have adequate warning properties.

MONITORING AND MEASUREMENT PROCEDURES

- **General**

Measurements to determine employee exposure are best taken so that the average eight-hour exposure is based on a single eight-hour sample or on two four-hour samples. Several short-time interval samples (up to 30 minutes) may also be used to determine the average exposure level. Air samples should be taken in the employee's breathing zone (air that would most nearly represent that inhaled by the employee).

- Method

An analytical method for alpha-chloroacetophenone is in the *NIOSH Manual of Analytical Methods*, 2nd Ed., Vol. 5, 1979, available from the Government Printing Office, Washington, D.C. 20402 (GPO No 017-033-00349-1)

RESPIRATORS

- Good industrial hygiene practices recommend that engineering controls be used to reduce environmental concentrations to the permissible exposure level. However, there are some exceptions where respirators may be used to control exposure. Respirators may be used when engineering and work practice controls are not technically feasible, when such controls are in the process of being installed, or when they fail and need to be supplemented. Respirators may also be used for operations which require entry into tanks or closed vessels, and in emergency situations. If the use of respirators is necessary, the only respirators permitted are those that have been approved by the Mine Safety and Health Administration (formerly Mining Enforcement and Safety Administration) or by the National Institute for Occupational Safety and Health.
- In addition to respirator selection, a complete respiratory protection program should be instituted which includes regular training, maintenance, inspection, cleaning, and evaluation.

PERSONAL PROTECTIVE EQUIPMENT

- Employees should be provided with and required to use impervious clothing, gloves, face shields (eight-inch minimum), and other appropriate protective clothing necessary to prevent any possibility of skin contact with solid alpha-chloroacetophenone or liquids containing alpha-chloroacetophenone.
- If employees' clothing may have become contaminated with solid alpha-chloroacetophenone, employees should change into uncontaminated clothing before leaving the work premises.
- Clothing contaminated with alpha-chloroacetophenone should be placed in closed containers for storage until it can be discarded or until provision is made for the removal of alpha-chloroacetophenone from the clothing. If the clothing is to be laundered or otherwise cleaned to remove the alpha-chloroacetophenone, the person performing the operation should be informed of alpha-chloroacetophenone's hazardous properties.
- Non-impervious clothing which becomes contaminated with alpha-chloroacetophenone should be removed immediately and not reworn until the alpha-chloroacetophenone is removed from the clothing.
- Where there is any possibility that employees' eyes may be exposed to alpha-chloroacetophenone, an eye-wash fountain should be provided within the immediate work area for emergency use.
- Employees should be provided with and required to use dust- and splash-proof safety goggles where there is any possibility of solid alpha-chloroacetophenone or liquids containing alpha-chloroacetophenone contacting the eyes.

SANITATION

• Skin that becomes contaminated with alpha-chloroacetophenone should be immediately washed or showered with soap or mild detergent and water to remove any alpha-chloroacetophenone.

• Eating and smoking should not be permitted in areas where solid alpha-chloroacetophenone is handled, processed, or stored.

• Employees who handle solid alpha-chloroacetophenone or liquids containing alpha-chloroacetophenone should wash their hands thoroughly with soap or mild detergent and water before eating, smoking, or using toilet facilities.

COMMON OPERATIONS AND CONTROLS

The following list includes some common operations in which exposure to alpha-chloroacetophenone may occur and control methods which may be effective in each case:

Operation	Controls
Liberation during loading of solutions for aerosols for law enforcement and civilian protective devices	General dilution ventilation; respiratory protective equipment
Liberation during manufacture	Process enclosure; general dilution ventilation
Liberation during denaturing of industrial alcohol	General dilution ventilation

EMERGENCY FIRST AID PROCEDURES

In the event of an emergency, institute first aid procedures and send for first aid or medical assistance.

• Eye Exposure

If alpha-chloroacetophenone gets into the eyes, wash eyes immediately with large amounts of water, lifting the lower and upper lids occasionally. Get medical attention as soon as possible. Contact lenses should not be worn when working with this chemical.

• Skin Exposure

If alpha-chloroacetophenone gets on the skin, immediately wash the contaminated skin using soap or mild detergent and water. If alpha-chloroacetophenone soaks through the clothing, remove the clothing immediately and wash the skin using soap or mild detergent and water. When there are chemical burns or evidence of skin irritation, get medical attention.

• Breathing

If a person breathes in large amounts of alpha-chloroacetophenone, move the exposed person to fresh air at once. If breathing has stopped, perform artificial respiration. Keep the affected person warm and at rest. Get medical attention as soon as possible.

• Swallowing

When alpha-chloroacetophenone has been swallowed, get medical attention immediately. If medical attention is not immediately available, get the afflicted person to vomit by having him touch the back of his throat with his finger or by giving him syrup of ipecac as directed on the package. This non-prescription drug is available at most drug stores and drug counters and should be kept with emergency medical supplies in the workplace. Do not make an unconscious person vomit.

• Rescue

Move the affected person from the hazardous exposure. If the exposed person has been overcome, notify someone else and put into effect the established emergency rescue procedures. Do not become a casualty. Understand the facility's emergency rescue procedures and know the locations of rescue equipment before the need arises.

SPILL AND DISPOSAL PROCEDURES

• Persons not wearing protective equipment and clothing should be restricted from areas of spills until cleanup has been completed.

• If alpha-chloroacetophenone is spilled, the following steps should be taken:

1. Ventilate area of spill.
2. For small quantities, sweep onto paper or other suitable material, place in an appropriate container and burn in a safe place (such as a fume hood). Large quantities may be reclaimed, however, if this is not practical, dissolve in a flammable solvent (such as alcohol) and atomize in a suitable combustion chamber equipped with an appropriate effluent gas cleaning device.

• Waste disposal methods:

alpha-Chloroacetophenone may be disposed of:

1. By making packages of alpha-chloroacetophenone in paper or other flammable material and burning in a suitable combustion chamber equipped with an appropriate effluent gas cleaning device.
2. By dissolving alpha-chloroacetophenone in a flammable solvent (such as alcohol) and atomizing in a suitable combustion chamber equipped with an appropriate effluent gas cleaning device.

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RESPIRATORY PROTECTION FOR ALPHA-CHLOROACETOPHENONE

Condition	Minimum Respiratory Protection* Required Above 0.05 ppm
Particulate and Vapor Concentration	
15 mg/m³ (2.5 ppm) or less	A chemical cartridge respirator with a full facepiece and an organic vapor cartridge(s) and high efficiency particulate filter(s).
	A gas mask with a chin-style or a front- or back-mounted organic vapor canister with a high efficiency particulate filter.
	Any supplied-air respirator with a full facepiece, helmet, or hood.
	Any self-contained breathing apparatus with a full facepiece.
100 mg/m³ (16 ppm) or less	A Type C supplied-air respirator with a full facepiece operated in pressure-demand or other positive pressure mode or with a full facepiece, helmet, or hood operated in continuous-flow mode.
Greater than 100 mg/m³ (16 ppm) or entry and escape from unknown concentrations	Self-contained breathing apparatus with a full facepiece operated in pressure-demand or other positive pressure mode.
	A combination respirator which includes a Type C supplied-air respirator with a full facepiece operated in pressure-demand or other positive pressure or continuous-flow mode and an auxiliary self-contained breathing apparatus operated in pressure-demand or other positive pressure mode.
Fire Fighting	Self-contained breathing apparatus with a full facepiece operated in pressure-demand or other positive pressure mode.
Escape··	Any gas mask with a full facepiece providing protection against organic vapors and particulates.
	Any escape self-contained breathing apparatus.

*Only NIOSH-approved or MSHA-approved equipment should be used.

Occupational Health Guideline for Chloropicrin

INTRODUCTION

This guideline is intended as a source of information for employees, employers, physicians, industrial hygienists, and other occupational health professionals who may have a need for such information It does not attempt to present all data, rather, it presents pertinent information and data in summary form.

SUBSTANCE IDENTIFICATION

• Formula: CCl_3NO_2
• Synonyms: Nitrotrichloromethane; trichloronitromethane; nitrochloroform
• Appearance and odor: Colorless, oily liquid with a sharp, penetrating odor that causes tears

PERMISSIBLE EXPOSURE LIMIT (PEL)

The current OSHA standard for chloropicrin is 0 1 part of chloropicrin per million parts of air (ppm) averaged over an eight-hour work shift. This may also be expressed as 0.7 milligram of chloropicrin per cubic meter of air (mg/m^3).

HEALTH HAZARD INFORMATION

• **Routes of exposure**
Chloropicrin can affect the body if it is inhaled or if it comes in contact with the eyes or skin. It can also affect the body if it is swallowed
• **Effects of overexposure**
1. Short-term Exposure: Chloropicrin causes eye irritation and tearing. It also causes cough, nausea, and vomiting, and severe irritation of the skin. Breathing chloropicrin vapors may also cause delayed severe breathing difficulties and which may cause death.
2. Long-term Exposure: Overexposure to chloropicrin may cause increased susceptibility to future overexposure.
3. Reporting Signs and Symptoms: A physician should be contacted if anyone develops any signs or symptoms and suspects that they are caused by exposure to chloropicrin.
• **Recommended medical surveillance**
The following medical procedures should be made available to each employee who is exposed to chloropicrin at potentially hazardous levels.
1. Initial Medical Examination:
—A complete history and physical examination The purpose is to detect pre-existing conditions that might place the exposed employee at increased risk, and to establish a baseline for future health monitoring Examination of the respiratory system should be stressed The skin should be examined for evidence of chronic disorders
—FVC and FEV (1 sec). Chloropicrin is a severe respiratory irritant. Persons with impaired pulmonary function may be at increased risk from exposure
—14" x 17" chest roentgenogram. Chloropicrin may cause respiratory impairment. Persons with pre-existing pulmonary disease may be at increased risk
2. Periodic Medical Examination: The aforementioned medical examinations should be repeated on an annual basis.
• **Summary of toxicology**
Chloropicrin vapor is a severe irritant of the eyes, skin, and respiratory tract A lethal exposure for humans is stated to be 119 ppm for 30 minutes, with death usually resulting from pulmonary edema; particular injury occurs in the medium and small bronchi. In addition to pulmonary irritation, human exposure results in lacrimation, cough, nausea, vomiting, and skin irritation, individuals injured by inhalation of chloropicrin vapor are said to be more susceptible to subsequent exposures. A concentration of 15 ppm could not be tolerated longer than 1 minute, even by persons acclimated to chloropicrin, exposure to 4 ppm for a few seconds is temporarily disabling, due to the irritant effects Concentrations of 0.3 to 0 37 ppm resulted in painful eye irritation in 3 to 30 seconds Chloropicrin is a severe skin irritant

These recommendations reflect good industrial hygiene and medical surveillance practices and their implementation will assist in achieving an effective occupational health program However they may not be sufficient to achieve compliance with all requirements of OSHA regulations

U S DEPARTMENT OF HEALTH AND HUMAN SERVICES
Public Health Service Centers for Disease Control
National Institute for Occupational Safety and Health

U S DEPARTMENT OF LABOR
Occupational Safety and Health Administration

September 1978

CHEMICAL AND PHYSICAL PROPERTIES

• **Physical data**

1. Molecular weight. 164.4
2. Boiling point (760 mm Hg): 112 C (234 F)
3. Specific gravity (water = 1): 1.635
4. Vapor density (air = 1 at boiling point of chloropicrin): 5.7
5. Melting point: −64 C (−83 F)
6. Vapor pressure at 20 C (68 F). 20 mm Hg
7. Solubility in water, g/100 g water at 20 C (68 F): 0.18
8. Evaporation rate (butyl acetate = 1) Data not available

• **Reactivity**

1. Conditions contributing to instability: High temperatures or severe shock, particularly when involving containers of greater than 30 gallons capacity
2. Incompatibilities: Contact with strong oxidizers may cause fires or explosions.
3. Hazardous decomposition products: Toxic gases and vapors (such as oxides of nitrogen, phosgene, nitrosyl chloride, chlorine, and carbon monoxide) may be released when chloropicrin decomposes
4. Special precautions: Liquid chloropicrin will attack some forms of plastics, rubber, and coatings.

• **Flammability**

1. Not combustible, but with strong initiation, heated material under confinement will detonate.
2. Fires involving chloropicrin should be fought from an explosion-resistant location.

• **Warning properties**

1. Odor Threshold: Stern reports an odor threshold of 0.0073 mg/l (1.1 ppm)
2. Eye Irritation Level: The *Documentation of TLV's* states that "according to Flury and Zernik, chloropicrin in concentrations of from 0.3 to 0.37 ppm resulted in painful irritation to the eyes in 3 to 30 seconds." Patty, however, reports that 1.3 ppm is the lowest irritant concentration, but that 0.3 to 3.7 ppm for 3 to 30 seconds causes "closing of the eyelids according to individual sensitivity."
3. Evaluation of Warning Properties: Through its irritant effects on the eyes, chloropicrin can be detected within three times the permissible exposure limit, according to the *Documentation of TLV's*. For the purposes of this guideline, therefore, it is treated as a material with good warning properties.

MONITORING AND MEASUREMENT PROCEDURES

• **General**

Measurements to determine employee exposure are best taken so that the average eight-hour exposure is based on a single eight-hour sample or on two four-hour samples. Several short-time interval samples (up to 30 minutes) may also be used to determine the average exposure level. Air samples should be taken in the employee's breathing zone (air that would most nearly represent that inhaled by the employee).

• **Method**

At the time of publication of this guideline, no measurement method for chloropicrin had been published by NIOSH.

RESPIRATORS

• Good industrial hygiene practices recommend that engineering controls be used to reduce environmental concentrations to the permissible exposure level. However, there are some exceptions where respirators may be used to control exposure. Respirators may be used when engineering and work practice controls are not technically feasible, when such controls are in the process of being installed, or when they fail and need to be supplemented. Respirators may also be used for operations which require entry into tanks or closed vessels, and in emergency situations. If the use of respirators is necessary, the only respirators permitted are those that have been approved by the Mine Safety and Health Administration (formerly Mining Enforcement and Safety Administration) or by the National Institute for Occupational Safety and Health.

• In addition to respirator selection, a complete respiratory protection program should be instituted which includes regular training, maintenance, inspection, cleaning, and evaluation.

PERSONAL PROTECTIVE EQUIPMENT

• Employees should be provided with and required to use impervious clothing, gloves, face shields (eight-inch minimum), and other appropriate protective clothing necessary to prevent any possibility of skin contact with liquid chloropicrin.

• Clothing contaminated with chloropicrin should be placed in closed containers for storage until it can be discarded or until provision is made for the removal of chloropicrin from the clothing. If the clothing is to be laundered or otherwise cleaned to remove the chloropicrin, the person performing the operation should be informed of chloropicrin's hazardous properties.

• Where there is any possibility of exposure of an employee's body to liquid chloropicrin, facilities for quick drenching of the body should be provided within the immediate work area for emergency use

• Non-impervious clothing which becomes contaminated with chloropicrin should be removed immediately and not reworn until the chloropicrin is removed from the clothing

• Employees should be provided with and required to use splash-proof safety goggles where there is any possibility of liquid chloropicrin contacting the eyes.

• Where there is any possibility that employees' eyes may be exposed to liquid chloropicrin, an eye-wash fountain should be provided within the immediate work area for emergency use.

SANITATION

• Skin that becomes contaminated with chloropicrin should be immediately washed or showered with soap or mild detergent and water to remove any chloropicrin.
• Eating and smoking should not be permitted in areas where liquid chloropicrin is handled, processed, or stored
• Employees who handle liquid chloropicrin should wash their hands thoroughly with soap or mild detergent and water before eating, smoking, or using toilet facilities.

COMMON OPERATIONS AND CONTROLS

The following list includes some common operations in which exposure to chloropicrin may occur and control methods which may be effective in each case.

Operation	Controls
Use as a soil fumigant, disinfectant, and sterilizer for control of fungi, nematodes, and other injurious organisms; liberation as a fumigant for stored grains, cereals, and fruits	Process enclosure; general dilution ventilation, personal protective equipment
Use as a rodenticide and insecticide for rats and insects	Process enclosure, general dilution ventilation; personal protective equipment
Use as a chemical intermediate in organic synthesis in dyes and as an oxidizing agent	Process enclosure, general dilution ventilation; personal protective equipment
Use as a warning agent in illuminating gas; use as a lacrimator, and as a nauseant in chemical warfare	General dilution ventilation; personal protective equipment
Use as a chemical sterilant without high temperature	General dilution ventilation, process enclosure; personal protective equipment

EMERGENCY FIRST AID PROCEDURES

In the event of an emergency, institute first aid procedures and send for first aid or medical assistance.
• Eye Exposure
If liquid chloropicrin or high concentrations of chloropicrin vapor get into the eyes, wash eyes immediately with large amounts of water, lifting the lower and upper lids occasionally If irritation persists after washing, get medical attention. Contact lenses should not be worn when working with this chemical
• Skin Exposure
If liquid chloropicrin gets on the skin, immediately wash the contaminated skin using soap or mild detergent and water If liquid chloropicrin soaks through the clothing, remove the clothing immediately and wash the skin using soap or mild detergent and water. If irritation persists after washing, get medical attention.
• Breathing
If a person breathes in large amounts of chloropicrin, move the exposed person to fresh air at once If breathing has stopped, perform artificial respiration. Keep the affected person warm and at rest. Get medical attention as soon as possible.
• Swallowing
When liquid chloropicrin has been swallowed and the person is conscious, give the person large quantities of water immediately After the water has been swallowed, try to get the person to vomit by having him touch the back of his throat with his finger. Do not make an unconscious person vomit Get medical attention immediately.
• Rescue
Move the affected person from the hazardous exposure. If the exposed person has been overcome, notify someone else and put into effect the established emergency rescue procedures. Do not become a casualty Understand the facility's emergency rescue procedures and know the locations of rescue equipment before the need arises.

SPILL, LEAK, AND DISPOSAL PROCEDURES

• Persons not wearing protective equipment and clothing should be restricted from areas of spills or leaks until cleanup has been completed
• If liquid chloropicrin is spilled or leaked, the following steps should be taken·
1. Ventilate area of spill or leak.
2. Collect for reclamation or absorb in vermiculite, dry sand, earth, or a similar material.
• Waste disposal method.
Chloropicrin may be disposed of by absorbing in vermiculite, dry sand, earth, or a similar material and disposing in sealed containers in a secured sanitary landfill.

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RESPIRATORY PROTECTION FOR CHLOROPICRIN

Condition	Minimum Respiratory Protection* Required Above 0.1 ppm
Vapor Concentration	
4 ppm or less	A chemical cartridge respirator with a full facepiece and an organic vapor cartridge(s).
	A gas mask with a chin-style or a front- or back-mounted organic vapor canister.
	Any supplied-air respirator with a full facepiece, helmet, or hood.
	Any self-contained breathing apparatus with a full facepiece.
Greater than 4 ppm** or entry and escape from unknown concentrations	Self-contained breathing apparatus with a full facepiece operated in pressure-demand or other positive pressure mode.
	A combination respirator which includes a Type C supplied-air respirator with a full facepiece operated in pressure-demand or other positive pressure or continuous-flow mode and an auxiliary self-contained breathing apparatus operated in pressure-demand or other positive pressure mode.
Fire Fighting	Self-contained breathing apparatus with a full facepiece operated in pressure-demand or other positive pressure mode.
Escape	Any gas mask with a full facepiece providing protection against organic vapors.
	Any escape self-contained breathing apparatus with a full facepiece.

*Only NIOSH-approved or MSHA-approved equipment should be used.

**Use of supplied-air suits may be necessary to prevent skin contact while providing respiratory protection from airborne concentrations of chloropicrin, however, this equipment should be selected, used, and maintained under the immediate supervision of trained personnel. Where supplied-air suits are used above a concentration of 4 ppm, an auxiliary self-contained breathing apparatus operated in positive pressure mode should also be worn.

MATERIAL SAFETY DATA SHEET

DISTILLED MUSTARD (HD)

POISON

6

SECTION I - GENERAL INFORMATION

DATE: 22 September 1988
REVISED: 28 February 1996

MANUFACTURER'S ADDRESS:

U.S. ARMY CHEMICAL BIOLOGICAL DEFENSE COMMAND
EDGEWOOD RESEARCH DEVELOPMENT, AND ENGINEERING CENTER (ERDEC)
ATTN: SCBRD-ODR-S
ABERDEEN PROVING GROUND, MD 20101-5423

Emergency telephone #' s: 0700-1630 EST: 410-671-4411/4414
After: 1630 EST: 410- 278-5201, Ask for Staff Duty Officer

CAS REGISTRY NUMBERS: 505-60-2, 39472-40-7, 68157-62-0

CHEMICAL NAME:

Bis-(2-chloroethyl)sulfide

TRADE NAMES AND SYNONYMS:

Sulfide, bis (2-chloroethyl)
Bis(beta-chloroethyl)sulfide
1,1'-thiobis(2-chloroethane)
1-chloro-2(beta-chloroethylthio)ethane
Beta, beta'-dichlorodiethyl sulfide
2,2'dichlorodiethyl sulfide
Di-2-chloroethyl sulfide
Beta, beta'-dichloroethyl sulfide
2,2'-dichloroethyl sulfide
H; HD, HS
Iprit
Kampstoff "Lost"; Lost
Mustard Gas

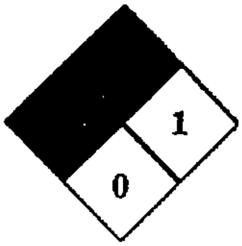
S-Lost; S-yperite; Schewefel-lost
Senfgas
Sulfur mustard; Sulphur mustard gas
Yellow Cross Liquid
Ypente
Y

CHEMICAL FAMILY: Chlorinated sulfur compound

FORMULA/CHEMICAL STRUCTURE:
C4H8Cl2S

$$ClCH_2CH_2-S-CH_2CH_2Cl$$

NFPA 704 HAZARD SIGNAL:



Health - 4
Flammability - 1
Reactivity - 1
Special - 0

SECTION II - HAZARDOUS INGREDIENTS

INGREDIENTS NAME	FORMULA	PERCENTAGE BY WEIGHT	AIRBORNE EXPOSURE LIMIT (AEL)
Sulfur Mustard	C4H8Cl2S	100	0.003 mg/m3

SECTION III - PHYSICAL DATA

BOILING POINT: 422 F 217 C

VAPOR PRESSURE (mm Hg):

0.072 mm Hg @ 20 C
0.11 mm Hg @ 25 C

VAPOR DENSITY (AIR=1): 5.5

SOLUBILITY IN WATER: Negligible. Soluble in fats and oils, gasoline, kerosene, acetone, carbon tetrachloride, alcohol, tetrachloroethane, ethylbenzoate, and ether. Miscible with the organophosphorus nerve agents.

SPECIFIC GRAVITY (H2O=1): 1.27 @ 20 C

FREEZING POINT: 14.45 C

575 143

LIQUID DENSITY (g/cc):

1.268 @ 25 C
1.27 @ 20 C

PERCENTAGE VOLATILE BY VOLUME:

610 mg/m3 @ 20 C
920 mg/m3 @ 25 C

APPEARANCE AND ODOR: Normally amber to black colored liquid with garlic or a horseradish odor. Water clear if pure. The odor threshold for HD is 0.6 mg/m3 (.0006 mg/L).

SECTION IV - FIRE AND EXPLOSION DATA

FLASHPOINT : 105 C (Can be ignited by large explosive charges)

FLAMMABILITY LIMITS (% by volume): Unknown

EXTINGUISHING MEDIA: Water, fog, foam, CO2. Avoid use of extinguishing methods that will cause splashing or spreading of HD.

SPECIAL FIRE FIGHTING PROCEDURES: All persons not engaged in extinguishing the fire should be immediately evacuated from the area. Fires involving HD should be contained to prevent contamination to uncontrolled areas. When responding to a fire alarm in buildings or areas containing agents, firefighting personnel should wear full firefighter protective clothing (without TAP clothing) during chemical agent firefighting and fire rescue operations. Respiratory protection is required. Positive pressure, full face piece, NIOSH-approved self-contained breathing apparatus (SCBA) will be worn where there is danger of oxygen deficiency and when directed by the fire chief or chemical accident/incident (CAI) operations officer. In cases where firefighters are responding to a chemical accident/incident for rescue/reconnaissance purposes they will wear appropriate levels of protective clothing (See Section VIII).

Do not breathe fumes. Skin contact with agents must be avoided at all times. Although the fire may destroy most of the agent, care must still be taken to assure the agent or contaminated liquids do not further contaminate other areas or sewers. Contact with the agent liquid or vapor can be fatal.

SECTION V - HEALTH HAZARD DATA

AIRBORNE EXPOSURE LIMIT (AEL): The AEL for HD is 0.003 mg/m3 as found in "AR 40-173, Occupational Health Guidelines for the Evaluation and Control of Occupational Exposure to Mustard Agents H, HD, HT." To date, the Occupational Safety and Health Administration (OSHA) has not promulgated a permissible exposure concentration for HD.

EFFECTS OF OVEREXPOSURE: HD is a vesicant (causing blisters) and alkylating agent producing cytotoxic action on the hematopoietic (blood-forming) tissues which are especially sensitive. The rate of detoxification of HD in the body is very slow and repeated exposures produce a cumulative effect. HD has been found to be a human carcinogen by the International Agency for Research on Cancer (IARC).

Median doses of HD in man are:
LD50 (skin) = 100 mg/kg ICt50 (skin) = 2000 mg-min/m3 at 70 - 80 F (humid environment)
= 1000 mg-min/m3 at 90 F (dry environment)

ICt50 (eyes) = 200 mg-min/m3

ICt50 (inhalation) = 1500 mg-min/m3 (Ct unchanged with time)

LD50 (oral) = 0.7 mg/kg

Maximum safe Ct for skin and eyes are 5 and 2 mg-min/m3, respectively.

ACUTE PHYSIOLOGICAL ACTION OF HD IS CLASSIFIED AS LOCAL AND SYSTEMIC.

LOCAL ACTIONS: HD effects both the eyes and the skin. SKIN damage occurs after percutaneous absorption. Being lipid soluble, HD can be absorbed into all organs. Skin penetration is rapid without skin irritation. Swelling (blisters) and reddening (erythema) of the skin occurs after a latency period of 4-24 hours following the exposure, depending on degree of exposure and individual sensitivity. The skin healing process is very slow. Tender skin, mucous membrane and perspiration-covered skin are more sensitive to the effects of HD. HD's effect on the skin, however, is less than on the eyes. Local action on the eyes produces severe necrotic damage and loss of eyesight Exposure of eyes to HD vapor or aerosol produces lacrimation, photophobia, and inflammation of the conjunctiva and cornea.

SYSTEMIC ACTIONS: Occurs primarily through inhalation and ingestion. The HD vapor or aerosol is less toxic to the skin or eyes than the liquid form. When inhaled, the upper respiratory tract (nose, throat, tracheae) is inflamed after a few hours latency period, accompanied by sneezing, coughing, and bronchitis, loss of appetite, diarrhea, fever, and apathy. Exposure to nearly lethal doses of HD can produce injury to bone marrow, lymph nodes, and spleen as showed by a drop in white blood cell count, thus resulting in increased susceptibility to local and systemic infections. Ingestion of HD will produce severe stomach pains, vomiting, and bloody stools after a 15-20 minute latency period.

CHRONIC EXPOSURE : HD can cause sensitization, chronic lung impairment, (cough, shortness of breath, chest pain), cancer of the mouth, throat, respiratory tract and skin, and leukemia. It may also cause birth defects.

EMERGENCY AND FIRST AID PROCEDURES:

INHALATION: Hold breath until respiratory protective mask is donned. Remove from the source IMMEDIATELY. If breathing is difficult, administer oxygen. If breathing has stopped, give artificial respiration. Mouth-to-mouth resuscitation should be used when approved mask-bag or oxygen delivery systems are not available. Do not use mouth-to-mouth resuscitation when facial contamination exits. Seek medical attention IMMEDIATELY.

EYE CONTACT: Speed in decontaminating the eyes is absolutely essential. Remove the person from the liquid source, flush the eyes immediately with water for at least 15 minutes by tilting the head to the side, pulling the eyelids apart with the fingers and pouring water slowly into the eyes. Do not cover eyes with bandages but, if necessary, protect eyes by means of dark or opaque goggles. Transfer the patient to a medical facility **IMMEDIATELY.**

SKIN CONTACT: Don respiratory protective mask. Remove the victim from agent sources immediately. Immediately wash skin and clothes with 5% solution of sodium hypochlorite or liquid household bleach within one minute. Cut and remove contaminated clothing, flush contaminated skin area again with 5% sodium hypochlorite solution, then wash contaminated skin area with soap and water. Seek medical attention **IMMEDIATELY.**

INGESTION: Do not induce vomiting. Give victim milk to drink. Seek medical attention **IMMEDIATELY.**

SECTION VI - REACTIVITY DATA

STABILITY: Stable at ambient temperatures. Decomposition temperature is 149 C to 177 C. Mustard is a persistent agent depending on pH and moisture, and has been known to remain active for up to three years in soil.

INCOMPATIBILITY: Rapidly corrosive to brass @ 65 C. Will corrode steel at a rate of .0001 in. of steel per month @ 65 C.

HAZARDOUS DECOMPOSITION: Mustard will hydrolyze to form HCl and thiodiglycol.

HAZARDOUS POLYMERIZATION: Does not occur.

SECTION VII - SPILL, LEAK, AND DISPOSAL PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED: If spills or leaks occur, only personnel in full protective clothing will remain in the area (**See Section VIII**). In case of personnel contamination **See Section V** for emergency and first aid instructions.

RECOMMENDED FIELD PROCEDURES: The HD should be contained using vermiculite, diatomaceous earth, clay or fine sand and neutralized as soon as possible using copious amounts of 5.25% sodium hypochlorite solution. Scoop up all material and clothing and place in a approved DOT container. Cover the contents of the container with decontaminating solution as above. The exterior of the container will be decontaminated and labeled according with EPA and DOT regulations. All leaking containers will be over packed with vermiculite placed between the interior and exterior containers. Decontaminate and label in accordance with EPA and DOT regulations. Dispose of the material in accordance with waste disposal methods provided below. Dispose of the decontaminate according to Federal, state and local regulations. Conduct general area monitoring with an approved monitor to confirm that the atmospheric concentrations do not exceed the airborne exposure limits (**See Sections II and VIII**).

If 5.25 % sodium hypochlorite solution is not available then the following decontaminants may be used instead and are listed in the order of preference: Calcium Hypochlorite, contamination Solution No. 2 (DS2), and Super Tropical Bleach Slurry (STB).

WARNING Pure, undiluted calcium hypochlorite will burn on contact with liquid HD.

RECOMMENDED LABORATORY PROCEDURES: A minimum of 65 grams of decon solution per gram of HD is allowed to agitate for a minimum of one hour. Agitation is not necessary following the first hour if a single phase is obtained At the end of 24 hours, the resulting solution will be adjusted to a pH between 10 and 11. Test for presence of active chlorine by use of acidic potassium iodide solution to give free iodine color. Place 3 ml of the decontaminate in a test tube. Add several crystals of potassium iodine and swirl to dissolve. Add 3 ml of 50 wt.% sulfuric acid:water and swirl. IMMEDIATE iodine color shows the presence of active chlorine. If negative, add additional 5.25% sodium hypochlorite solution to the decontamination solution, wait two hours, then test again for active chlorine Continue procedure until positive chlorine is given by solution. A 10 wt.% calcium hypochlorite (HTH) mixture may be substituted for sodium hypochlorite. Use 65 grams of decon per gram of HD and continue the test as described for sodium hypochlorite. Scoop up all material and clothing and place in a approved DOT container. Cover the contents of the container with decontaminating solution as above. The exterior of the container will be decontaminated and labeled according with EPA and DOT regulations. All leaking containers will be over packed with vermiculite placed between the interior and exterior containers. Decontaminate and label in accordance with EPA and DOT regulations Dispose of the material in accordance with waste disposal methods provided below. Dispose of the decontaminate according to Federal, state and local regulations. Conduct general area monitoring with an approved monitor to confirm that the atmospheric concentrations do not exceed the airborne exposure limits **(See Section VIII).**

NOTE: Surfaces contaminated with HD, then rinse and decontaminated may evolve sufficient HD vapor to produce a physiological response. HD on laboratory glassware may be oxidized by its vigorous reaction with concentrated nitric acid.

CAUTION
CHEMICAL STORAGE

WASTE DISPOSAL METHOD: Open pit burning or burying of HD or items containing or contaminated with HD in any quantity is prohibited. Decontamination of waste or excess material will be accomplished according to the procedures outlined above can be destroyed by incineration in EPA approved incinerators according to appropriate provisions of Federal, State and local Resource Conservation Recovery Act (RCRA) regulations.

NOTE: Some states define decontaminated surety material as a RCRA hazardous waste.

SECTION VIII - SPECIAL PROTECTION INFORMATION

RESPIRATORY PROTECTION:

CONCENTRATION	RESPIRATORY PROTECTIVE EQUIPMENT.
< 0 003 mg/m3	A full face piece, chemical canister, air purifying protective mask will be on hand for escape. (The M9-, M17-, or M40-series masks are acceptable for this purpose. Other masks certified as equivalent may be used)
> 0.003 mg/m3	A NIOSH/MSHA approved pressure demand full face piece SCBA suitable for use in high agent concentrations with protective ensemble (See DA PAM 385-61 for examples).

VENTILATION:

Local Exhaust: Mandatory. Must be filtered or scrubbed. Air emissions will meet local, state and federal regulations.

Special: Chemical laboratory hoods will have an average inward face velocity of 100 linear feet per minute (lfpm) +/- 10% with the velocity at any point not deviating from the average face velocity by more than 20%. Existing laboratory hoods will have an inward face velocity of 150 lfpm +/- 20%. Laboratory hoods will be located such that cross drafts do not exceed 20% of the inward face velocity. A visual performance test using smoke producing devices will be performed in assessing the ability of the hood to contain agent HD

Other: Recirculation of exhaust air from agent areas is prohibited. No connection between agent area and other areas through the ventilation system are permitted. Emergency backup power is necessary. Hoods should be tested semiannually or after modification or maintenance operations. Operations should be performed 20 centimeters inside hoods.

PROTECTIVE GLOVES: Butyl Rubber Gloves M3 and M4 Norton, Chemical Protective Glove Set

EYE PROTECTION: As a minimum, chemical goggles will be worn. For splash hazards use goggles and face shield.

OTHER PROTECTIVE EQUIPMENT: For laboratory operations, wear lab coats, gloves and have mask readily accessible. In addition, daily clean smocks, foot covers, and head covers will be required when handling contaminated lab animals.

MONITORING: Available monitoring equipment for agent HD is the M8/M9 detector paper, blue band tube, M256/M256A1 kits, bubbler, Depot Area Air Monitoring System (DAMMS), Automated Continuous Air Monitoring System (ACAMS),CAM-M1, Hydrogen Flame Photometric Emission Detector (HYFED), the Miniature Chemical Agent Monitor (MINICAM), and Real Time Analytical Platform (RTAP).

Real-time, low-level monitors (with alarm) are required for HD operations. In their absence, an Immediately Dangerous to Life and Health (IDLH) atmosphere must be presumed. Laboratory operations conducted in appropriately maintained and alarmed engineering controls require only periodic low-level monitoring.

SECTION IX - SPECIAL PRECAUTIONS

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING: When handling agents, the buddy system will be incorporated. No smoking, eating, or drinking in areas containing agents is permitted. Containers should be periodically inspected for leaks, (either visually or using a detector kit) Stringent control over all personnel practices must be exercised. Decontaminating equipment will be conveniently placed. Exits must be designed to permit rapid evacuation. Chemical showers, eyewash stations, and personal cleanliness facilities must be provided. Wash hands before meals and shower thoroughly with special attention given to hair, face, neck, and hands using plenty of soap and

water before leaving at the end of the work day .

OTHER PRECAUTIONS: HD should be stored in containers made of glass for Research, Development, Test and Evaluation (RDTE) quantities or one-ton steel containers for large quantities. Agent will be double-contained in liquid and vapor tight containers when in storage.

For additional information see "AR 385-61, The Army Toxic Chemical Agent Safety Program," "DA PAM 385-61, Toxic Chemical Agent Safety Standards," and "AR 40-173, Occupational Health Guidelines for the Evaluation and Control of Occupational Exposure to HD Agents H, HD, and HT."

SECTION X - TRANSPORTATION DATA

FORBIDDEN FOR TRANSPORT OTHER THAN VIA MILITARY (TECHNICAL ESCORT UNIT) TRANSPORT ACCORDING TO 49 CFR 172

PROPER SHIPPING NAME: Poisonous liquids, n.o.s.

DOT HAZARD CLASS: 6.1, Packing Group I, Hazard Zone B

DOT LABEL: Poison

DOT MARKING: Poisonous liquids, n.o.s. Bis-(2-chloroethyl) sulfide UN 2810, Inhalation Hazard

DOT PLACARD: POISON

EMERGENCY ACCIDENT PRECAUTIONS AND PROCEDURES: **See Sections IV, VII and VIII.**

PRECAUTIONS TO BE TAKEN IN TRANSPORTATION: Motor vehicles will be placarded regardless of quantity. Drivers shall be given full information regarding shipment and conditions in case of an emergency. AR 50-6 deals specifically with the shipment of chemical agents. Shipment of agents will be escorted in accordance with AR 740-32.

While the Edgewood Research Development, and Engineering Center, Department of the Army believes that the data contained herein are actual and the opinions expressed are those of the experts regarding the results of the tests conducted, the data are not to be taken as a warranty or representation for which the Department of the Army or Edgewood Research Development, and Engineering Center assume legal responsibility. They are offered solely for your consideration, investigation, and verification. Any use of these data and information must be determined by the user to be in accordance with applicable Federal, State, and local laws and regulations.

ADDENDUM A
ADDITIONAL INFORMATION FOR THICKENED HD

TRADE NAME AND SYNONYMS: Thickened HD, THD

HAZARDOUS INGREDIENTS: K125 (acryloid copolymer, 5%) is used to thicken HD. K125 is not known to be hazardous except in a finely-divided, powder form.

PHYSICAL DATA: Essentially the same as HD except for viscosity. The viscosity of HD is between 1000 and 1200 centistoke @ 25 C.

FIRE AND EXPLOSION DATA: Same as HD.

HEALTH HAZARD DATA: Same as HD except for skin contact. For skin contact, don respiratory protective mask and remove contaminated clothing IMMEDIATELY. IMMEDIATELY scrape the HD from the skin surface, then wash the contaminated surface with acetone. Seek medical attention IMMEDIATELY.

SPILL, LEAK, AND DISPOSAL PROCEDURES: If spills or leaks of HD occur, follow the same procedures as those for HD, but dissolve THD in acetone before introducing any decontaminating solution. Containment of THD is generally not necessary. Spilled THD can be carefully scraped off the contaminated surface and placed in a fully removable head drum with a high density, polyethylene lining. THD can then be decontaminated, after it has been dissolved in acetone, using the same procedures used for HD. Contaminated surfaces should be treated with acetone, then decontaminated using the same procedures as those used for HD.

NOTE: Surfaces contaminated with THD or HD and then rinse-decontaminated may evolve sufficient HD vapor to produce a physiological response.

SPECIAL PROTECTION INFORMATION: Same as HD.

SPECIAL PRECAUTIONS: Same as HD with the following addition. Handling THD requires careful observation of the "stringers" (elastic, threadlike attachments) formed when the agents are transferred or dispensed. These stringers must be broken cleanly before moving the contaminating device or dispensing device to another location, or unwanted contamination of a working surface will result.

TRANSPORTATION DATA: Same as HD.

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1. Chemical Code or EA Number: H

2. Chemical Name: Levinstein Mustard. Composed of about 70% Bis (2-chloroethyl) sulfide and 30% of usually higher MW polysulfides.

3. Chemical Formulae:

   a. Empirical.

   b. Structural.

4 - 17. Most Levinstein H consists of about 70% pure H with about 30% of polysulfides. The percent of pure H in Levinstein H varies from sample to sample and therefore no specific data can be given on its colligative properties.

   The biological properties of H are similar to those given for HD (q.v.).

18. Molecular Weight: Average MW varies with purity, but is generally higher than that of pure mustard (159.08).

19. Purity Range (average):

   a. Laboratory Sample.

   b. Plant Sample. 64 to 69 wt%.

20. Physical Appearance: Amber to dark brown liquid.

21. Vapor Density, Relative to Air: Varies with MW, generally exceeds value for HD of 5.5.

22. Liquid Density: 1.27 g/ml @ 25° C; fairly constant, independent of product purity.

23. Solid Density:

   a. Bulk Density. Not applicable.

   b. Crystal Density. Not applicable.

Levinstein Mustard

24. Normal Freezing Point or Melting Point: approx. 8° C.

25. Boiling Point: Varies with product composition; decomposes around 130° C.

26. Vapor Pressure :

    No general value since vapor pressure varies with purity of sample. High molecular weight impurities of H tend to lower vapor pressure below 0.11 torr reported for HD.

27. Volatility: approx. 920 mg/m^3 @ 25° C (reported for HD).

28. Viscosity: See HD.

29. Flash Point: 105° C.

30. Autoignition Temperature: Unknown.

31. Latent Heat of Vaporization: In the range of 94 cal/g reported for HD.

32. Latent Heat of Fusion: See HD.

33. Vapor-Air-Explosive Hazard Range: Not available.

34. Relative Persistency:

    a. Soil. Persistent.

    b. Surface (Wood, Methal, Masonry, Rubber, Paint).

    c. Water. Persistent due to low solubility.

35. Solubility: Similar to HD.

36. Thermal Decomposition Rate (half-life): See HD.

37. Heat of Combustion: 4500 cal/g (calculated from bomb calorimetry for products given in Item 38).

38. Products of Combustion: CO_2, Cl_2, H_2O, H_2SO_4, HCl (bomb calorimetry).

39. Rate of Hydrolysis: See HD.

40. Hydrolysis Products: See HD.

41. Corrosive Properties: Brass rapidly corroded; cast iron poor.

42. Detection Methods and Equipment:

    Spotted Disk (SD) Test, Dragendorff Test.

    For Liquid: ABCM8 detector paper; M6A1 detector paper.
    For Vapor: M15A2, M18A2, M19 kits
    (DB-3 Test, blue band detector tube)

43. Decontaminants:

    a. Personnel. Flush eyes with H_2O. Protective ointment M1, M5 ointment; M13 kit (liquid on skin). M13 Kit - outer clothing. Shower with soap and water.

    b. Equipment. Bleaching powder, DANC, DS2, sodium hypochlorite, fire.

    c. Areas. Terrain: Aeration. STB slurry applied by M9 or M12A1 decontaminating apparatus.

44. DOT Classification: Poison A.

45. Stabilizer Utilized:

    a. Laboratory Sample. See HD.

    b. Production Sample.

46. Types of Containers Required for Storage:

    a. RDT&E Quantities. Glass.

    b. Stockpile Quantities. One-ton containers, 55-gallon steel drums, steel cylinders.

47. Q-D Classification: 3
    Compatability Group: A
    Chemical Group: A

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MATERIAL SAFETY DATA

LEWISITE

SECTION I - GENERAL INFORMATION

DATE. 16 April 1988
REVISED: 27 March 1996

MANUFACTURER'S ADDRESS.

U S ARMY CHEMICAL BIOLOGICAL DEFENSE COMMAND EDGEWOOD RESEARCH DEVELOPMENT. ANDENGINEERING CENTER (ERDEC)
ATTN: SCBRD-ODR-S
ABERDEEN PROVING GROUND. MD 20101-5423

Emergency telephone #' s· 0700-1630 EST: 410-671-4411/4
After: 1630 EST. 410- 278-5201, Ask for Staff Duty Officer

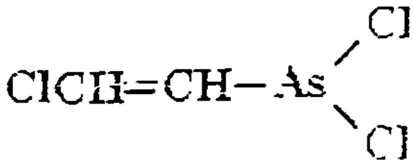
CAS REGISTRY NUMBER. 541-25-3

CHEMICAL NAME:
Dichloro-(2-chlorovinyl) arsine

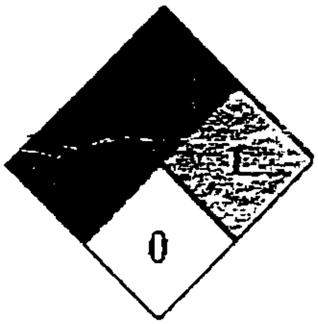
TRADE NAME AND SYNONYMS·
Arsine, (2-chlorovinyl) dichloro-
Arsonous dichloride, (2-chloroethenyl)
Chlorovinylarsine dichloride
2-Chlorovinyldichloroarsine
beta-Chlorovinyldichloroarsine
Lewisite

L
EA 1034
CHEMICAL FAMILY. Arsenical (vesicant)

FORMULA/CHEMICAL STRUCTURE: C2H2AsC13



NFPA 704 HAZARD SIGNAL.



Health - 4
Flammability - 1
Reactivity - 1
Special - 0

SECTION II - HAZARDOUS INGREDIENTS

INGREDIENTS NAME FORMULA PERCENTAGE BY WEIGHT AIRBORNE EXPOSURE LIMIT (AEL)LewisiteC2H2AsCl3 100* 0.003 mg/m3 * This is a ceiling value

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SECTION III - PHYSICAL DATA

BOILING POINT· 374 F 190 C

VAPOR PRESSURE (mm Hg)·
0.35 @ 25 C
0.394 @ 20 C
VAPOR DENSITY (AIR=1). 7 1

SOLUBILITY: Insoluble in water and dilute mineral acids. Soluble in organic solvents, oils. and alcohol.

SPECIFIC GRAVITY ($H2O=1$)· 1.88 @ 25 C

FREEZING POINT 18 C to 0.1 C depending on purity

VOLATILITY. 4,480 mg/m3 @ 20 C

MOLECULAR WEIGHT 207 32

LIQUID DENSITY 1 89 at 20 C (Much heavier than Mustard)

APPEARANCE AND ODOR Pure L is a colorless oily liquid. "War gas" is an amber to dark brown liquid. A characteristic odor is usually geranium-like: very little odor when pure.

SECTION IV - FIRE AND EXPLOSION DATA

FLASHPOINT (Method Used): Does not flash

FLAMMABILITY LIMITS N/A.

EXTINGUISHING MEDIA. Water, fog, foam. CO2. Avoid use of extinguishing methods that will cause splashing or spreading of L.

SPECIAL FIRE FIGHTING PROCEDURES. All persons not engaged in extinguishing the fire should be evacuated immediately Fires involving L should be contained to prevent contamination of uncontrolled areas. When responding to a fire alarm in buildings or areas containing agents, firefighting personnel should wear full firefighter protective clothing during chemical agent firefighting and fire rescue operations: Respiratory protection is required. Positive pressure. full face piece, NIOSH approved self-contained breathing apparatus (SCBA) will be worn where there is danger of oxygendeficiency and when directed by the fire chief or chemical accident/incident (CAI)operations officer. In cases where firefighters are responding to a chemical accident/incident for rescue/reconnaissance purposes, they will wear appropriate levels of protective clothing (See Section VIII).

Do not breathe fumes. Skin contact with nerve agents must be avoided always. Although the fire may destroy most of the agent, care must still be taken to assure the agent or contaminated liquids do not further contaminate other areas or sewers. Contact with the agent liquid or vapor can be fatal.

SECTION V - HEALTH HAZARD DATA

AIRBORNE EXPOSURE LIMITS (AEL): The permissible airborne exposure concentration of L for an 8-hour workday or a 40-hour work week is an 8-hour time weighted average (TWA) of 0.003 mg/m3 as a ceiling value. A ceiling value may notbe exceeded anytime The ceiling value for Lewisite is based upon the present technologically feasible detection limits of 0 003 mg/m3. This value can be found in "DA Pam 40-173, Occupational Health Guidelines for the Evaluation and Control of Occupational Exposure to Mustard H, HD, HT. and L." To date, however, the Occupational Safety and Health Administration (OSHA) has not promulgated permissible exposure concentration for L.

EFFECTS OF OVEREXPOSURE: L is a vesicant (blister agent), also, it acts as a systemic poison, causing pulmonary edema, diarrhea, restlessness, weakness, subnormal temperature. and low blood pressure. In order of severity and appearance of symptoms, it is: a blister agent, a toxic lung irritant, and absorbed in tissues, a systemic poison. When inhaled in high concentrations, may be fatal in as short a time as 10 minutes. L is not detoxified by the body Common routes of entry into the body include ocular, percutaneous, and inhalation.

TOXICOLOGICAL DATA

Man:

LCt50 (inhalation, man) = 1200 - 1500 mg min/m3
LCt50 (skin vapor exposure, man) = 100,000 mg min/m3 LDLO (skin, human) = 20 mg/kg
LCt50 (skin, man): >1500 mg/min3 L irritates eyes and skin and gives warning of its presence. Minimum effective dose (ED min) = 200 mg/m3 (30 min).
ICt50 (eyes, man) <300 mg min/m3

Animal:

LD50 (oral, rat) = 50 mg/kg
LD50 (subcutaneous, rat) = 1 mg/kg
LCtLO (inhalation, mouse) = 150 mg/m3 10m
LD50 (skin, dog = 15 mg/kg RTECS) or 38 mg/kg (CRDEC chemical agent data sheets)
LD50 (skin, rabbit) = 6 mg/kg
LD50 (subcutaneous, rabbit) = 2 mg/kg
LD50 (intravenous, rabbit) = 500 mg/kg
LD50 (skin, guineapig) = 12 mg/kg
LD50 (subcutaneous, guinea pig) = 1 mg/kg
LD50 (skin, domestic farm animals) = 15 mg/kg
LCt50 (inhalation, rat) = 1500 mg min/m3 (9 min)
LCt50 (vapor skin, rat) = 20,000 mg min-m 25 min)

LCD50 (skin, rat) = 15 - 24 mg/kg
LD50 (ip, dog) = 2 mg/kg
EDmin (skin, dog) = 50 mg/m3 (30 min)
EDmin (eye, dog) = 20 mg/m3 (30 min)
EDmin (skin, rabbit) = 25 mg/m3 (30 min)
EDmin (eye, rabbit) = 1 mg/m3 (30 min)

ACUTE EXPOSURE.

EYES. Severe damage. Instant pain, conjunctivitis and blepharospasm leading to closure of eyelids, followed by corneal scarring and iritis. Mild exposure produces reversible eye damage if decontaminated instantly Otherwise, more permanent injury or blindness is possible within one minute of exposure.

SKIN: Immediate stinging pain increasing in severity with time. Erythema (skin reddening) appears within 30 minutes after exposure accompanied by pain with itching and irritation for 24 hours. Blisters appear within 12 hours after exposure with more pain that diminished after 2-3 days. Skin burns are much deeper than with HD. Tender and moist skin (mucous membrane; perspiration covered; . .), absorbs more L, therefore is more sensitive than the skin. This, however, is counteracted by L's hydrolysis by moisture, producing less vesicant. higher vapor pressure product.

RESPIRATORY TRACT Irritating to nasal passages and produces a burning sensation followed by a profuse nasal secretion and violent sneezing. Prolonged exposure causes coughing and production of large quantities of froth mucus. In experimental animals, injury to respiratory tracts, due to vapor exposure is similar to mustard's: however, edema of the lung is more marked and frequently accompanied by pleural fluid.

SYSTEMIC EFFECTS L on the skin, and inhaled vapor, is absorbed and may cause systemic poisoning. A manifestation of this is a change in capillary permeability, which permit's loss of sufficient fluid from the bloodstream to cause hemoconcentration, shock and death. In nonfatal cases, hemolysis of erythrocytes has occurred with a resultant hemolytic anemia. The excretion of oxidized products into the bile by the liver produces focal necrosis of that organ, necrosis of the mucosa of the biliary passages with periobiliary hemorrhages, and some injury to the intestinal mucosa. Acute systematic poisoning from large skin burns cause's pulmonary edema, diarrhea, restlessness weakness, subnormal temperature, and low blood pressure in animals.

CHRONIC EXPOSURE. L can cause sensitization and chronic lung impairment. Also, by comparison to agent mustard and arsenical compounds, it can be considered as a suspected human carcinogen.

EMERGENCY AND FIRST AID PROCEDURES:

INHALATION. Hold breath until respiratory protective mask id donned. Remove from the source IMMEDIATELY. If breathing has stopped give artificial respiration. If breathing is difficult, administer oxygen. Seek medical attention IMMEDIATELY.

EYE CONTACT Speed in decontaminating the eyes is essential. Remove the person from the liquid source, flush the eyes immediately with water for at least 15 minutes by tilting the head to the side, pulling eyelids apart with fingers and pouring water slowly into the eyes. Do not cover eyes with bandages but, if necessary, protect eyes by means of dark or opaque goggles. See medical attention IMMEDIATELY.

SKIN CONTACT: Remove the victim from the source immediately and remove contaminated clothing. Immediately decon affected areas by flushing with 10% sodium carbonate solution. After 3-4 minutes, wash off with soap and water to protect against erythema. Seek medical attention IMMEDIATELY

INGESTION: Do not induce vomiting. Give victim milk to drink. Seek medical attention IMMEDIATELY.

SECTION VI - REACTIVITY DATA

STABILITY Stable in steel or glass containers.

INCOMPATIBILITY. Corrosive to steel at a rate of 1 x 10 -5 to 5 x 10-5 in/month at 65 C.

HAZARDOUS DECOMPOSITION PRODUCTS. Reasonably stable; however, in presence of moisture, it hydrolyses rapidly, losing its vesicant property. It also hydrolyses in acidic medium to form HC1 and non-volatile (solid) chlorovinylarsenious oxide, which is less vesicant than Lewisite. Hydrolysis in alkaline medium, as in decontamination with alcoholic caustic or carbonate solution or DS2, produces acetylene and trisodium arsenate (Na3AS04). Therefore, decontaminated solution would contain toxic arsenic.

SECTION VII - SPILL, LEAK, AND DISPOSAL PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED: Only personnel in full protective clothing (See Section VIII) will be allowed in area where L is spilled. See Section V for emergency and first aid procedures.

RECOMMENDED FIELD PROCEDURES. The L should be contained using vermiculite, diatomaceous earth, clay, or fine sand and neutralized as soon as possible using copious amounts of alcoholic caustic, carbonate, or DS2. Caution must be exercised when using these decontaminates since acetylene will be given off. Household bleach can also be used if accompanied by stirring to allow contact. Scoop up all contaminated material and place in approved DOT containers. Cover with additional decontaminant. Decontaminate the outside of the container, label according to DOT and EPA requirements, and dispose of as specified below. Conduct general area monitoring with an approved monitor to confirm that the atmospheric concentrations do not exceed the airborne exposure limit (See Sections II and

VIII).

RECOMMENDED LABORATORY PROCEDURES: A 10 wt. % alcoholic sodium hydroxide solution is prepared by adding 100 grams of denatured ethanol to 900 grams of 10 wt.% NaOH in water. A minimum of 200 grams of decon is required for each gram of L. The decon/agent solution is agitated for a minimum of one hour. At the end of one hour the resulting pH should be checked and adjusted to above 11.5 using additional NaOH, if required. It is permitted to substitute 10 wt.% alcoholic sodium carbonate made and used in the same ratio as the NaOH listed above. Reaction time should be increased to 3-hours with agitation for the first hour. Final pH should be adjusted to above 10. It is permitted to substitute 5.25% sodium hypochlorite for the 10% alcoholic sodium hydroxide solution above. Allow one hour with agitation for the reaction. Adjustment of the pH is not required. Conduct general area monitoring to confirm that the atmospheric concentrations do not exceed the airborne exposure limit (See Section VIII). WASTE DISPOSAL METHOD: All neutralized material should be collected and contained for disposal according to land ban RCRA regulations or thermally decomposed in an EPA permitted incinerator equipped with a scrubber that will scrub out the chlorides and equipped with an electrostatic precipitator or other filter device to remove arsenic. Collect all the arsenic dust from the electrostatic precipitator or other filter device and containerize and label according to DOT and EPA regulations. The arsenic will be disposed of according to land ban RCRA regulations. Any contaminated materials or protective clothing should be decontaminated using alcoholic caustic, carbonates, or bleach analyzed to assure it is free of detectable contamination (3X) level. The clothing should then be sealed in plastic bags inside properly labeled drums and held for shipment back to the DA issue point.

NOTE. Some states define decontaminated surety material as an RCRA hazardous waste

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SECTION VIII - SPECIAL PROTECTION INFORMATION

RESPIRATORY PROTECTION.

<u>CONCENTRATIONRESPIRATORY PROTECTIVE EQUIPMENT</u> <0.003 mg/m3A full
face piece, chemical canister, air purifying
protective mask will be on hand for escape
(The M9-, M17-, or M40-series masks are
acceptable for this purpose. Other masks
certified as equivalent may be used) > 0.003 mg/m3 or unknownA NIOSH/MSHA approved,
full face piece SCBA
suitable for use in high agent concentrations with
a protective ensemble. (See DA Pam 385-61) VENTILATION
Local exhaust: Mandatory. Must be filtered or scrubbed to limit exit concentration to non-detectable level. Air emissions will meet local, state and federal regulations

Special. Chemical laboratory hoods will have an average inward face velocity of 100 linear feet per minute (lfpm)ñ 10% with the velocity at any point not deviating from the average face velocity by more than 20%. Existing laboratory hoods will have an inward face velocity of 150 lfpm ñ20%. Laboratory hoods will be located such that cross drafts do not exceed 20% of the inward face velocity A visual performance test utilizing smoke producing devices will be performed in the assessment of the inclosure's ability to contain Lewisite.

Other: Recirculation of exhaust air from agent areas is prohibited. No connection between agent area and other areas through the ventilation system is permitted. Emergency backup power is necessary. Hoods should be tested semiannually or after modification or maintenance operations. Operations should be performed 20 centimeters inside hoods. Procedures should be developed for disposal of contaminated filters.

PROTECTIVE GLOVES. Norton. Chemical Protective Glove Set. M3 Butyl Rubber

EYE PROTECTION: As a minimum, protective eye glasses will be worn. For splash hazard use goggles and face-shield.

OTHER PROTECTIVE EQUIPMENT For laboratory operations. wear lab coats. gloves and have a mask readily accessible. In addition, daily clean smocks, foot covers, and head covers will be required when handling contaminated lab animals.

MONITORING: Available monitoring equipment for agent L is the M18A2 (yellow band), bubblers (arsenic and GC method), and M256 & A1 Kits.

Real-time, low-level monitors (with alarm) are required for L operations. In their absence, an IDLH atmosphere must be presumed. Laboratory operations conducted in appropriately maintained and alarmed engineering controls require only periodic low-level monitoring.

SECTION IX - SPECIAL PRECAUTIONS

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING: When handling agents, the buddy system will be incorporated. No smoking, eating, or drinking in areas containing agents is permitted. Containers should be periodically inspected for leaks, either visually or using a detector kit. Stringent control over all personnel handling L must be exercised. Decontaminating equipment will be conveniently located. Exits must be designed to permit rapid evacuation. Chemical showers, eye wash stations, and personal cleanliness facilities must be provided. Wash hands before meals and shower thoroughly with special attention given to hair, face, neck, and hands, using plenty of soap before leaving at the end of the workday.

OTHER PRECAUTIONS. L should be stored in containers made of glass for Research, DevelopmentTest and Evaluation (RDTE) quantities or one-ton steel containers for large quantities. Agent will be double contained in liquid tight containers when in storage or during transportation.

For additional information see "AR 385-61, The Army Toxic Chemical Agent Safety Program," "DA Pam 385-61, Toxic Chemical Agent Safety Standards," and "DA Pam 40-173, Occupational Health Guidelines for the Evaluation and Control of Occupational Exposure to Mustard H, HD, HT, and L."

SECTION X - TRANSPORTATION DATA

PROPER SHIPPING NAME Poisonous liquids, n.o.s.

DOT HAZARDS CLASSIFICATION: 6.1, Packing Group I

DOT LABEL: Poison

DOT MARKING: Poisonous liquids, n.o.s. Dichloro-(2-chlorovinyl)arsine UN 2810

DOT PLACARD: POISON

EMERGENCY ACCIDENT PRECAUTIONS & PROCEDURES: See Sections IV and VIII.

PRECAUTIONS TO BE TAKEN IN TRANSPORTATION: Motor vehicles will be placarded regardless of quantity. Drivers will be given full information regarding shipment and conditions in case of an emergency AR 50-6 deals specifically with the shipment of chemical agents. Shipment of agents will be escorted according to AR 740-32.

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LIQUID AIR -- PHOSGENE
MATERIAL SAFETY DATA SHEET
FSC: 6810
NIIN: 00F002675
Manufacturer's CAGE: 18260
Part No. Indicator: A
Part Number/Trade Name: PHOSGENE

General Information

Company's Name: LIQUID AIR CORPORATION
Company's Emerg Ph #. (800) 231-1366
Record No. For Safety Entry: 001
Tot Safety Entries This Stk#: 001
Date MSDS Prepared: 01JAN87
Safety Data Review Date. 28FEB86
MSDS Serial Number· BBLMB

Ingredients/Identity Information

Proprietary: YES
Ingredient: PROPRIETARY
Ingredient Sequence Number: 01

Physical/Chemical Characteristics

Appearance And Odor: COLORLESS GAS WITH SWEET ODOR.
Boiling Point: 45.6F
Vapor Pressure (MM Hg/70 F): 22.
Vapor Density (Air=1). .255
Specific Gravity: 3.42
Solubility In Water: DECOMPOSES

Fire and Explosion Hazard Data

Flash Point: N/A
Lower Explosive Limit: N/A
Upper Explosive Limit: N/A
Extinguishing Media: NONFLAMMABLE
Special Fire Fighting Proc: N/A
Unusual Fire And Expl Hazrds: N/A

Reactivity Data

Stability: YES
Cond To Avoid (Stability): TEMPERATURES ABOVE 572F
Materials To Avoid: WATER, AMMONIA, PRIMARY AMINES,
Hazardous Decomp Products: CO, CHLORINE
Hazardous Poly Occur: NO

Health Hazard Data

Signs/Symptoms Of Overexp· INHALATION: CHOKING/COUGHING/TIGHTNESS OF THE CHEST/BREATH/LACRYMATION/EVENTUAL CYANOSIS.
Emergency/First Aid Proc: INHALATION: UNCONSCIOUS PERSONS SHOULD BE ASSISTED TO AN UNCONTAMINATED AREA/INHALE FRESH AIR/GIVEN OXYGEN. KEEP THE VICTIM WARM/QUIET. CALL PHYSICIAN.

Precautions for Safe Handling and Use

Steps If Matl Released/Spill: EVACUATE ALL PERSONNEL FROM AFFECTED AREA. USE APPROPRIATE PROTECTIVE EQUIPMENT. IF AK IS IN USER'S EQUIPMENT, BE CERTAIN TO PURGE PIPING WITH AN INERT GAS IOR TO ATTEMPTING REPAIRS.
Waste Disposal Method: DON'T ATTEMPT TO DISPOSE OF RESIDUAL OR UNUSED QUANTITES. RETURN IN THE SHIPPING CONTAINER PROPERLY LABELED, WITH ANY VALVE OUTLET PLUGS OR CAPS SECURED AND VALVE PROTECTION CAP IN PLACE TO LIQUID AIR CORPORATION FOR PROPER DISPOSAL.
Precautions-Handling/Storing: PROTECT CYLINDERS FROM PHYSICAL DAMAGE. STORE IN COOL, DRY, WELL-VENTILATED AREA AWAY FROM HEALY TRAFFICKED AREAS. DON'T STORED ABOVE 130F.
Other Precautions: USE ONLY IN WELL-VENTILATED AREAS. VALVE PROTECTION CAPS AND VALVE OUTLET THREADED PLUGS MUST REMAIN IN PLACE UNLESS CONTAIN IS SECURED WITH VALVE OUTLET PIPED TO USE POINT.

Control Measures

Respiratory Protection: POSITIVE PRESSURE AIR LINE WITH MASK, SCBA FOR EMERGENCY USE.
Ventilation: HOOD WITH FORCED VENTILATION
Protective Gloves: RUBBER OR TEFLO
Eye Protection: GOGGLES/GLASSES/FACESHIEL
Other Protective Equipment: SAFETY SHOES/SHOWER/EYEWASH.
Suppl. Safety & Health Data: ONE CALIFORNIA PLAZA, SUITE 350/2121 N. CALIFORNIA BLVD/WALNUT CREEK, CALIFORNIA 94596. MOLECULAR WEIGHT: 98.91

Transportation Data

Disposal Data

Disposal Data Review Date: 88320
Rec # For This Disp Entry: 01
Tot Disp Entries Per NSN: 001
Landfill Ban Item: YES
Disposal Supplemental Data: ONE CALIFORNIA PLAZA, SUITE 350/2121 N CALIFORNIA BLVD/WALNUT CREEK, CALIFORNIA 94596. MOLECULAR WEIGHT: 98.91 IN CASE OF ACCIDENTAL EXPOSURE OR DISCHARGE, CONSULT HEALTH AND SAFETY FILE FOR PRECAUTIONS.
1st EPA Haz Wst Code New: P095
1st EPA Haz Wst Name New: PHOSGENE; CARBONYL CHLORIDE
1st EPA Haz Wst Char New: ACUTELY TOXIC (H)
1st EPA Acute Hazard New: YES

Label Data

Label Required: YES
Label Status: G
Common Name: PHOSGENE
Special Hazard Precautions: INHALATION: CHOKING/COUGHING/ TIGHTNESS OF THE CHEST/BREATH/LACRYMATION/EVENTUAL CYANOSIS.
Label Name: LIQUID AIR CORPORATION
Label Emergency Number: (800) 231-1366

ANNEX D

HAZARDOUS WASTE MANIFEST FORMS AND INSTRUCTIONS AND OTHER TRANSPORTATION FORMS

ANNEX D

575 167A

HAZARDOUS WASTE MANIFEST FORMS AND INSTRUCTIONS AND OTHER TRANSPORTATION FORMS

The following pages provide the following forms and instructions to support the transportation and storage of chemical warfare materiel (CWM):

- DD Form 626 Motor Vehicle Inspection
- Interim Holding Facility (IHF) Inspection Checklist
- DD Form 1911, Materiel Courier Receipt.

MOTOR VEHICLE INSPECTION (TRANSPORTING HAZARDOUS MATERIALS)

(Read instructions before completing this form.)

This form applies to all vehicles which must be marked or placarded in accordance with Title 49 CFR.	1. GOVERNMENT BILL OF LADING/TRANSPORTATION CONTROL NUMBER

SECTION 1 - DOCUMENTATION	ORIGIN a.	DESTINATION b
2. CARRIER/GOVERNMENT ORGANIZATION		
3. DATE/TIME OF INSPECTION		
4 LOCATION OF INSPECTION		
5. OPERATOR(S) NAME(S)		
6. OPERATOR(S) LICENSE NUMBER(S)		
7 MEDICAL EXAMINER'S CERTIFICATE*		

8. *(X if satisfactory at origin)*							9. CVSA DECAL DISPLAYED ON COMMERCIAL EQUIPMENT*	YES	NO
a. MILITARY HAZMAT ENDORSEMENT		d ERG OR EQUIVALENT COMMERCIAL		YES		NO			
b VALID LEASE*		e DRIVER'S VEHICLE INSPECTION REPORT*					a. TRUCK/TRACTOR		
c. ROUTE PLAN		f. COPY OF 49 CFR PART 397					b. TRAILER		

SECTION II - MECHANICAL INSPECTION

All items shall be checked on empty equipment prior to loading. Items with an asterisk shall be checked on all incoming loaded equipment.

10. TYPE OF VEHICLE(S)	11. VEHICLE NUMBER(S)

12. PART INSPECTED *(X as applicable)*	ORIGIN (1) SAT	ORIGIN (1) UNSAT	DESTINATION (2) SAT	DESTINATION (2) UNSAT	[redacted]	ORIGIN (1) SAT	ORIGIN (1) UNSAT	DESTINATION (2) SAT	DESTINATION (2) UNSAT	COMMENTS (3)
a SPARE ELECTRICAL FUSES					k. EXHAUST SYSTEM					
b HORN OPERATIVE					l BRAKE SYSTEM*					
c STEERING SYSTEM					m SUSPENSION					
d WINDSHIELD/WIPERS					n COUPLING DEVICES					
e MIRRORS					o CARGO SPACE					
f WARNING EQUIPMENT					p. LANDING GEAR*					
g FIRE EXTINGUISHER*					q. TIRES, WHEELS, RIMS					
h ELECTRICAL WIRING					r TAILGATE/DOORS*					
i LIGHTS AND REFLECTORS					s. TARPAULIN*					
j FUEL SYSTEM*					t. OTHER *(Specify)*					

13 INSPECTION RESULTS *(X one)* ACCEPTED ☐ REJECTED ☐

(If rejected give reason under "Remarks". Equipment will be approved if deficiencies are corrected prior to loading.)

14. SATELLITE MOTOR SURVEILLANCE SYSTEM: *(X one)* ACCEPTED ☐ REJECTED ☐

15. REMARKS

16. INSPECTOR SIGNATURE *(Origin)*	17. INSPECTOR SIGNATURE *(Destination)*

SECTION III - POST LOADING INSPECTION This section applies to Commercial and Government/Military vehicles All items will be checked prior to release of loaded equipment and shall be checked on all incoming loaded equipment	ORIGIN (1) SAT	ORIGIN (1) UNSAT	DESTINATION (2) SAT	DESTINATION (2) UNSAT	COMMENTS (3)
18 LOADED IAW APPLICABLE SEGREGATION/COMPATIBILITY TABLE OF 49 CFR					
19. LOAD PROPERLY SECURED TO PREVENT MOVEMENT					
20 SEALS APPLIED TO CLOSED VEHICLE; TARPAULIN APPLIED ON OPEN EQUIPMENT					
21. PROPER PLACARDS APPLIED					
22. SHIPPING PAPERS/DD FORM 836 FOR GOVERNMENT VEHICLE SHIPMENTS					
23. COPY OF DD FORM 626 FOR DRIVER					
24 SHIPPED UNDER DOT EXEMPTION 868					

25. INSPECTOR SIGNATURE *(Origin)*	26. DRIVER(S) SIGNATURE *(Origin)*
27. INSPECTOR SIGNATURE *(Destination)*	28. DRIVER(S) SIGNATURE *(Destination)*

DD FORM 626, SEP 1998 (EG) PREVIOUS EDITION IS OBSOLETE Page 1 of 3 Pages

Designed using Perform Pro, WHS/DIOR Sep 98

INSTRUCTIONS

SECTION I - DOCUMENTATION

General Instructions.

All items (2 through 9) will be checked at origin prior to loading Items with an asterisk (*) apply to commercial operators or equipment only Only Items 2 through 7 are required to be checked at destination

Items 1 through 5 Self explanatory

Item 6 Enter operator's Commercial Driver's License (CDL) number or Military OF-346 License Number. CDL and OF-346 must have the HAZMAT and other appropriate endorsements IAW Part 383.

Item 7 *Enter the expiration date listed on the Medical Examiner's Certificate.

Item 8 a APPLIES TO MILITARY OPERATORS ONLY Military Hazardous Materials Certification In accordance with applicable service regulations, ensure operator has been certified to transport hazardous materials

b *Valid Lease. Shipper will ensure a copy of the appropriate contract of lease is carried in all leased vehicles and is available for inspection. (Defense Transportation Regulation (DTR) requirement)

c Route Plan. Prior to loading any Hazard Class/Division 1 1, 1.2, or 1.3 (Explosives) for shipment, ensure that the operator possesses a written route plan in accordance with 49 CFR Part 397. Route Plan requirements for Hazard Class 7 (Radioactive) materials are found in 49 CFR 397.101.

d Emergency Response Guidebook (ERG) or Equivalent. Commercial operators must be in possession of an ERG or equivalent document. Shipper will provide applicable ERG page(s) to military operators.

e *Driver's Vehicle Inspection Report. Review the operator's Vehicle Inspection Report Ensure that there are no defects listed on the report that would affect the safe operation of the vehicle.

f Copy of 49 CFR Part 397. Operators are required by regulation to have in their possession a copy of 49 CFR Part 397 (Hazardous Materials Driving and Parking Rules) If military operators do not possess this document, shipper may provide a copy to operator

Item 9 *Commercial Vehicle Safety Alliance (CVSA) Decal Check to see if equipment has a current CVSA decal and mark applicable box. Vehicles without CVSA, check documentation of the last vehicle periodic inspection

SECTION II - MECHANICAL INSPECTION

General Instructions.

All items (12.a. through 12.r.) will be checked on all incoming empty equipment prior to loading. All UNSATISFACTORY conditions must be corrected prior to loading Items with an asterisk (*) shall be checked on all incoming loaded equipment Unsatisfactory conditions that would affect the safe off-loading of the equipment must be corrected prior to unloading

SECTION II *(Continued)*

Item 12.a. Spare Electrical Fuses. Check to ensure that at least one spare fuse for each type of installed fuse is carried on the vehicle as a spare or vehicle is equipped with an overload protection device (circuit breaker). (49 CFR 393 95)

b Horn Operative Ensure that horn is securely mounted and of sufficient volume to serve purpose. (49 CFR 393 81)

c Steering System. The steering wheel shall be secure and must not have any spokes cracked through or missing. The steering column must be securely fastened. Universal joints shall not be worn, faulty or repaired by welding. The steering gear box shall not have loose or missing mounting bolts or cracks in the gear box mounting brackets. The pitman arm on the steering gear output shaft shall not be loose. Steering wheel shall turn freely through the limit of travel in both directions. All components of a power steering system must be in operating condition. No parts shall be loose or broken Belts shall not be frayed, cracked or slipping. The power steering system shall not be leaking (49 CFR 396 Appendix G)

d. Windshield/Wipers Inspect to ensure that windshield is free from breaks, cracks or defects that would make operation of the vehicle unsafe; that the view of the driver is not obscured and that the windshield wipers are operational and wiper blades are in serviceable condition. Defroster must be operative when conditions require. (49 CFR 393.60, 393.78 and 393.79)

e. Mirrors. Every vehicle must be equipped with two rear vision mirrors located so as to reflect to the driver a view of the highway to the rear along both sides of the vehicle. Mirrors shall not be cracked or dirty. (49 CFR 393.80)

f Warning Equipment. Equipment must include three bidirectional emergency reflective triangles that conform to the requirements of FMVSS No. 125 FLAME PRODUCING DEVICES ARE PROHIBITED. (49 CFR 393.95)

g. Fire Extinguisher. Military vehicles must be equipped with two serviceable fire extinguishers with an Underwriters Laboratories rating of 10 BC or more (Commercial motor vehicles must be equipped with one serviceable 10 BC Fire Extinguisher). Fire extinguisher(s) must be located so that it is readily accessible for use and securely mounted on the vehicle. The fire extinguisher must be designed, constructed and maintained to permit visual determination of whether it is fully charged. (49 CFR 393.95)

h Electrical Wiring· Electrical wiring must be clean and properly secured. Insulation must not be frayed, cracked or otherwise in poor condition There shall be no uninsulated wires, improper splices or connections. Wires and electrical fixtures inside the cargo area must be protected from the lading (49 CFR 393 28, 393.32, 393 33)

INSTRUCTIONS

SECTION II *(Continued)*

i Lights/Reflectors (Head, tail, turn signal, brake, clearance, marker and identification lights, Emergency Flashers) Inspect to see that all lighting devices and reflectors required are operable, of proper color and properly mounted. Ensure that lights and reflectors are not obscured by dirt or grease or have broken lenses. High/Low beam switch must be operative Emergency Flashers must be operative on both the front and rear of vehicle. (49 CFR 393)

j. Fuel System. Inspect fuel tank and lines to ensure that they are in serviceable condition, free from leaks, or evidence of leakage and securely mounted Ensure that fuel tank filler cap is not missing. Examine cap for defective gasket or plugged vent Inspect filler necks to see that they are in completely serviceable condition and not leaking at joints. (49 CFR 393.83 and 396 Appendix G)

k Exhaust System Exhaust system shall discharge to the atmosphere at a location to the rear of the cab or if the exhaust projects above the cab, at a location near the rear of the cab. Exhaust system shall not be leaking at a point forward of or directly below the driver compartment. No part of the exhaust system shall be located where it will burn, char or damage electrical wiring, fuel system or any other part of the vehicle No part of the exhaust system shall be temporarily repaired with wrap or patches (49 CFR 393 83 and 396 Appendix G)

l. Brake System (to include hand brakes, parking brakes and Low Air Warning devices). Check to ensure that brakes are operational and properly adjusted Check for audible air leaks around air brake components and air lines. Check for fluid leaks, cracked or damaged lines in hydraulic brake systems. Ensure that parking brake is operational and properly adjusted. Low Air Warning devices must be operative. (49 CFR 396 Appendix G)

m. Suspension. Inspect for indications of misaligned, shifted or cracked springs, loosened shackles, missing bolts, spring hangers unsecured at frame and cracked or loose U-bolts. Inspect for any unsecured axle positioning parts, and sign of axle misalignment, broken torsion bar springs (if so equipped). (49 CFR 396 Appendix G)

n. Coupling Devices (Inspect without uncoupling). Fifth Wheels. Inspect for unsecured mounting to frame or any missing or damaged parts. Inspect for any visible space between upper and lower fifth wheel plates. Ensure that the locking jaws are around the shank and not the head of the kingpin Ensure that the release lever is seated properly and safety latch is engaged Pintle Hook, Drawbar, Towbar Eye and Tongue and Safety Devices: Inspect for unsecured mounting, cracks, missing or ineffective fasteners (welded repairs to pintle hook is prohibited) Ensure safety devices (chains, hooks, cables) are in serviceable condition and properly attached. (49 CFT 396 Appendix G)

o. Cargo Space. Inspect to ensure that cargo space is clean and free from exposed bolts, nuts, screws, nails or inwardly projecting parts that could damage the lading Check floor to ensure it is tight and free from holes Floor shall not be permeated with oil or other substances. (49 CFR 177.815(e)(1) and 398.94)

p Landing Gear Inspect to ensure that landing gear and assembly are in serviceable condition, correctly assembled, adequately lubricated and properly mounted

SECTION II *(Continued)*

q. Tires, Wheels and Rims: Inspect to ensure that tires are properly inflated Flat or leaking tires are unacceptable Inspect tires for cuts, bruises, breaks and blisters Tires with cuts that extend into the cord body are unacceptable. Thread depth shall not be less than. 4/32 inches for tires on a steering axle of a power unit, and 2/32 inches for all other tires. Mixing bias and radial on the steering axle is prohibited Inspect wheels and rims for cracks, unseated locking rings, broken, loose, damaged or missing lug nuts or elongated stud holes. (49 CFR 396 Appendix G)

r Tailgate/Doors Inspect to see that all hinges are tight in body Check for broken latches and safety chains Doors must close securely. (49 CFR 177 835(h))

s. Tarpaulin If shipment is made on open equipment, ensure that lading is properly covered with fire and water resistant tarpaulin. (49 CFR 177.835(h))

t. Other Unsatisfactory Condition Note any other condition which would prohibit the vehicle from being loaded with hazardous materials.

Item 14 For AA&E and other shipments requiring satellite surveillance, ensure that the Satellite Motor Surveillance System is operable Shipper will instruct the driver to send a "test" emergency message to DTTS by having the driver activate the "emergency (panic) button" Shipper will contact DTTS at 1-800-826-0794 to verify that test message was received. Message must be received by DTTS for system to be considered operational.

SECTION III - POST LOADING INSPECTION

General Instructions.

All items will be checked prior to the release of loaded equipment. Shipment will not be released until deficiencies are corrected. All items will be checked on incoming loaded equipment. Deficiencies will be reported in accordance with applicable service regulations

Item 18. Check to ensure shipment is loaded in accordance with 49 CFR Part 177.848 and the applicable Segregation or Compatibility Table of 49 CFR 177 848.

Item 19 Check to ensure the load is secured from movement in accordance with applicable service outload drawings.

Item 20. Check to ensure seal(s) have been applied to closed equipment, fire and water resistant tarpaulin applied on open equipment.

Item 21 Check to ensure each transport vehicle has been properly placarded in accordance with 49 CFR Part 172 Subpart F.

Item 22. Check to ensure operator has been provided shipping papers that comply with 49 CFR Part 172 Subpart C For shipments transported by Government vehicle, shipping paper will be DD Form 836.

Item 23. Ensure operator(s) sign DD Form 626, are given a copy and understand the hazards associated with the shipment

Item 24. Applies to Commercial Shipments Only If shipment is made under DOT Exemption 868, ensure that shipping papers are properly annotated and copy of Exemption 868 is with shipping papers.

Interim Holding Facility Inspection Checklist

Period Covered From ________ to ________

	MON		TUES		WED		THUR		FRI		SAT		SUN	
Inspector: Date Time														
	Pass	Fail	Pass	Fail	Pass	Fail	Pass	Fail	Pass	Fail	Pass	Fail	Pass	Fail
Outside														
Signs posted on IHF entrance gate	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Area secure, gate closed and locked, IHF door closed and locked	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Storage Area														
Building structurally sound	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Area clean of debris	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Aisle space adequate for emergency response	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
All containers on pallets	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
All containers sealed	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
No leaks, spills, leaking containers, or residue	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Containers turned so that labels are visible	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Inspect container labels														
composition of waste	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
quantity of waste	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
generator	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
date of acceptance	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Inspect secondary containment sumps	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

Interim Holding Facility Inspection Checklist (Continued)

Period Covered From ________ to ________

	MON		TUES		WED		THUR		FRI		SAT		SUN	
Inspector:														
Date														
Time.														
	Pass	Fail	Pass	Fail	Pass	Fail	Pass	Fail	Pass	Fail	Pass	Fail	Pass	Fail
Equipment														
Emergency shower/eyewash operable	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Absorbent available	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Inspect fire extinguishers	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Gloves available	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Eye protection available	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Respirators available	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Protective clothing available	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Spill kit available and complete	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Tool kit available and complete	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
First aid kit available and complete	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Records/Reports														
Waste logs complete, accurate and up-to-date	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Manifests logged and filed	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Copies of returned manifests	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Emergency Response Contingency Plan on file	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Sample records on file	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Discrepancy reports prepared and filed	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Incident reports for spills on file	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

Comments:

____

____

Interim Holding Facility Inspection Checklist (Continued)

Corrective Action:

Mon:	Item:	______	Action Taken:	______
	Date:	______	Signature:	______
Tue	Item:	______	Action Taken:	______
	Date:	______	Signature:	______
Wed:	Item	______	Action Taken:	______
	Date	______	Signature:	______
Thur:	Item	______	Action Taken	______
	Date	______	Signature:	______
Fri:	Item:	______	Action Taken:	______
	Date:	______	Signature	______
Sat	Item:	______	Action Taken	______
	Date:	______	Signature	______
Sun:	Item	______	Action Taken:	______
	Date:	______	Signature:	______

MATERIEL COURIER RECEIPT	SHIPPER'S CONTROL/DOCUMENT NO
SHIPPER	SUPPLY ACCOUNT NUMBER
DESTINATION	SUPPLY ACCOUNT NUMBER

PRIVACY ACT STATEMENT

AUTHORITY 5 U S C , Sec 552a (PL 93 579)

PRINCIPLE PURPOSES To provide a receipt for transfer of controlled materiel The use of the SSAN is required and is necessary to provide positive identification of the individuals receipting for the materiel

ROUTINE USES To document transfer of materiel from a shipper to a courier, courier to courier and/or receiver

DISCLOSURE IS VOLUNTARY Since the SSAN must be used refusal to provide SSAN may be grounds for action to remove the individual concerned from duties involving the materiel transferred by use of this form

I certify by my signature that I have received the materiel listed on this form and am aware of the applicable safety and security requirements

SHIPMENT TRANSFERS

FIRST	LOCATION OF TRANSFER	DATE (YR/MO/DAY)
RECIPIENT'S PRINTED NAME (LAST, FIRST, M I)		ORGAN OR ACCOUNT NO
SIGNATURE		SOCIAL SECURITY NUMBER
SECOND	LOCATION OF TRANSFER	DATE (YR/MO/DAY)
RECIPIENT'S PRINTED NAME (LAST FIRST, M I)		ORGAN OR ACCOUNT NO
SIGNATURE		SOCIAL SECURITY NUMBER
THIRD	LOCATION OF TRANSFER	DATE (YR/MO/DAY)
RECIPIENT'S PRINTED NAME (LAST, FIRST, M I)		ORGAN OR ACCOUNT NO
SIGNATURE		SOCIAL SECURITY NUMBER
FOURTH	LOCATION OF TRANSFER	DATE (YR/MO/DAY)
RECIPIENT'S PRINTED NAME (LAST, FIRST, M I)		ORGAN OR ACCOUNT NO
SIGNATURE		SOCIAL SECURITY NUMBER
FIFTH	LOCATION OF TRANSFER	DATE (YR/MO/DAY)
RECIPIENT'S PRINTED NAME (LAST, FIRST, M I)		ORGAN OR ACCOUNT NO
SIGNATURE		SOCIAL SECURITY NUMBER

SHIPMENT DESCRIPTION

LINE NUMBER	QUANTITY	SERIAL NUMBERS	REMARKS

DD FORM 82 MAY 1911 PREVIOUS EDITION MAY BE USED UNTIL 31 DEC 82

DD Form 1911, Materiel Courier Receipt

ANNEX E
GLOSSARY OF TERMS

ANNEX E
GLOSSARY OF TERMS

TERM	DESCRIPTION
AEC	**U.S. Army Environmental Center:** independent Department of the Army special staff agency that supports and advises on Army installation hazardous and toxic waste cleanup. Coordinates with PMNSCM. (Formerly USATHAMA.)
AMC	**U.S. Army Materiel Command:** Army Major Command; responsible for all chemical installations in continental United States; responsible for safety, security, and maintenance of chemical stockpile.
CERCLA	**Comprehensive Environmental Response, Compensation, and Liability Act (1980):** also called Superfund; Federal law authorizing identification and remediation of abandoned hazardous waste sites; enforced by USEPA.
CWM	**Chemical Warfare Materiel:** includes chemical weapons, containers, chemical agent identification sets (CAIS), and any equipment that may contain or be contaminated with chemical agent.
DLA	**Defense Logistics Agency:** organization responsible for activities at Defense Logistics Agency (for example, depot) installations.
DoD	**U.S. Department of Defense:** Federal department responsible for administering military programs to protect the nation from external aggression; includes all of the military services, the Office of the

Secretary of Defense, the Office of the Joint Chiefs of Staff, and several defense agencies.

DOT	**U.S. Department of Transportation:** Federal department; enforces regulations governing the transport of hazardous and nonhazardous materials.
OSHA	**Occupational Safety and Health Administration:** Federal agency that oversees and regulates work place health and safety.
PMCD	**U.S. Army Program Manager for Chemical Demilitarization (formerly U.S. Army Chemical Demilitarization and Remediation Activity and U.S. Army Chemical Materiel Destruction Agency):** single Army agency responsible for all CWM destruction; works for SBCCOM and is headed by a general officer; has two Project Managers.
PMNSCM	**Product Manager for Non-Stockpile Chemical Materiel:** provides centralized management and direction to DoD program for the reclamation, recovery, and disposal of non-stockpile chemical materiel in a safe, environmentally sound, cost-effective manner; works for Commander, PMCD.
RCRA	**Resource Conservation and Recovery Act (1976):** law regulating management and disposal of hazardous materials and wastes currently being generated, treated, stored, disposed, or distributed.
SBCCOM	**U.S. Army Soldier and Biological Chemical Command (formerly U.S. Army Chemical and Biological Defense Command):** AMC organization responsible for chemical and

biological defense issues; includes Army experts in chemical munitions design, defense equipment, decontamination, monitoring, etc.

TEU	**U.S. Army Technical Escort Unit:** part of SBCCOM; responsible for escort of chemical surety materiel during transportation; has EOD and transportation expertise; can be used for emergency destruction of chemical ammunition and for emergency response to chemical agent events.
USACE	**U.S. Army Corps of Engineers:** Army Major Command responsible for CWM removal at all active defense sites with suspect chemical weapons and for remediating contaminated soil and water. They have three agencies that may be involved at CWM sites: the geographical engineering district; a specialized hazardous, toxic, and radiological waste (HTRW) cleanup district; and the Corps of Engineers, Huntsville Division (CEHNC).
USEPA	**U.S. Environmental Protection Agency:** Federal agency; primary agency responsible for enforcement of federal laws protecting the environment; ensures that regulations mandated by CERCLA, RCRA, Clean Air Act, etc. are followed.

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ANNEX F

ACRONYMS/ABBREVIATIONS

ANNEX F
ACRONYMS/ABBREVIATIONS

AFFF	aqueous film forming foam
AMC	Army Materiel Command
AR	Army Regulation
ASTM	American Society for Testing and Materials
BRAC	Base Realignment and Closure Act
CAIRA	Chemical Accident or Incident Response and Assistance
CAIS	chemical agent identification set
CEHNC	U.S. Army Corps of Engineers, Huntsville Center
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CG	phosgene
CN	chloroacetophenone
CPR	cardiopulmonary resuscitation
CWM	chemical warfare materiel
DA	Department of the Army
DAAMS	Depot Area Air Monitoring System
DA Pam	Department of the Army Pamphlet
DLA	Defense Logistics Agency
DoD	Department of Defense
DOT	Department of Transportation
DS2	decontaminating solution

ECBC	Edgewood Chemical Biological Center (formerly Edgewood Research, Development and Engineering Center)
EOD	Explosive Ordnance Disposal
GC	gas chromatograph
H	sulfur mustard
HA	hazard analysis
HAZWOPER	Hazardous Waste Operations and Emergency Response
HD	distilled mustard
HS	sulfur mustard
HTH	calcium hypochlorite
HTRW	hazardous, toxic, and radiological waste
IHF	interim holding facility
L	Lewisite
MCE	maximum credible event
MIL-STD	military standard
MRC	multiple round container
MSDS	material safety data sheet
NFPA	National Fire Protection Association
NRT	near real-time
NSCM	non-stockpile chemical materiel
OSHA	Occupational Safety and Health Administration
PMCD	U.S. Army Program Manager for Chemical Demilitarization
PMNSCM	Project Manager for Non-Stockpile Chemical Materiel
POIO	Public Outreach and Information Office

POP	Performance Oriented Packaging
PPE	personal protective equipment
ppm	parts per million
PS	chloropicrin
psig	pounds per square inch gauge
RAC	risk assessment code
RCRA	Resource Conservation and Recovery Act
SBCCOM	U.S. Army Soldier and Biological Chemical Command
SOP	standing operating procedure
SS	Safety Submission
SSMP	System Safety Management Plan
SSPM	System Safety Program Manager
SSO	site safety officer
STB	supertropical bleach
TEU	U.S. Army Technical Escort Unit
TDEC	Tennessee Department of Environment and Conservation
TM	technical manual
TP	Technical Provision
TWA	time-weighted average
UN	United Nations
USACE	U.S. Army Corps of Engineers
USACMDA	U.S. Army Chemical Materiel Destruction Agency
USEPA	U.S. Environmental Protection Agency

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ANNEX G
REFERENCES

ANNEX G
REFERENCES

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ANNEX H
PERSONAL PROTECTIVE EQUIPMENT

ANNEX H
PERSONAL PROTECTIVE EQUIPMENT

1. OSHA Designations (29 CFR 1910.120):

   a. Level A: A self-contained breathing apparatus (SCBA) or supplied-air respirator with escape cylinder, in combination with a fully encapsulated suit, capable of maintaining a positive air pressure inside the suit. Level A ensembles include both inner and outer chemical-resistant gloves, chemical-resistant steel-toed boots, and two-way radio communications. Additional items, such as long underwear or coveralls, may also be included. This ensemble is required for the highest level of protection for the skin, eyes, and the respiratory system.

   b. Level B: Same respiratory protection as Level A, along with hooded chemical-resistant clothing, inner and outer chemical-resistant gloves, chemical-resistant, steel-toed boots, and other optional items, such as hard hats, boot covers, and coveralls. Not a positive pressure suit. Level B PPE is used when the type and atmospheric concentrations of substances have been identified and require a high level of respiratory protection, but a lesser level of skin protection.

   c. Level C: Full-facepiece or half-facepiece air-purifying respirators with hooded, chemical-resistant clothing, inner and outer chemical-resistant gloves, and chemical-resistant boots. Level C PPE should be used when the atmospheric contaminants have been identified, concentrations measured, and an air-purifying respirator is appropriate and available to remove the contaminants of interest.

   d. Level D: A work uniform affording minimal protection, used for nuisance contamination only.

2. Army Designations (AR 385-61):

   a. Modified Level A: A SCBA or supplied-air respirator with escape cylinder, in combination with a fully encapsulated suit, capable of maintaining a positive air pressure inside the suit. Modified Level A ensembles include both inner and outer chemical-resistant gloves, chemical-resistant, steel-toed boots, and two-way radio communications. In addition, for HD and L operation, wearing impregnated undergarments and gloves is required. This ensemble is required for the highest level of protection for the skin, eyes, and respiratory system.

   b. Level A: Military full-face, gas/particulate canister, air-purifying respirator (M9, M17, or M40), worn with butyl rubber hood, coveralls, boots and gloves, cotton coveralls, and surgical gloves worn underneath. In addition, for HD operations, wearing impregnated undergarments and gloves is required.

   c. Level B: Military full-face, gas/particulate canister, air-purifying respirator (M9, M17, or M40), worn with butyl rubber hood, apron, boots and gloves, cotton coveralls, and surgical gloves worn underneath. In addition, for HD operations, wearing impregnated undergarments and gloves is required.

   d. Level C: Military full-face, gas/particulate canister, air-purifying respirator (M9, M17, or M40), worn with butyl rubber boots and gloves, and cotton overalls. A butyl rubber apron is only required when bodily contact with liquid agent-filled items is anticipated.

   e. Level D: Military full-face, gas/particulate canister, air-purifying respirator (M9, M17, or M40) carried in slung position, while wearing butyl rubber boots and gloves, and cotton overalls. A butyl rubber apron is only required when bodily contact with liquid agent-filled items is anticipated.

f. Level E: Military full-face, gas/particulate canister, air-purifying respirator (M9, M17, or M40) carried in slung position, while wearing cotton coveralls.

g. Level F: Military full-face, gas/particulate canister, air-purifying respirator (M9, M17, or M40) carried in slung position, while wearing street clothes.

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ANNEX I

QUESTIONS AND ANSWERS FOR FORMER DEFENSE DEPOT MEMPHIS INTERIM HOLDING FACILITY PLAN

ANNEX I

QUESTIONS AND ANSWERS FOR FORMER DEFENSE DEPOT MEMPHIS INTERIM HOLDING FACILITY PLAN

Q: What items may be recovered at the Former Defense Depot Memphis?

A: *The items are bottles and ampules from chemical agent identification sets that were disposed of at Dunn Field.*

Q: What is a chemical agent identification set?

A: *Chemical agent identification sets were used by the Army from the 1920s to the 1960s to train soldiers in how to identify and respond to chemical agents. They consisted of small bottles or ampules of chemical agents and industrial chemicals that were used to teach soldiers how to use chemical agent identification and decontamination equipment.*

Q: What chemicals are in these chemical agent identification sets?

A: *The chemicals in the bottles and ampules include the chemical warfare agents: mustard and lewisite, as well as the industrial chemicals: phosgene, chloroacetophenone, adamsite, chloropicrin, and triphosgene. Depending on the type of chemical agent identification set the bottles came from, the chemical warfare agents may be pure liquid agent, they may be adsorbed onto charcoal, or they may be diluted with the solvent chloroform.*

Q: What are the dangers from these chemicals?

A: *All these chemicals are irritating to the eyes, nose, throat, and lungs. Some of them, especially mustard and lewisite, can cause blisters on the skin.*

Q: How big are the bottles?

A: *The ampules are 1.3 ounces in size. The bottles may be either a 3.5-ounce size or a 3.8-ounce size depending on which kind of identification set they came from.*

Q: How did the items come to be at Defense Depot Memphis?

A: *One of the kinds of military material that the Memphis depot was established to handle was chemical material. The items that may be recovered were disposed of at the depot as part of routine stock control, storage, and maintenance operations. Prior to the enactment of modern environmental laws, disposal of potentially hazardous materials by burying them was accepted practice throughout the United Sates.*

Q: How many bottles do they expect to find?

A: Historical records confirm the burial of six chemical agent identification sets at Dunn Field. However, even with good historical records, it is not possible to know what will be found in the ground until the digging starts. The IHF Plan is based on recovery of 39 bottles or ampules containing chemical warfare agents. Bottles containing industrial chemicals do not require the extreme measures taken to protect chemical warfare material. Industrial chemicals will be disposed of as hazardous waste by whatever regular commercial means is appropriate for the chemical in the bottle.

Q: Why are the items being dug up?

A: *The Former Defense Depot Memphis is cleaning up Dunn Field as part of its base restoration program and in preparation of turning the land over to civilian or local government ownership. This plan was developed as a contingency for the possibility that chemical warfare material may be found.*

Q: Is there any danger to the public?

A: *There is very little danger to the public during the recovery or storage of these items. Recovery operations will be performed inside an enclosure built over the recovery site. The enclosure will have an air filtration system that will filter any chemical contaminants out of the air before it leaves the enclosure. Before any chemical warfare items are removed from the enclosure, they will be packaged inside of Department of Transportation approved containers designed to prevent leakage even in the event of an accident or rough handling. Once the items have been packaged inside these containers, they will be moved into a storage structure known as an Interim Holding Facility, designed for storage of hazardous materials. A specialized military unit that has had extensive experience working with chemical warfare materiel will perform the recovery and storage operations.*

Q: What will happen to the items once they have been recovered?

A: *The bottles and ampules will be packed inside Department of Transportation approved hazardous waste containers called multiple round containers. After being packaged inside these containers, the items will be placed into a storage facility at Dunn Field to await disposition.*

Q: How long will the items be stored at the depot?

A: *It is not possible to give an exact length of time. Current plans call for storing the items until the remediation work at Dunn Field is complete. At that time, the items will be transported to a military installation with the personnel and permits required for storage of these types of materials until they can be destroyed.*

Q: Who will perform the work?

A: *The U.S. Army Technical Escort Unit, specially training individuals skilled in all aspects of storage, handling, and transport of chemical warfare materiel, will perform the work.*

Q: What government organizations are involved in this project?

A: *The principal organizations are: the Program Manager for Chemical Demilitarization; the U.S. Army Corps of Engineers, Engineering Support Center at Huntsville, Alabama; the U.S. Army Edgewood Chemical and Biological Center; and the U.S. Army Technical Escort Unit.*

Q: What will the recovery workers wear?

A: *Workers performing the recovery and handling the actual chemical containers will wear Occupational Safety and Health Administration personal protective equipment including a supplied air respirator, a one-piece disposable chemical resistant suit, and chemical resistant gloves and boots covers. Once the items have been packaged inside the Department of Transportation containers, the workers will only need to wear regular work clothes such as coveralls, gloves, and safety shoes. As a precaution they will carry a respirator with them.*

Q: Will local authorities and the public be informed when the work is to take place?

A: *Yes. Local officials will be informed. Also the Remediation Advisory Board will be kept appraised of plans and operations.*

Q: Whom can I call for more information?

A: *For questions about the restoration activities at the depot contact the Former Defense Depot Memphis Public Affairs Office, Mr. Shawn Phillips, 901-544-0611. For information about this Interim Holding Facility Plan or the handling, transport and storage of chemical warfare materiel, contact the Product Manager for Non-Stockpile Chemical Materiel, Public Outreach and Information Office, Mr. Bob Jones, 800-488-0648.*

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TAB

Transportation Plan

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U.S. Army
Program Manager for
Chemical Demilitarization

Product Manager for
Non-Stockpile Chemical Materiel

Former Defense Distribution Depot Memphis Transportation Plan

Final
Revision 1

January 2000

EXECUTIVE SUMMARY

The U.S. Army Program Manager for Chemical Demilitarization (PMCD) is responsible for the destruction of all United States chemical warfare materiel (CWM). The Product Manager for Non-Stockpile Chemical Materiel (PMNSCM) is responsible for destroying non-stockpile chemical materiel (NSCM). The PMNSCM and the U.S. Army Technical Escort Unit (TEU) will support the Former Defense Depot Memphis, Tennessee in the transport of recovered CWM from the Memphis Depot to Pine Bluff Arsenal (PBA), Arkansas.

The Transportation Plan has been written in accordance with Public Law 103-337, Section 143, Transportation of Chemical Munitions, (b) Transportation of Chemical Munitions Not in the Chemical Weapons Stockpile. In the case of chemical munitions that are discovered or otherwise come within the control of the Department of Defense (DoD) and that do not constitute part of the chemical weapons stockpile, the Secretary of Defense may transport such munitions to the nearest chemical munitions stockpile storage facility that has necessary permits for receiving and storing such items if the transportation of such munitions to that facility (1) is considered by the Secretary of Defense to be necessary; and (2) can be accomplished while protecting the public health and safety. PBA satisfies the requirement of Public Law 103-337 because it is the nearest chemical stockpile storage facility that has the necessary permits for receiving and storing these items.

The PMNSCM Public Outreach and Information Office (POIO) continues to forge two-way communications with stakeholders. Coordination between PMNSCM, the Memphis Depot Public Affairs Office (PAO), and Pine Bluff Chemical Activity (PBCA) PAO is critical to establishing and maintaining timely, effective, and accurate information exchange among all interested parties and affected agencies. PMNSCM POIO should be consulted prior to all public outreach initiatives (that is, public meetings, official meetings, press releases, etc.).

Telephone numbers and points of contact for the Memphis Depot and PBCA Public Affairs are located in section 9 of this Transportation Plan.

For additional information and comments, contact:

Mr. Bob Jones
Product Manager for Non-Stockpile Chemical Materiel
Public Outreach and Information Office
Attn: SFAE-CD-P
Aberdeen Proving Ground, Maryland 21010-5401
1-800-488-0648 or 410-436-7439
FAX 410-436-8738
rjones@cdra.apgea.army.mil

The Memphis Depot is the generator of the recovered CWM and will be accountable for the waste until the PBCA accepts accountability at PBA. PMNSCM is responsible for ensuring that the transport of recovered CWM is done in a safe and environmentally acceptable manner. TEU, under the direction of the U.S. Army Soldier and Biological Chemical Command (SBCCOM), will have physical custody of the recovered CWM and will conduct the transport operations. PBA will store the recovered CWM in the PBA interim status Resource Conservation and Recovery Act (RCRA)-permitted hazardous waste storage facility until final disposition.

This Transportation Plan is based on one trip from the Memphis Depot to PBA with two Department of Transportation-approved multiple round containers (MRCs) containing bottles of mustard agent (H, HD, HS) and lewisite (L). The exact quantities and kinds of CWM to be transported will be determined before this plan is implemented. Recovered CWM from the Memphis Depot will be transported to PBA in two segments: (1) transport by helicopter from the Memphis Depot helipad to the PBA helicopter landing zone and (2) transport by truck from the PBA helicopter landing zone to the PBCA storage facility.

The Hazard Analysis (HA), presented in annex A, examines the risk of transporting recovered CWM from the Memphis Depot to PBA. Incidents that could occur during transportation operations are discussed qualitatively. To assign quantitative values to potential risk, risk assessment codes (RACs) were identified for each hazard or hazardous condition. This HA encompasses only the risks associated with transporting CWM and does not address the risks associated with recovering, packaging, or storing the CWM. Descriptions of ways to eliminate or mitigate likely system failures are included.

Analysis of all potential hazards involved in transport of recovered CWM from the interim holding facility (IHF) at the Memphis Depot to PBA yields a total carrier accident probability of 6.7×10^{-5}. According to the System Safety Management Plan (SSMP), this accident is improbable, but could have catastrophic results, resulting in a RAC of 3 for the transportation.

The maximum credible event (MCE) for this operation is judged to be a helicopter accident without fire resulting in the evaporative release of 1.34 liters of HD. The release results in a "no deaths" distance of 6 meters and a "no effects" distance of 84 meters.

Transporting recovered CWM from the Memphis Depot to PBA can be performed safely by implementing the recommended mitigating steps.

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LIST OF ILLUSTRATIONS

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SECTION 1
INTRODUCTION

1.1 Introduction

The Department of Defense (DoD) has designated the Department of the Army (DA) as the Defense Executive Agent for the destruction of United States chemical warfare materiel (CWM). The U.S. Army Program Manager for Chemical Demilitarization (PMCD) has, in turn, been given responsibility for destroying the CWM. The Product Manager for Non-Stockpile Chemical Materiel (PMNSCM) is responsible for destroying the five categories of NSCM, including buried CWM. This Transportation Plan discusses the transportation of CWM recovered at the Former Defense Depot Memphis, Tennessee to Pine Bluff Arsenal (PBA), Arkansas. It describes transportation procedures and packaging, monitoring, emergency response, inspection, training, and security procedures associated with transportation. In addition, the roles and responsibilities of the government organizations associated with the transportation operation are described.

1.2 Objectives

The objective of this Plan is to provide decision-makers and site personnel information and direction for safe, secure, and environmentally sound onsite and offsite transportation of recovered CWM. A description of the plans to perform onsite storage at the interim holding facility (IHF) prior to transport to PBA is presented in the Memphis Depot Interim Holding Facility Plan (PMCD, 2000).

This Transportation Plan provides guidance for the safe transportation of CWM from the Memphis Depot to PBA. Transportation will start at the Memphis Depot IHF where the recovered CWM, overpacked in multiple round containers (MRCs), will be loaded onto a UH-1N helicopter and flown to the PBA helicopter landing zone. At the PBA landing zone, the cargo will be placed onto a truck and driven to the interim status Resource

Conservation and Recovery Act (RCRA)-permitted hazardous waste storage facility at Pine Bluff Chemical Activity (PBCA). The CWM will be stored at PBA until final disposition. Figure 1-1 provides a flow chart of the transportation activities associated with the recovered CWM.

To support the premise that CWM can be safely transported, a hazard analysis (HA) was performed to evaluate the plans and procedures presented in this Transportation Plan. The HA determined that the plans and procedures can provide for the onsite and offsite transportation of recovered CWM in a safe, secure, and environmentally sound manner. The complete HA is presented in annex A.

In preparing this Plan, the following assumptions about site conditions and regulations applicable to CWM storage and transportation activities were made:

a. The CWM has been identified, labeled, and packaged in MRCs that allow for normal handling.

b. The CWM is classified as hazardous waste and will be managed in accordance with applicable environmental laws and regulations. Security will be equivalent to that required for shipment of any other hazardous waste.

c. All recovered CWM at the Memphis Depot will be transported to PBA in one shipment. A UH-1N helicopter carrying a crew of three plus two Technical Escort Unit (TEU) personnel with approximately 250 pounds of equipment has sufficient lift to carry an additional 1,000 pounds of internal cargo on a flight from the Memphis Depot to PBA.

d. Based on the history of the Memphis Depot site and experience at other sites, the most likely scenario is that only one or two MRCs will need to be

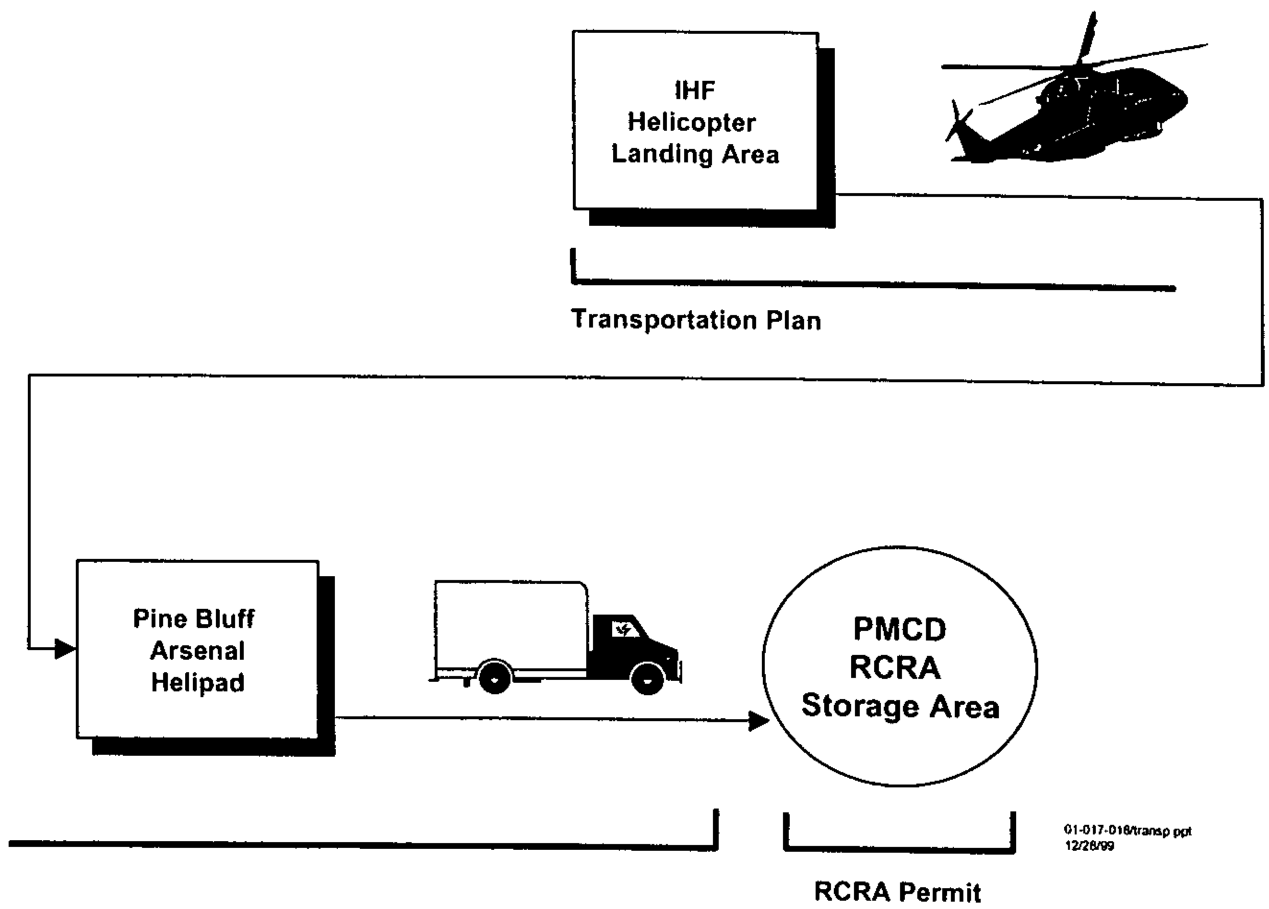

Figure 1-1. Transportation Flow Process for the Memphis Depot

transported. Two MRCs plus packing material, tie-downs, and bracing weigh approximately 300 pounds, well within the load limit of the helicopter.

e. The exact number and types of items to be transported will not be known until recovery operations are complete. Therefore, in order to perform the HA, a list of chemical agent identification set (CAIS) items was postulated based on site history and past experience. Table 1-1 shows a breakdown of these items. The 13 bottles of HD would be packed inside one MRC and the other 26 bottles would be packed inside the second MRC. Based on this example, a maximum credible event (MCE) was calculated for the evaporative release of all the contents of the 13 bottles of distilled mustard (HD) (45.5 ounces or 1.34 liters of HD). If the actual quantity or types of items to be transported are markedly different from this example, the MCE distances should be re-calculated using numbers for the actual items to be transported.

f Once the CWM leaves the IHF at the Memphis Depot, it will not be stored until it reaches its final destination at PBA.

g All required environmental studies will be completed by the Memphis Depot and the necessary documentation, permits, and approvals will be obtained prior to the execution of this Transportation Plan.

Table 1-1. Example CAIS Items to be Transported

CAIS Type	Number of Bottles	Contents Per Bottle
K941	13	3 5 ounces of HD
K955	17	25 milliliters of HS adsorbed onto charcoal
K955	9	25 milliliters of L adsorbed onto charcoal

h. The transportation of recovered CWM will be in accordance with all applicable regulations

1.3 Background

The Memphis Depot, located in the southern portion of the city of Memphis, is approximately 6 miles north of the Tennessee-Mississippi border and 8 miles east of the Mississippi River (figure 1-2). The Memphis Depot covers 642 acres and is the principal distribution center for the Defense Logistics Agency in shipping and receiving hazardous materials, textile products, food products, electronic equipment, construction materials, and industrial, medical, and general supplies.

CAIS were used by the military from the 1920s to the 1960s to train service members how to identify chemical agents and decontaminate equipment in the field. At the Memphis Depot, the remains of CAIS have been identified in Dunn Field. Items from the following types of CAIS may have been disposed of in the landfill: K941, K942, and K955.

Items from these CAIS may be recovered from the landfill during remediation. If CWM is recovered, it will be inspected, identified, packaged in MRCs, labeled, and manifested according to applicable Tennessee Department of Environmental Conservation (TDEC) requirements. The CWM will be temporarily stored in an IHF until implementation of this Transportation Plan.

1.4 Potential Chemical Warfare Materiel

The CWM reported to have been buried at the Memphis Depot are components of CAIS. A description of CAIS items that may be transported follows:

a. *K941, Toxic Gas Set, M1.* Consists of 24 glass bottles, each containing 3.5 ounces of mustard (H and HS) or HD for a total of 84 ounces per set.

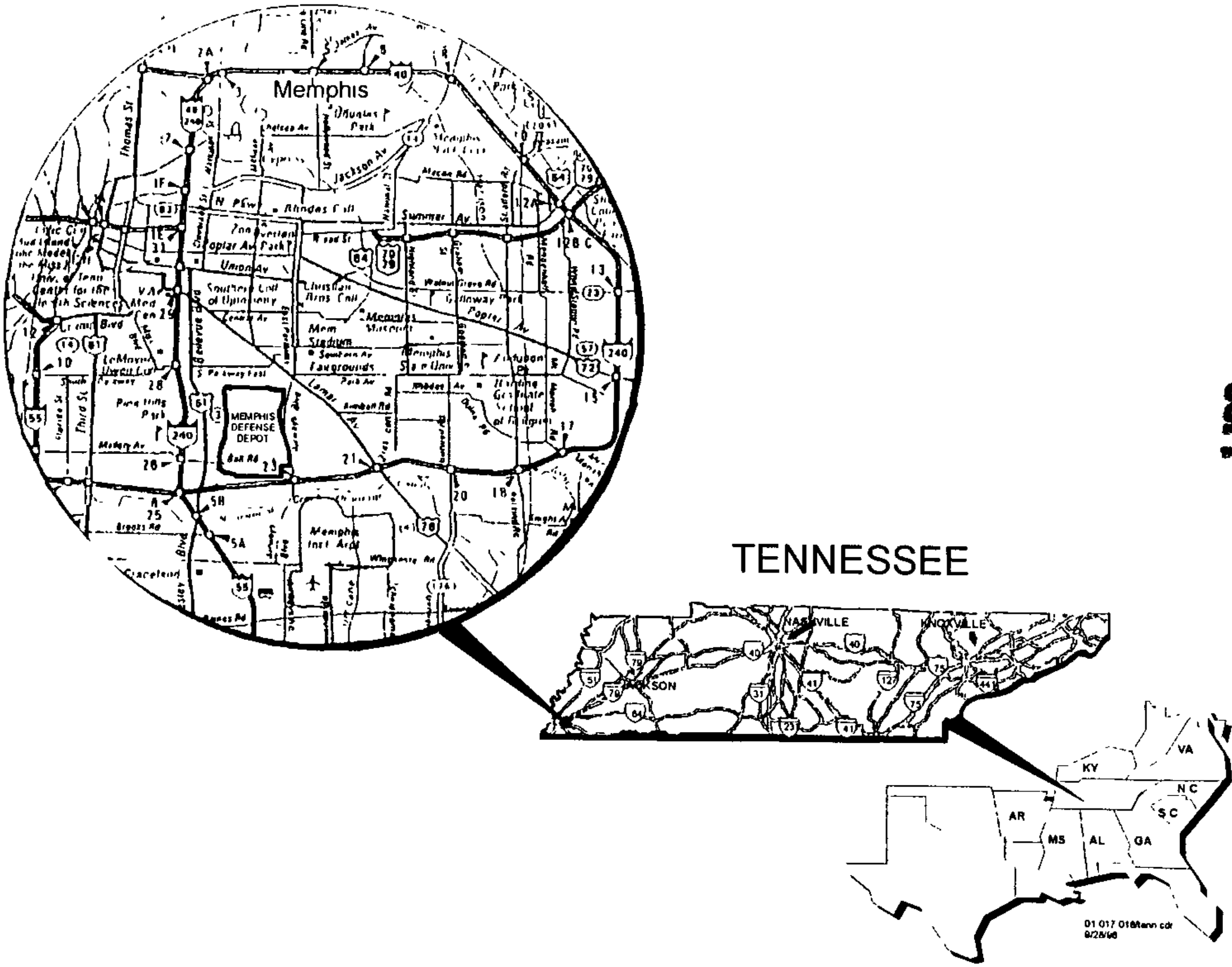

Figure 1-2. Location of Former Defense Distribution Depot Memphis, Tennessee

b. *K942, Toxic Gas Set.* Consists of 28 heat-sealed glass ampules, each containing 3.8 ounces of mustard (H, HS, or HD) for a total of 106.4 ounces per set.

c. *K955 Gas Identification Set, Instructional, M1 (Navy Set).* Contains seven glass bottles. Four of the bottles contain 3 ounces of activated charcoal on which 25 milliliters of agent or industrial chemical has been adsorbed. Of these four bottles, two have HS, one has lewisite (L), and one has chloropicrin (PS) adsorbed onto the charcoal. Of the remaining three bottles, one contains 6 grams of triphosgene (a CG simulant), another contains 15 grams of chloroacetophenone (CN), and the third contains 15 grams of adamsite (DM).

The chemical and physical properties of chemicals of concern are listed in annex B. Health and safety data may be found in the Material Safety Data Sheets (MSDSs) in annex C

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SECTION 2
ORGANIZATION

The primary organizations that will participate in transporting recovered CWM from the Memphis Depot to PBA are presented in figure 2-1. A general description of organizational responsibilities is presented below. Specific details of the roles and responsibilities of each organization are provided in section 8.

2.1 Former Defense Distribution Depot Memphis, Tennessee

The Memphis Depot has overall responsibility for activities occurring at the Memphis Depot and exercises direct oversight of the installation operating contractor. The Memphis Depot is the generator of the CWM but will allow the TEU to take physical custody of the CWM during transportation. The Memphis Depot will provide equipment for onsite movement and loading of the CWM, and is also responsible for coordinating medical support, security, backup emergency response and supplies for activities at the Memphis Depot.

2.2 U.S. Army Product Manager for Non-Stockpile Chemical Materiel

PMNSCM is responsible for identifying, properly storing, transporting, and disposing of all recovered CWM and for coordinating activities with supporting agencies. PMNSCM has the program responsibility for ensuring that the transportation of recovered CWM is accomplished in a safe and environmentally acceptable manner.

2.3 U.S. Army Soldier and Biological Chemical Command, Technical Escort Unit

The U.S. Army Soldier and Biological Chemical Command (SBCCOM) and TEU will provide support to the Memphis Depot by taking physical custody of the CWM and transporting it from the Memphis Depot to PBA. The TEU will be the first responders for

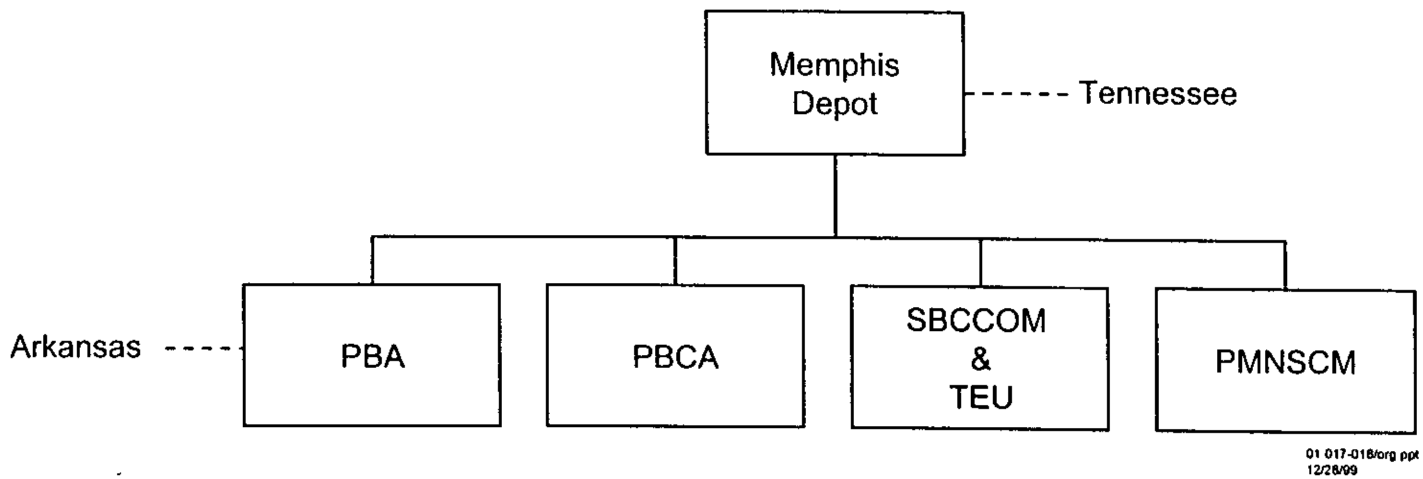

Figure 2-1. Primary Organizations for the Memphis Depot Transportation Plan

emergency situations during transportation. SBCCOM will arrange for aircraft, select the transportation route, and coordinate landing and flight activities with the Memphis Depot, PBA, PBCA, and federal aviation officials. TEU will provide the onsite personnel and equipment to unload the CWM from the aircraft and to move it from the PBA helicopter landing zone to the storage facility.

2.4 Pine Bluff Chemical Activity

The PBCA will receive the CWM from TEU and operate the storage facility where the materiel will be stored until final disposition. PBCA Commander will assume responsibility for the CWM at the time it is placed in storage.

2.5 Pine Bluff Arsenal

PBA will provide support to the Memphis Depot by coordinating with the State of Arkansas Department of Environmental Quality on permit issues regarding receipt of the CWM, will sign the hazardous waste manifest, and will provide security and facility support.

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SECTION 3
PRETRANSPORTATION ACTIVITIES

This section describes pretransportation activities to include packaging, hazardous waste manifesting, facility inspections, and training.

3.1 Packaging

The following paragraphs describe the packaging, blocking, and bracing requirements associated with the transportation of CWM.

3.1.1 Containers. Recovered CWM will be placed into overpacks (MRCs) based on the size of the item. The MRCs are designed to protect the CWM from damage during transportation and will contain chemical liquids and vapors should any of the containers inside the overpack leak. As a minimum, the overpacks meet the general packaging requirements of the Department of Transportation.

3.1.2 Tie-Downs and Bracing. TEU personnel will secure the overpack containers to wooden pallets prior to transport. The overpacks and the pallets will be secured to the transport vehicle using blocking and bracing specified by the vehicle operator, pilot, or crew chief.

3.2 Hazardous Waste Manifest

Recovered CWM is categorized as a hazardous waste by Army Regulation (AR) 50-6, Chemical Surety. Therefore, transfer of responsibility for the CWM must be conducted in accordance with RCRA packaging, labeling, and manifest regulations [40 Code of Federal Regulations (CFR) 262.20 through 262.23]. As generator of the waste, the Memphis Depot will prepare a hazardous waste manifest prior to CWM transport and will retain accountability for the waste until it is placed into storage at PBA. The Memphis Depot waste generator identification number, TN4210020570, and the PBA interim status storage facility identification number, AR0213820707, will be used on the waste manifest. This manifest must accompany the shipment and be verified during each transfer operation.

While the Memphis Depot retains accountability for the CWM during transport, TEU will take physical custody of the CWM and be responsible for its safe handling during transportation from the Memphis Depot to PBA. TEU will obtain all necessary permits to transport hazardous waste through all jurisdictions on the route. The TEU will transfer accountability for the CWM to the storage facility manager by conducting and documenting a joint inventory. This will also serve as a chain-of-custody inventory and will ensure that manifested hazardous waste has been accounted for as required. The Commander, PBCA will accept responsibility for the CWM at the time it is placed in storage at PBA.

A sample hazardous waste manifest form is provided in annex D

3.3 Facility Inspection Requirements

TEU will ensure that an inspection has been conducted of the storage facility at the Memphis Depot prior to removal of the CWM and at PBA prior to placing the CWM into storage. For each facility, storage structures, equipment, and operational procedures will be evaluated to ensure that each storage activity is operating in a manner that is protective of public health and safety and the environment. The facility inspections will evaluate the condition and status of the following:

a. Equipment that is integral to:

- Safety
- Emergency response
- Security
- Operations.

b. Procedures and records that provide an inventory of the number, type, and characteristics of the CWM in storage

c. Records of inspections and documentation of repairs and remedial actions that were performed to prevent health or environmental hazards.

Facility inspections will be performed in accordance with a facility inspection checklist that will be provided at the Memphis Depot IHF and the PBCA storage facility. Loading and unloading areas will be inspected daily when in use.

3.4 Safety Equipment

Each vehicle and aircraft used to transport CWM will be equipped with the following safety equipment.

a. *Radio or Cellular Telephone.* For communication between participating organizations and with emergency response agencies

b. *Fire Extinguisher.* Suitable for use on a class A-, B-, or C-fire

c. *First Aid Supplies.* Easily accessible and clearly displayed and marked

d. *Spill Kit.* For quick access in case of a material spill

e. *Personal Protective Clothing.* The following personal protective equipment (PPE) will be available in each vehicle:

- OSHA Level B PPE
- Gloves
- Eye Protection
- Respirators.

3.5 Training and Certification Procedures

Each agency will provide an employee training program that complies with requirements specified in 49 CFR 172.700 through 172.704 and DA Pamphlet (Pam) 385-61. Training will be provided on hazardous waste operations, use of PPE, and, if needed, heavy equipment operation.

3.5.1 Site-Specific Training. Site-specific training will be provided for all employees, contractors, and subcontractors who have met the requirements of 49 CFR 172.700 through 172.704 and DA Pam 385-61. Operational training will be conducted prior to transportation of the CWM. Topics addressed will include:

- Packaging
- Loading
- Blocking and bracing
- Emergency procedures during transportation.

Training will be conducted prior to the job startup to ensure that personnel have a thorough understanding of the Emergency Response and Contingency Plan for the Memphis Depot, PBA Disaster Control Plan, standing operating procedures (SOPs), and physical and chemical hazards of the site. The following topics will be addressed in the health and safety training:

- Names and titles of employees and their duties

- Persons responsible for safety and health

- Acute and chronic effects of exposure to hazardous substances that may be present, potential routes of exposure of these substances, exposure limits, and the level of personal exposure that can be anticipated

- Monitoring procedures and functions, limitations, and maintenance of monitoring equipment
- SOPs
- Site control measures
- PPE
- Emergency procedures.

By the time this Transportation Plan is implemented, all personnel involved in the transport of the CWM will have completed at least 40 hours of training in health and safety issues associated with work at a hazardous substance site.

3.5.2 Safety Meetings. All personnel involved in the transport of CWM must attend a safety meeting at the beginning of the transportation action. This meeting, conducted by the TEU, will cover items such as specific health and safety issues, planned transportation activities, changes in plans, PPE, personnel and equipment decontamination, potential chemical and physical hazards, and contingency actions.

3.5.3 Training Documentation. Documentation of personnel training is the responsibility of each organization. Written documentation verifying compliance with DA Pam 385-61 and 29 CFR 1910.120 (e)(3), (e)(4) (as applicable), and (e)(8) must be submitted to the health and safety officer before CWM is transported or emergency response duties are assigned. Documentation of workers' current training credentials will be maintained by the Memphis Depot, PBA, PBCA, or TEU, as applicable.

3.5.4 Hazard Communication Training. Hazard communication training will be conducted in accordance with the Occupational Safety and Health Administration (OSHA) Hazard Communication Standard (29 CFR 1910.1200 and 1926.59). Copies of MSDSs for hazardous materials that are to be transported will be available to all personnel taking part in activities described in this Plan. The hazard communication training will be conducted in accordance with 29 CFR 1910.1200 and 1926.59. Training will include all hazards or potential hazards associated with transportation activities, and a description of any hazardous chemicals to be transported.

3.5.5 Chemical Warfare Materiel Training. All personnel involved in the transportation of CWM will undergo training concerning the CWM, although site activity involving CWM or contamination resulting from these agents will only involve the TEU. The intent of this training is to inform personnel of the hazards associated with CWM. The TEU personnel have undergone U.S. Army training required to qualify and maintain proficiency in their military or civilian occupational specialties.

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SECTION 4
TRANSPORTATION ACTIVITIES

This section describes the transportation activities associated with moving recovered CWM from the Memphis Depot to PBA. Based on the HA performed to evaluate the plans and procedures presented in this Transportation Plan, this Plan can provide for the onsite and offsite transportation of recovered CWM in a safe, secure, and environmentally sound manner. Details of the HA are presented in annex A.

4.1 Description of Transportation Vehicles

4.1.1 Ground Transportation Vehicles. Local materiel handling equipment will be used to move the MRCs from the IHF to the helicopter landing zone at the Memphis Depot. The Memphis Depot landing zone is located on the south side of the paved area where the IHF is located (see figure 4-1). A suitable truck capable of hauling at least 1,000 pounds of cargo will transport the CWM from the PBA helicopter landing zone to the storage facility at PBA. Transfer equipment to load and unload CWM may be required at the Memphis Depot and PBA.

4.1.2 Aircraft. The Army intends to use a U.S. Army UH-1N helicopter to transport the CWM from the Memphis Depot helipad to the PBA helicopter landing zone.

4.2 Transportation Routes

Specific transportation routes must be verified before the Plan is implemented. All drivers and pilots as well as assistant drivers, copilots, operators, and navigators will have clear instructions and maps to identify the route that will be taken. Any required stops for fuel or maintenance will be at pre-selected locations indicated on the route map. All routes will be as direct as possible.

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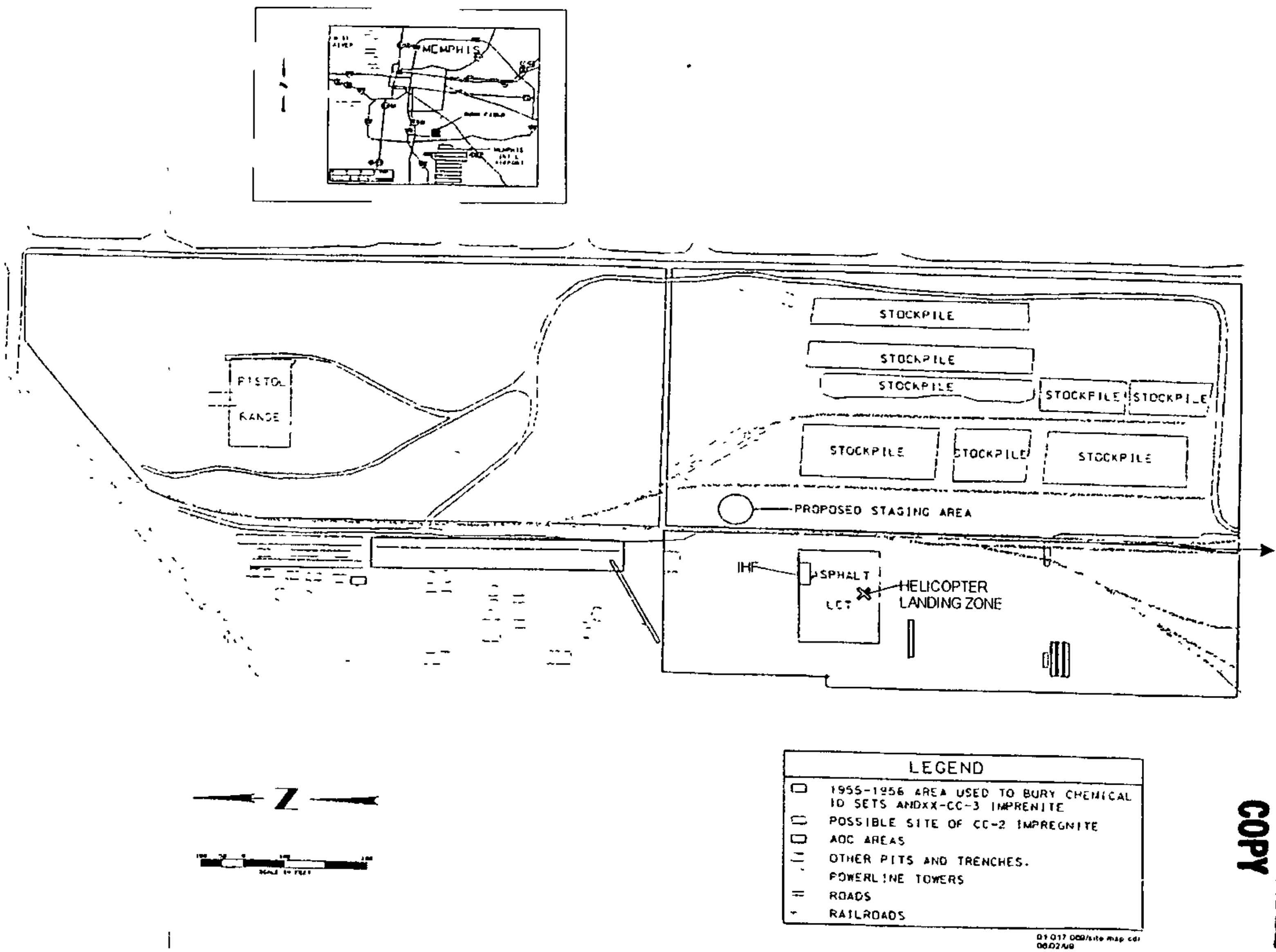

Figure 4-1. Dunn Field Site Map, Former Defense Distribution Depot, Memphis

4.2.1 Air Transportation Route. The CWM will be transported by military aircraft from the Memphis Depot to PBA by the most direct route that avoids densely populated areas and minimizes disruption of normal traffic activities. The distance from the Memphis Depot to PBA is estimated to be 135 nautical miles. A generalized air transportation route is shown in figure 4-2.

4.2.2 Truck Transportation Routes. A suitable truck will be used to transport the CWM approximately 6 miles from the helicopter landing zone to the interim status RCRA-permitted hazardous waste storage facility. The route is shown in figure 4-3. The helicopter landing zone is located on Doolittle Road. The transport vehicle will travel north on Doolittle Road to Webster Road, and west on Webster to Rideout Road. The truck will turn left onto Rideout Road and travel to Avenue 55 where it will turn right. From Avenue 55, it will turn right onto 504 Street and travel to Roemer Road. At Roemer Road it will turn left and travel to Hanlon Road, where it will turn left. From Hanlon Road, it will turn left onto Avenue 6251 and travel to the Site Security Control Center for entry into the Bond Road Exclusion Area, site of the storage facility.

4.3 Transportation Procedures

The transportation procedures described in the following paragraphs include predeparture, en route, prearrival, and arrival activities. These procedures apply to each configuration of cargo, each site, and each mode of transport throughout the transfer of CWM from the Memphis Depot to PBA.

The transportation activities described in these paragraphs will be performed at each CWM transfer site. Transfer sites are where CWM is transferred from a storage facility to a transportation vehicle, transloaded from one transportation vehicle to another, or transferred from a transportation vehicle to a storage facility. The transfer sites in this plan include the Memphis Depot IHF, the Memphis Depot helipad, the PBA helicopter landing zone, and the PBCA storage facility.

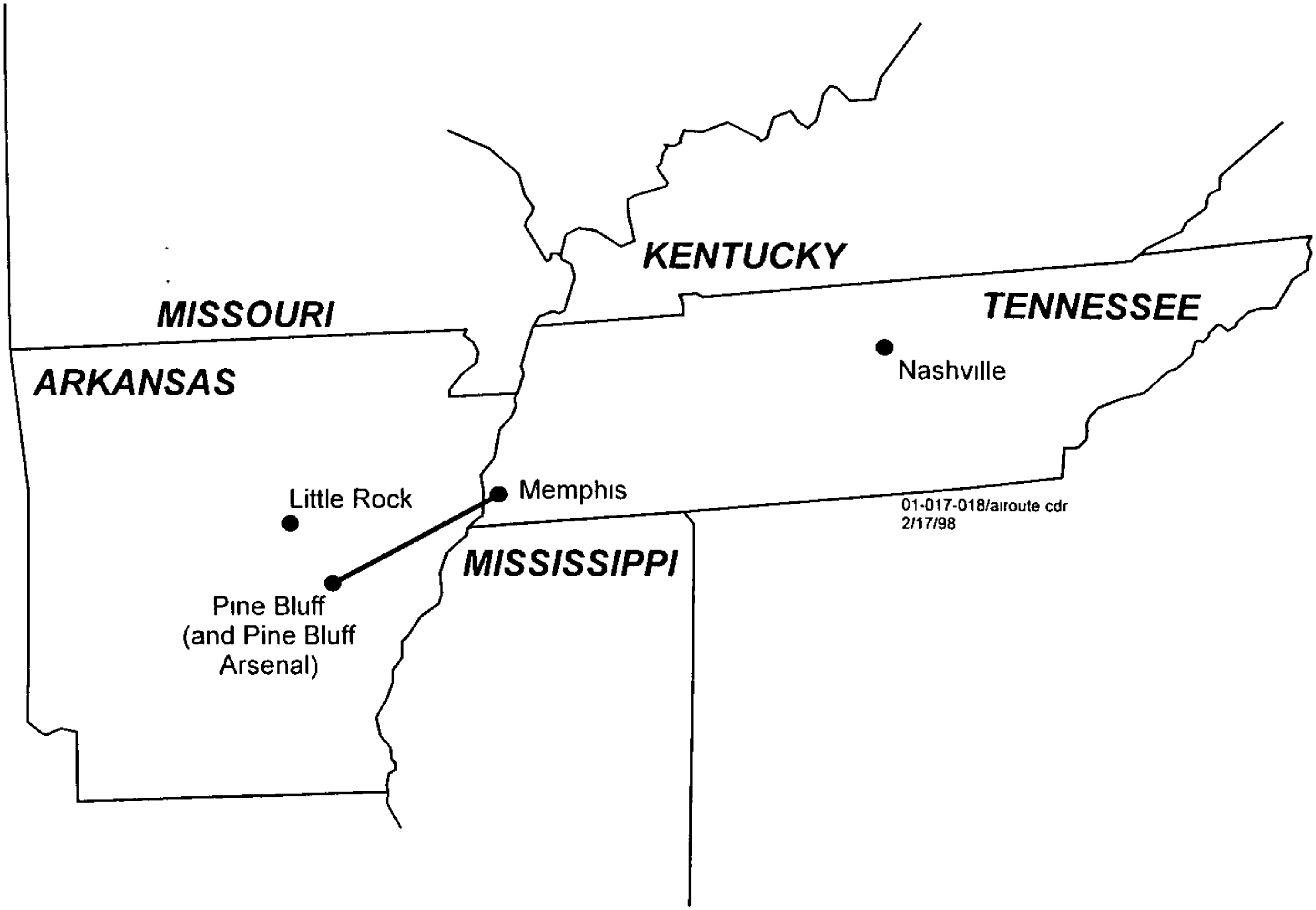

Figure 4-2. Generalized Air Route Between Former Defense Depot Memphis and Pine Bluff Arsenal

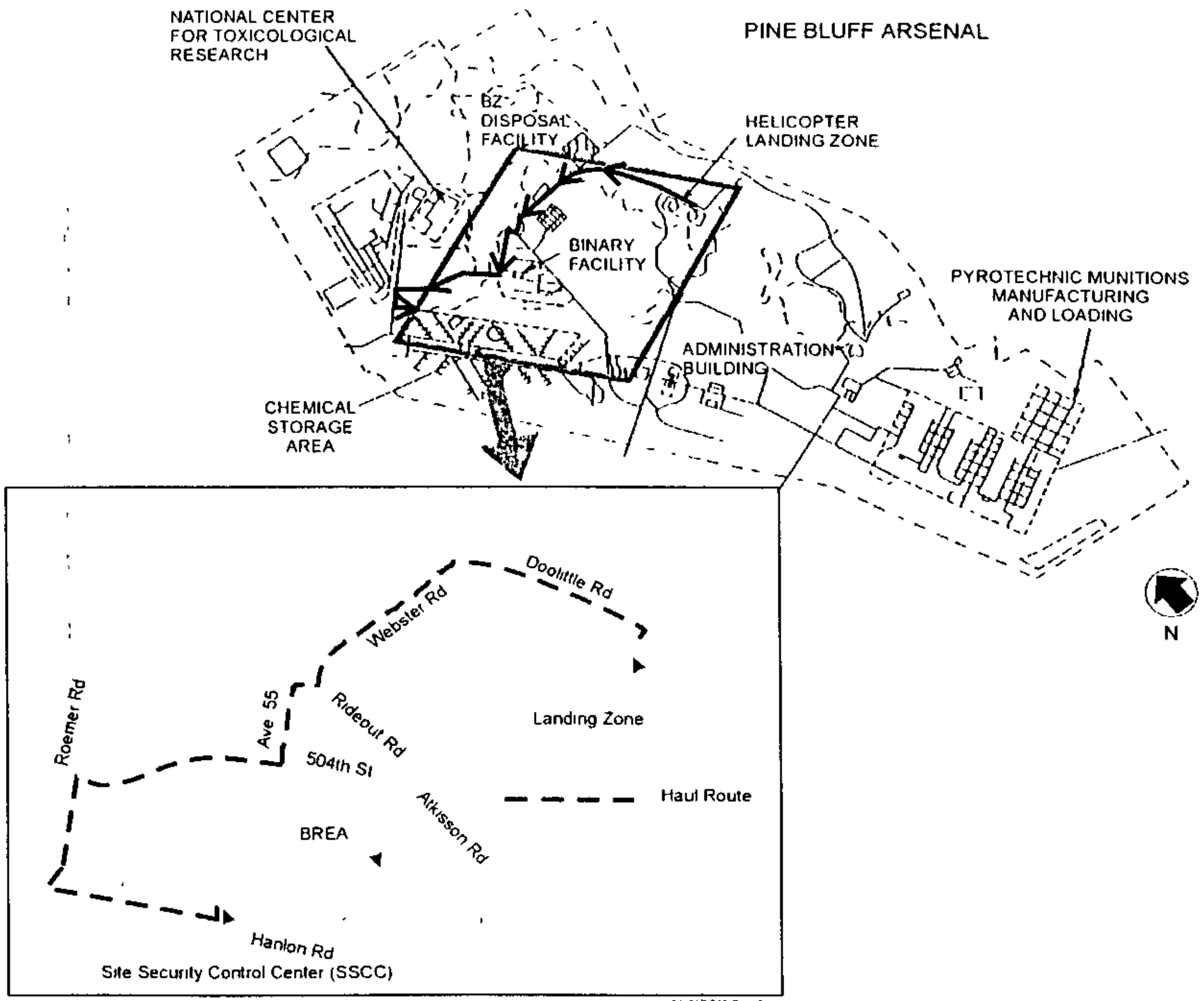

Figure 4-3. Pine Bluff Arsenal Transportation Route

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4.3.1 Predeparture Activities. Predeparture activities will occur prior to transporting CWM from the Memphis Depot storage facility, prior to moving CWM at each transfer site, and prior to resuming transportation after any intermediate stops.

a. *Determine Number of Vehicles and Order of Movement.* The TEU, after consultation with the pilot, will determine cargo configuration based on quantity of items to be moved and type of vehicle(s) that will be used. The TEU operations officer will also specify where any escort vehicles will be in relation to the cargo vehicle(s).

b. *Plan Route.* The ground and air routes proposed in this Plan may not be available at the time of transport; for example, a road may be closed for repairs. Therefore, the TEU will consult with the appropriate authorities to determine the best available routes for ground and air transport. All vehicle operators, assistant operators, and navigators will have clear instructions and maps to identify the route and any preselected stops for fuel (not planned), maintenance, and so forth. In the case of air transport, the route map will also indicate the location of airports where emergency landings can be made

c *Inspect Vehicles and Material Handling Equipment.* Prior to loading, preoperational checks will be performed on the cargo, vehicles, and material handling equipment according to the operator's manual for each vehicle. All ground transportation vehicles will be inspected using DD Form 626, Motor Vehicle Inspection.

d. *Verify Contingency Personnel and Systems in Place.* Emergency response teams, communication equipment, spill response kits, and detection equipment will be checked and verified as operational prior to execution of loading procedures.

e Inspect and Monitor IHF. In accordance with the Memphis Depot IHF Plan, TEU will visually inspect the IHF to verify its integrity prior to entering the structure. They will verify that the IHF door has not been tampered with and is closed and locked. Prior to entering the IHF, first entry monitoring (paragraph 6.1.1) will be conducted remotely using low-level, near real-time (NRT) air monitoring equipment to ensure that airborne chemical concentrations are below the time-weighted average (TWA) levels.

f. *Execute Loading Procedures.* Preapproved loading procedures will be executed to move the shipping containers from the storage area to the staging area, and from the staging area onto the transportation vehicles.

g *Inspect and Monitor Containers.* Each shipping container will be inspected and monitored to verify its integrity prior to completion of loading procedures. Tie-downs will be inspected to ensure containers are correctly secured. Packing requirements are described in paragraph 3.1. Monitoring requirements are described in section 6

h. *Verify Hazardous Waste Manifest.* The TEU will inspect each shipping container with the Memphis Depot Accountable Officer to verify information on the hazardous waste manifest. TEU and the Memphis Depot representatives will each sign the manifest to certify its accuracy. Additional verifications of the manifest will occur during loading, transfer, and unloading of CWM.

i. *Conduct Safety Briefing.* A safety briefing from the TEU will be given to all personnel in the transport vehicles prior to transportation in accordance with the TEU operations plan.

j. *Perform Communications Check.* A communications check will be made with each piece of communications equipment on each vehicle or aircraft prior to departure, in accordance with the TEU operations plan.

k. *Notify PBCA.* Inform PBCA of exact quantity and configuration of material being transported.

l. *Give Notification of Departure.* The Memphis Depot, PMNSCM, and PBCA will be notified immediately upon departure of the transport vehicle.

4.3.2 En Route Activities. En route activities will occur during transport from the Memphis Depot helipad to the PBA helicopter landing zone and from the PBA helicopter landing zone to the PBCA storage facility.

a. *Location, Status, and Communications Check Procedures.* At predetermined checkpoints along the route, each vehicle will verify its location in accordance with SOPs for the move. (For example, operators may use the radio to communicate when they have reached a specific checkpoint.) The aircraft will be in constant communication with the SBCCOM Emergency Operation Center (EOC) throughout the air transport. Any transport problems will be reported to the SBCCOM EOC first. The SBCCOM EOC will initiate further calls for assistance.

b. *Halting Procedures.* Halting procedures will be established and used when the transport vehicle is required to stop for the following circumstances:

(1) *Major Mechanical Failure.* In this situation, the vehicle or aircraft cannot continue or be repaired with resources available within the transport vehicle. If the failure occurs during air transport, the procedures will involve emergency landing at the pilot's discretion. Selecting approved runways in less populated areas will be a part

of the approved contingency plans. If the mechanical failure occurs during road transport, escort and operating personnel will attempt to move the vehicle so as not to impede other traffic. The cargo will be secured until suitable replacement vehicles have been provided.

(2) *Minor Mechanical Failure.* In this situation, the driver or operator experiences mechanical difficulty with the vehicle, but the vehicle can be repaired with resources available within the transport vehicle. Procedures will be in place to stop the vehicle or aircraft as safely and as quickly as possible (emergency runways, etc.). Communication procedures will be in place to inform SBCCOM, PBCA, and the Memphis Depot of the transporter status. Prior to restarting transportation operations, procedures will be implemented to account for all personnel and cargo.

(3) *Accident with Damage to Cargo.* An accident that results in damage to the CWM cargo will be addressed by the emergency response procedures in section 7.

(4) *Accident without Damage to Cargo.* Procedures will be in place for the transport vehicle to stop as safely and quickly as possible and for TEU personnel to inspect cargo for leaks, secure loose cargo, and administer first aid. PMNSCM, SBCCOM, PBCA, and the Memphis Depot will be notified of the problem.

(5) *Public Disturbance and Traffic Obstruction.* In the event of an unexpected block of the transportation route, procedures will be developed to allow the transportation team to stop (if necessary), communicate status to the SBCCOM EOC, choose an alternate route, and react according to the situation.

4.3.3 Prearrival Activities. Prearrival activities will occur prior to arrival of the CWM at the PBA helicopter landing zone and the PBCA storage facility. To prepare for arrival of the cargo, the following tasks must be completed:

a. *Equipment Inspection.* All equipment required to unload the cargo and transfer it from one vehicle to another or from a vehicle to the storage facility will be inspected to ensure that the equipment is on hand and operable. All PPE and safety equipment will also be checked.

b. *Contingency Personnel and Systems.* Emergency response personnel will be notified of the pending arrival of the CWM and will be standing by as required by the contingency plans. Contingency personnel supervisors will inspect all necessary equipment to verify its presence and to ensure that it is operable. Duty and equipment assignments can be verified at this time.

c. *Storage Facility Inspection.* Prior to implementation of this Transportation Plan, PBCA Material Management Personnel will ensure that sufficient space is available for storage Prior to arrival of the CWM, facility personnel will ensure that all storage facilities and equipment are inspected and are operating in accordance with RCRA hazardous waste interim status storage requirements.

d. *Control of Site Access.* Access to the storage and transfer sites will be controlled to ensure that no personnel, beyond the minimum necessary, are exposed to hazards from CWM transfer and storage operations. Prior to arrival of the CWM, transfer and storage areas will be checked and controlled to prevent access by unnecessary personnel.

4.3.4 Arrival Activities. The following arrival activities will be required at the PBCA storage facility and at transfer points. The following actions will be taken once the cargo arrives at the transfer site or storage facility.

a. *Inspect CWM Overpack Containers.* Upon arrival at a transloading site, the TEU will inspect and monitor the CWM in accordance with TEU regulations, and procedures in section 6 of this Transportation Plan.

b. *Custody Transfer.* Upon arrival at the PBCA storage facility, the TEU and PBCA will conduct a joint inventory of the cargo and transfer accountability of the CWM to PBCA.

c. *Unloading and Transfer Operations.* Unloading and transfer operations will be conducted by TEU and PBCA personnel in accordance with TEU, PBCA, and PBA regulations, plans, and procedures.

d. *Verify that the Transportation Vehicle is Uncontaminated.* The transport vehicle will be certified as clean before being released from the storage facility or transfer point. This can be accomplished by verifying the following:

- No unusual activity occurred during transport (strong turbulence, cargo shifting, etc.).
- CWM overpacks are intact (not leaking), based on visual inspection.
- The cargo bay has no visible signs of contamination.
- At PBA only, results of low-level NRT air monitoring will demonstrate that vapor levels are below 1 TWA.

If any of the above are not true, contingency plans involving decontamination will be implemented before the vehicle will be released

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SECTION 5
SUPPORT ACTIVITIES

This section describes support activities associated with the transportation of CWM Support activities include communications, medical, and security.

5.1 Communications

Tracking of the cargo movement and notification of local authorities may involve use of electronic communication media. Some communication may rely on visual signals in addition to electronic methods.

5.1.1 Internal Communication. Personnel in cargo vehicles and any escort vehicles will communicate using radios or cellular phones. Communication equipment will be checked for proper operation at commencement of transport. TEU personnel accompanying the movement or on standby for emergency response may also use radios or cellular phones.

5.1.2 External Communication. The following external communication will be maintained throughout the transportation operation:

a. *Command Personnel.* To ensure safe passage and to maintain command and control, CWM movement will be tracked throughout the mission. Tracking may be accomplished by using predetermined checkpoints and by radio or telephone contact. Mobile radios and phones may be used to advise of changes in routes, unplanned stops, or need for repair personnel.

b. *Emergency Response Personnel.* In the event of an accident, TEU will notify the SBCCOM EOC (section 7) and local authorities for coordination of response efforts in accordance with the emergency response contingency plan. Prior to beginning transport, movement personnel will be briefed on how to contact emergency response agencies along the route.

c. *Public.* In the unlikely event of an accident requiring notification or evacuation of the public, the SBCCOM EOC will coordinate with the local government officials to inform the public in accordance with existing emergency response plans and procedures.

d. *Communication Checks.* Communication checks will be performed when the shipment enters a new organization's area of responsibility. SBCCOM will monitor the status of the movement.

5.1.3 Notifications. Prior to actual transport, the Tennessee and Arkansas emergency management offices will be notified.

Tennessee Emergency Management Agency
P.O. Box 41502
3041 Sidco Drive
Nashville, Tennessee 37204-1502
605-741-6528
FAX 605-242-9635

Arkansas Office of Emergency Services
P.O. Box 758
Conway, Arkansas 70233
501-329-5601
FAX 501-329-8047.

5.2 Medical

To respond to chemical accidents or incidents that may affect workers or the public, medical support will be required. Procedures described in the PBA Chemical Accident/Incident Response and Assistance Plan address any situation that could occur during the transportation of CWM from the Memphis Depot to PBA.

5.3 Security

The Memphis Depot will provide security during the movement from the IHF to the Memphis Depot helipad across the street. TEU will be responsible for security during air transport. PBA will provide security after the shipment arrives at the PBA.

5.4 Monitoring

The TEU will provide or arrange for agent monitoring equipment for the transportation operation. PMNSCM will have responsibility for oversight of monitoring activities and for equipment selection to support the transportation effort. Monitoring procedures and equipment are discussed in section 6.

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SECTION 6
MONITORING

Chemical agents and industrial chemicals of concern will be monitored using the sampling devices at the concentration levels specified in table 6-1. The frequency and location of air sampling are based on the type of monitoring required by DA Pamphlet (Pam) 385-61. Monitoring recovered CWM during transportation will be performed using the methods described in this Plan for each chemical agent that will be transported.

6.1 Types of Monitoring

Four types of monitoring are discussed in this section: first entry, transloading, confirmation, and contingency. First entry monitoring will be conducted at the Memphis Depot IHF in accordance with the IHF Plan. Transloading monitoring will include visual inspection, and if a leak is suspected, gross-level monitoring. Contingency monitoring will be done when an emergency arises, such as a leaking MRC Confirmation monitoring will verify an alarm activated during transloading procedures or during contingency monitoring.

6.1.1 First Entry Monitoring. First entry monitoring of the IHF will be performed with low-level NRT monitors to ensure that the interior airborne concentrations are below the workplace exposure level and to ensure that the CWM, overpacked in MRCs, is contained.

6.1.2 Transloading Monitoring. Transloading is removal of CWM from one conveyance and loading it onto another. En route aircraft transport is also considered transloading for purposes of monitoring. Monitoring during transloading will include periodic visual inspection to ensure that the MRCs are not leaking. The recovered

Table 6-1. Monitoring Equipment and Levels

Chemical of Concern	Type of Monitoring Instrument	Workplace Exposure Level[a] TWA	Workplace Exposure Level[a] mg/m³	Lowest Monitor Detection Level[b] TWA	Lowest Monitor Detection Level[b] mg/m³
Chemical Agent					
Mustard (H, HS, HD)	First Entry NRT MINICAMS®	1 0	0 003	0 2	0 0006
	First Entry Confirmation: DAAMS	1 0	0 003	0 2	0 0006
	Transloading Movement NRT CAM	Gross Level		10 0	0 03
	Transloading Movement Confirmation Colorimetric Tube	Gross Level		36 7	0 11
	Transloading Movement Destination NRT MINICAMS®	1 0	0 003	0 2	0 0006
	Transloading Movement Destination Confirmation: DAAMS	1 0	0 003	0 2	0 0006
	Contingency NRT: MINICAMS®	1 0	0 003	0.2	0 0006
	Contingency Confirmation: DAAMS	1 0	0 003	0.2	0 0006
Lewisite (L)	First Entry NRT MINICAMS®	1 0	0 003	0.2	0 0006
	First Entry Confirmation DAAMS	1 0	0 003	0 2	0 0006
	Transloading Movement NRT Detection/Confirmation. Colorimetric Tube	Gross Level		16 7	0 05
	Transloading Movement Destination NRT: MINICAMS®	1 0	0 003	0.2	0 0006
	Transloading Movement Destination Confirmation. DAAMS	1.0	0.003	0 2	0.0006
	Contingency NRT. MINICAMS®	1 0	0 003	0.2	0 0006
	Contingency Confirmation DAAMS	1.0	0 003	0.2	0 0006

Notes:

[a] Workplace exposure level is an umbrella term encompassing all such levels, including the 8-hour TWA, the permissible exposure limit (for industrial chemicals only), the threshold limit value (for industrial chemicals only), and other limits developed for personnel protection

[b] The lowest level that can be reliably quantified based on sampling and analytical procedures and calibration of the monitor

CAM = chemical agent monitor
DAAMS = Depot Area Air Monitoring System
mg/m³ = milligram per cubic meter
NA = not available
NRT = near real-time
TWA = time-weighted average

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CWM, overpacked in an MRC, will be considered under engineering control and will not require additional monitoring (other than visual) until it is unloaded at the PBCA storage facility.

Upon arrival at a destination, and prior to unloading the cargo, transport vehicles will be inspected visually for evidence of contamination. If visual inspection indicates that the integrity of a container is suspect, gross-level monitoring will be performed as described in paragraph 6.1.3.1. If contamination is detected with gross-level monitors, the vehicle and any other affected material will be decontaminated in accordance with approved decontamination procedures.

Upon arrival at PBA, if visual inspection indicates that all MRCs are intact, low-level monitoring will be performed before the MRCs are transloaded for delivery to the PBCA storage facility. The purpose of low-level monitoring at the final destination is to document that the MRCs are not leaking when they are placed into storage.

6.1.3 Contingency Monitoring. Contingency monitoring is done when an emergency arises such as when a leaking MRC is identified. TEU will implement emergency response contingency actions (section 7) as a result of detecting a release during transloading operations or as a result of a credible event (accident during transport) indicating a potential release.

6.1.3 1 Release During Transloading. Upon visually detecting a release, the TEU, dressed in the appropriate level of PPE, will conduct monitoring using the appropriate monitoring instrument to confirm the release. TEU will monitor where the chemical materiel was released, identify the source of the release, and contain the leaking item in accordance with TEU operating procedures. Once the leakage has been contained, the area will be decontaminated by the TEU in accordance with DA Pam 50-6 or Technical Manual (TM) 60A-1-1-11. TEU personnel will continuously monitor the area until readings fall below the TWA for a minimum of three consecutive sampling periods.

6.1.3.2 Potential Release After a Catastrophic Event. Downwind monitoring will be initiated if a release is suspected as the result of a catastrophic event or at the scene of an accident during onsite transportation. The TEU will follow the response actions outlined in section 7. Plans for monitoring during contingencies will include a first-level contingency array based on the cargo inventory and the prevailing weather conditions. The appropriate monitors (table 6-1) will be used at each monitoring station in the monitoring array. Example monitoring arrays for situations involving transport of CWM are shown in figures 6-1 through 6-3. Specific distances will be determined based on the MCE (see annex A, paragraph 4).

6.1.4 Confirmation Monitoring. Confirmation monitoring will verify a gross-level or a low-level alarm when monitoring during loading procedures or during an emergency response. Confirmation monitoring will be conducted using monitors specified in table 6-1 Colorimetric techniques will be used to confirm a gross-level alarm and Depot Area Air Monitoring System (DAAMS) will be used to confirm a low-level alarm.

6.2 Offsite Transportation

When the recovered CWM is to be transported offsite, the CWM (overpacked in an MRC) will be loaded onto the aircraft and transported to the PBA helicopter landing zone. At the PBA helicopter landing zone, the CWM will be transloaded onto a truck for delivery to the storage facility.

6.3 Roles and Responsibilities

The TEU, acting as an agent of PMNSCM, will provide qualified personnel to perform chemical agent monitoring. The TEU will provide a monitoring team to perform the following:

a. Configure monitoring equipment for operations that use a MINICAMS® and DAAMS to detect chemical agents.

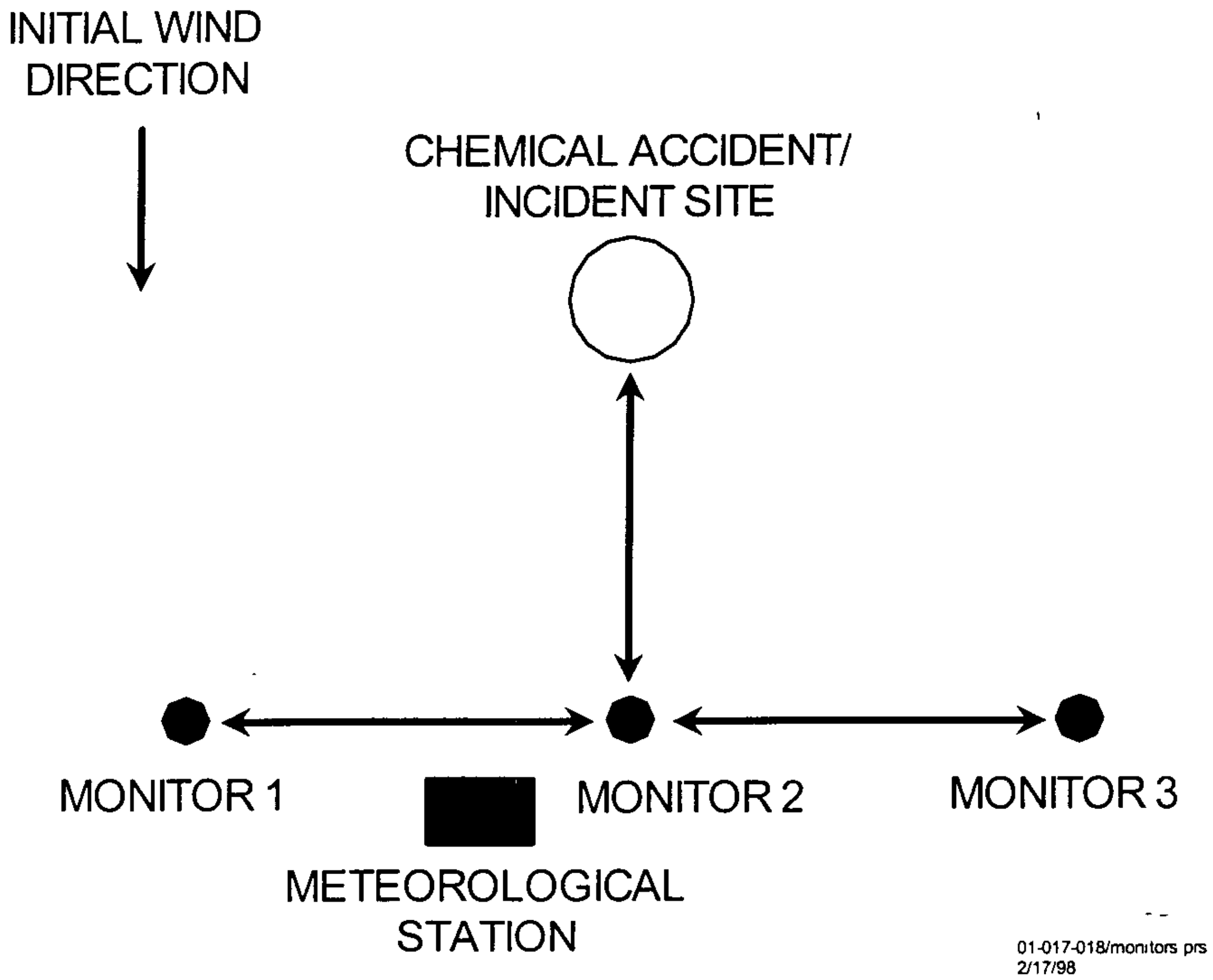

Figure 6-1. Initial Monitoring During Offsite Emergency Response

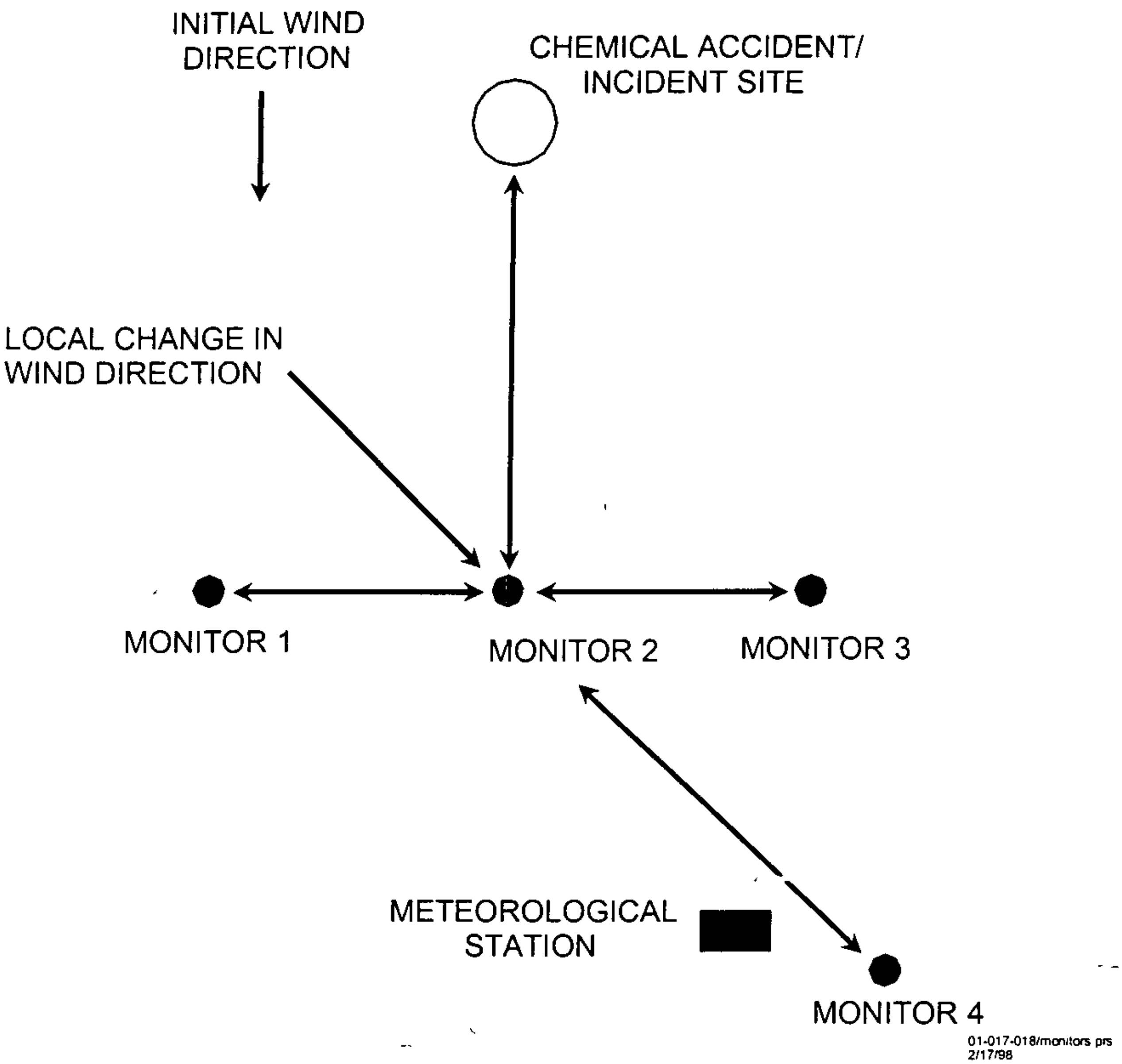

Figure 6-2. Second Array Monitoring During Offsite Emergency Response

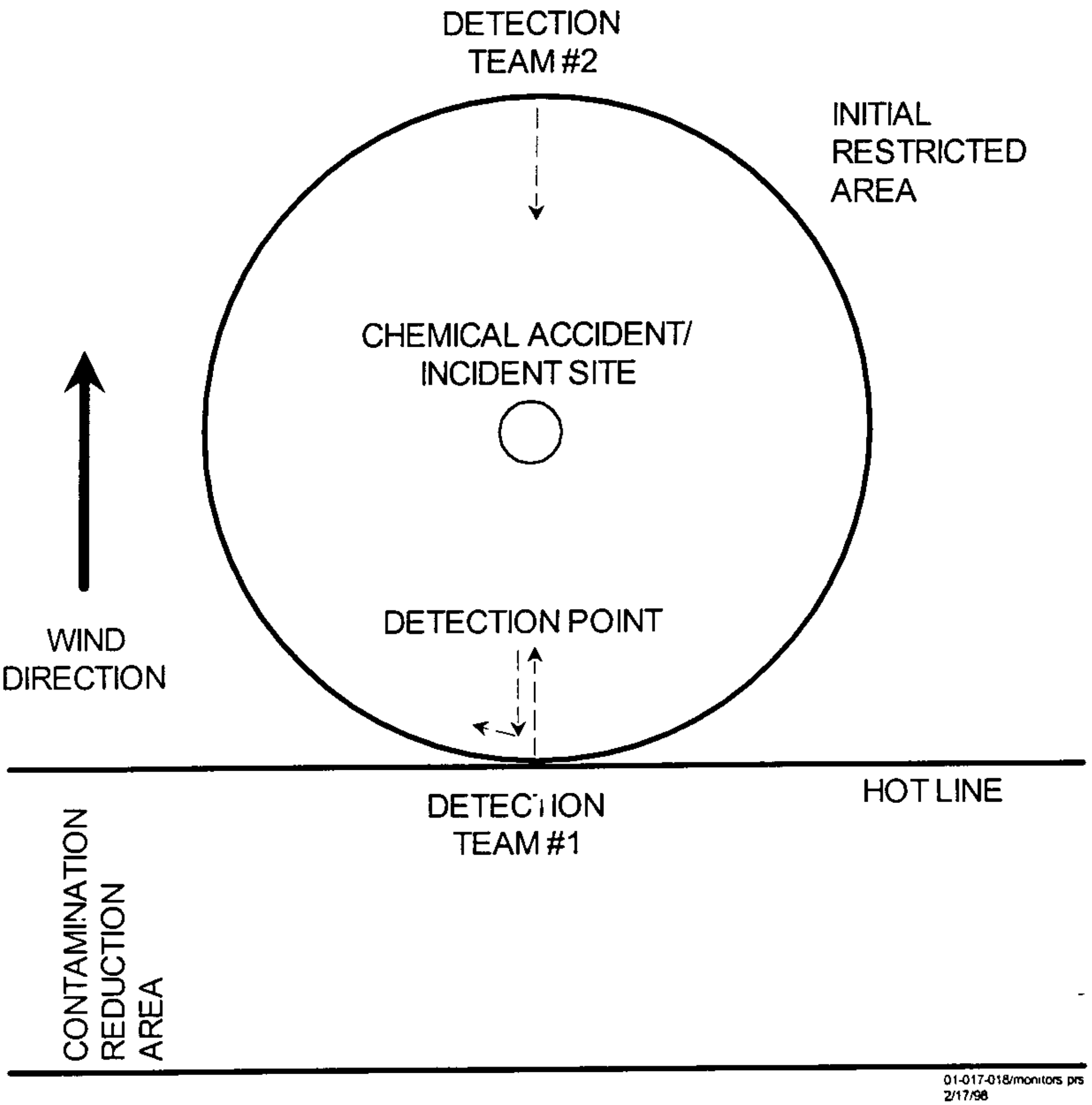

Figure 6-3. Surveillance Monitoring of the Restriction Area

b. Obtain agent standards for HD and L.

c. Record calibration data, instrument parameters, and agent standards (when used) in instrument logbooks

Other TEU responsibilities associated with monitoring include the following:

a. Provide the required personnel, equipment, and support vehicles to conduct the operation.

b. Provide logistical support and resupply assets to sustain continuous operation throughout the duration of the project.

c. Ensure that a health and safety (air monitoring) log is maintained.

d. Coordinate with the Memphis Depot and other onsite organizations to ensure that the monitoring plan is understood and that actions to be taken in the event agent is detected are known.

e Ensure monitoring equipment is tested and serviceable prior to commencing operations.

f. Perform D2PC hazard prediction modeling, prior to commencing monitoring, after a catastrophic event.

6.4 Chemicals of Concern

The following paragraphs provide a brief description of the monitoring strategies for the chemicals of concern. The workplace exposure levels for each chemical are identified in table 6-1.

6.4.1 Mustard (H, HS, and HD). The TEU will monitor for H, HS, and HD using MINICAMS® (see paragraph 6.5.1 for description) during first entry and contingency monitoring. The MINICAMS® will be configured with a flame photometric detector in the sulfur mode to detect H, HS, and HD. The workplace exposure level for mustard is 1.0 TWA [0 003 milligram per cubic meter (mg/m^3)]. The MINICAMS® detection limit for H, HS, and HD is 0.2 TWA. An HD standard will be used for instrument calibration per Army requirements. DAAMS tube samples (see paragraph 6.5.2) will be collected to confirm a MINICAMS® alarm.

In the event that a release is suspected during transloading, gross-level NRT monitoring will be conducted using a chemical agent monitor (CAM) (see paragraph 6.5.3) while Draeger colorimetric tubes (CH25803, as thioether) will be used for gross-level confirmation

6.4.2 Lewisite (L). The TEU will monitor for L using MINICAMS® (see paragraph 6.5.1 for description) during first entry and contingency monitoring. The MINICAMS® will be modified for the detection of L by adding a 1,2-ethanedithiol (EDT) derivative module on the intake end of the sample line and will be configured with a halogen selective detector (XSD). The workplace exposure level for L is 1.0 TWA (0.003 mg/m^3). The MINICAMS® detection limit for L is 0.2 TWA. An L standard will be used for instrument calibration per Army requirements DAAMS tube samples (see paragraph 6.5.2) will be collected to confirm a MINICAMS® alarm.

In the event that a release is suspected during transloading, gross-level NRT detection and confirmation will be conducted using Draeger colorimetric tubes (CH25001, as arsine).

6.5 Required Monitoring Equipment

The following paragraphs provide a brief description of the types of monitors to be used in accordance with this Transportation Plan. Monitoring equipment detection levels are provided in table 6-1.

6.5.1 MINICAMS® NRT Low-Level. Air samples for first entry and contingency monitoring of H, HS, HD, and L will be collected and analyzed with MINICAMS®. The MINICAMS® is a low-level, NRT vapor monitor that has been designed to detect chemical agents. The MINICAMS® detectors are configured for each chemical that is to be monitored (see each individual chemical for appropriate detector, paragraph 6.4).

The MINICAMS® uses a preconcentration sampler that passes air through a solid sorbent, such as a course mesh Tenax®, to collect the sample over a timed sampling cycle. The sample is desorbed and carried through a gas chromatograph (GC) temperature-programmed capillary column to the detector (see each individual chemical for appropriate detector, paragraph 6.4)

6.5.2 Depot Area Air Monitoring System. The DAAMS is not an instrument but an air sampling and analysis method that provides sampling data by using sorbent tubes. The system consists of small, glass, sorbent-packed tubes, a vacuum pump, and flow control hardware. Tenax® tubes will be used to sample all chemical agents. In the DAAMS method, a contaminant is collected by absorption onto the tube packing while air passes through the tube. After sample collection, the sample is thermally desorbed from the tube into the carrier stream of a GC and subsequently detected by a flame photometric detector. DAAMS has been certified for H, HD, and L and will be used to confirm a MINICAMS® alarm.

6.5.3 Chemical Agent Monitor. The CAM is a gross-level qualitative NRT monitor to detect HD. The CAM is a hand-held battery powered ion mobility spectrometer capable of a response time of 60 seconds. The CAM is the best device available for en route aircraft NRT air monitoring. If required, the CAM will be used for en route monitoring.

6.5.4 Colorimetric Techniques. Colorimetric techniques are based on specific chemical reactions that produce of colored reaction products when contaminants are present above threshold concentrations. The colorimetric tubes listed below are available for qualitative detection of the chemical agents and quantitative detection of the industrial chemicals of concern.

a. HD (Draeger tube CH25803)
b. L (Draeger tube CH25303).

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SECTION 7
EMERGENCY RESPONSE CONTINGENCY PLAN

7.1 Introduction

This section outlines procedures to be taken in the unlikely event of an accident, emergency, or unintentional release of chemical agent during any phase of the transportation operation. The following procedures deal specifically with CWM transport. However, they rely heavily on emergency response procedures already prepared by the Army. Applicable references include:

a. DA Pamphlet 50-6, Chemical Accident or Incident Response and Assistance (CAIRA) Operations

b. Chemical Weapons and Materiel Escorts (TEU SOP 50-1)

c. Explosive Ordnance Disposal Procedures Chemical/Biological (C/B) Agents and Related Materiels; Characteristics, Leak Sealing, Disposal, and Decontamination (Army TM 60A-1-1-11)

d. PBA, Disaster Control Plan, Annex C, CAIRA Plan

e. DA Final Emergency Response and Contingency Plan for Solid Waste Management Sites (DDMT).

In developing emergency response procedures, consideration was also given to requirements in the Emergency Response Guidebook developed by the Research and Special Programs Identification of the Department of Transportation, and DA Contingency Plans and Procedures, including Oil and Hazardous Substance Spill Contingency Planning Control and Emergency Response set out in chapter 8 of AR 200-1, Environmental Protection and Enhancement.

7.2 Background

CWM is to be transported from the Memphis Depot to PBA. Specific operational phases are the following:

a. Transferring the CWM from the IHF onto a helicopter and flying the CWM from the Memphis Depot helipad to the PBA helicopter landing zone

b Transloading the CWM from the IHF onto a truck and driving it to the PBCA storage facility

c. Unloading the truck at the storage facility and placing the CWM into storage.

7.3 Objective

The primary concern of emergency response to a chemical accident/incident (CAI) is to protect human health and the environment by controlling chemical agent release. Transportation personnel will be prepared in the event of an emergency. All emergency response operations will be performed in the fastest manner compatible with safety and in accordance with preapproved contingency plans. The major types of emergencies that can be encountered are: (1) spills that may include exposure to potentially hazardous materials; (2) incidents requiring medical help, and (3) fire.

This emergency response contingency plan complies with 29 CFR 1910.120 (q) (1) and addresses the following elements:

a. Planning
b. Emergency recognition
c. Personnel, authority, and communications
d. Emergency alerting and reporting

e. Evacuation routes
f. PPE and emergency equipment
g. Procedures for decontamination and medical treatment.

As recommended by the Environmental Protection Agency, this emergency response contingency plan also includes paragraphs that address procedures to protect the local affected population in case of an accident or emergency. They are as follows:

a. First responders
b. First aid and medical information
c. Air monitoring plan
d. Spill control and countermeasures.

7.4 Command and Control

The recovered CWM being moved is not designated as chemical surety materiel and is not considered vital to national defense. Therefore, the DoD does not have inherent authority over civil authorities during contingency operations involving this Plan. CWM transportation will be the responsibility of the TEU, while PMNSCM has overall responsibility for the transportation of the CWM. The Memphis Depot retains the accountability for the CWM as generator o' the waste. While the Army is responsible for safe transport and may be liable for the effects of any release of toxic material, it does not necessarily have the authority to direct response actions. In case of a CAI, the TEU traveling with the cargo will be the first responder and will take those actions necessary to save lives, protect property, and notify local and regional authorities. Authority for directing response actions beyond first response depends on where the emergency occurs. If a CAI occurs at the Memphis Depot, the Memphis Depot has authority for emergency response. If a CAI occurs at PBA, then the Commander, PBA has authority. If a CAI occurs outside of these installations, then the local civilian authorities will direct the response actions. If a CAI occurs on a military installation but the effects extend off the installation, response actions would be conducted by both military and civilian authorities based on preapproved agreements between the federal and local governments.

In case of an emergency, the TEU will assume initial control of the CAI scene and will notify local authorities and the SBCCOM EOC. Once local authorities arrive at the scene, the TEU will assume an advisory role and will cooperate with the local authorities (for example, provide advice on the need for evacuation, size of hazard area, or need for PPE). Render-safe and leak-sealing procedures should be approved by local authorities; otherwise, only those actions needed to save lives will be performed.

TEU personnel accompanying the shipment are trained first responders for a CAI. Minor accidents or leaks could be handled by TEU on board the transport vehicle. EOC will notify the hazardous material response teams whose facilities are located along the route of the transport activities.

7.5 Emergency Response Resources

An accident during transport creates different problems than would an accident at a fixed site. Since a potential CAI can occur anywhere on the transportation route, the personnel associated with CWM transportation will be the most effective resource to respond to a chemical accident and shall be trained and prepared to handle any situation that may arise. The following paragraphs outline the personnel, equipment, and local, state, and federal resources that should be or are available in the event of an emergency.

7.5.1 Personnel. CWM escort will be the responsibility of the TEU, which is under direction from SBCCOM. The TEU will be the first responder in the event of a CAI. PMNSCM has overall responsibility for the transportation of the CWM.

The TEU is responsible for the custody of the recovered CWM and for handling emergencies during transportation phases. The TEU personnel will be trained and equipped to respond to any type of CAI that may occur. The TEU will be capable of implementing the same primary public safety measures as those performed by community officials in fixed-site emergency response programs. The TEU will have the proper tools to handle an unpredicted situation requiring monitoring, first aid, decontamination, and fire protection.

a. *Driver Requirements.* Each vehicle and aircraft will have a licensed driver and assistant driver. Drivers will be alert and will have passed a physical exam as prescribed by the Interstate Commerce Commission Motor Carrier Safety Regulations, Federal Aviation Administration Regulations, or military equivalent.

b. *Training and Certification.* All personnel who participate in the emergency response to a chemical accident during the movement of CWM should (and all TEU personnel will) be trained and certified in emergency procedures, use of PPE, first aid, cardiopulmonary resuscitation (CPR), and should possess basic knowledge of agent exposure symptoms (again, TEU personnel will have this knowledge). This will include, as a minimum, 49 CFR 172.700 through 172.704 and DA Pam 385-61 training. Team leaders will have familiarized themselves with the PBA CAIRA Plan, the Memphis Depot Emergency Response and Contingency Plan, and the TEU operations procedures and SOPs applicable to CWM transportation, decontamination, spill cleanup, and the emergency response procedures in this plan.

c. *Team Coordination and Support Personnel.* The TEU will have the capability to coordinate responses with local emergency response personnel, who should provide response management expertise in areas such as public alert, notification, traffic and access control, assistance to affected populations, initial medical intervention and care, and fire fighting.

d. *Backup Personnel.* If any person required for safe accomplishment of the mission cannot perform his or her function, the mission must have replacement personnel on board or must stop until replacement personnel arrive.

7.5.2 Equipment. The TEU, whether part of the road or air transport, will be equipped to handle emergencies. The same types of equipment, operations, PPE, decontamination and spill containment equipment, and communication and medical supplies will be used for each transportation mode. During ground transport, a vehicle will be available to transport injured personnel to the identified emergency medical facilities. TEU will perform its escort mission in accordance with TEU Regulation 50-1.

7.5.3 Local and State Emergency Response Resources.

a. *Local.* The Memphis Depot Emergency Response and Contingency Plan and the PBA CAIRA will be reviewed prior to recovered CWM transport. These Plans specify the onsite emergency coordinators, local emergency response agencies, and safety and environmental officials. County-based response forces and resources adjacent to the transportation corridor will be identified by the SBCCOM EOC prior to conducting the air transportation. These resources will be available for use in the event of a CAI. The local officials at PBA must be notified about the initiation of air transport.

b. *State.* State emergency response resources may be needed to provide secondary support such as medical and evacuee care and security. The Memphis Depot Emergency Response and Contingency Plan and the PBA CAIRA Plan can be referred to for the authorities who should be contacted.

7.6 Emergency Response Procedures

These procedures outline operational tasks to be completed before CWM transportation and in the event an accident or incident occurs involving the cargo.

Before starting transportation operations, the TEU will review the emergency procedures and will ensure that all necessary emergency equipment is ready for use. All personnel training will have been accomplished prior to operations. TEU personnel will be briefed on their roles in emergencies such as firefighting, cleanup, or first aid.

In the case of an accident during the transportation of CWM, immediate emergency response actions are required. An emergency would begin upon detection of agent by a monitor or an alarm, the presence of smoke, or the suspicion of CWM contamination. These hazards may include (but are not limited to) the following:

a. Hazards associated with CWM
b. Fire
c. Medical emergencies
d. Hazardous material handling.

These hazards and associated mitigating actions are addressed in the following paragraphs.

7.6.1 Hazards Associated with Chemical Warfare Materiel. Handling of CWM will be addressed in the TEU operations plan. Some of the essential procedures used to handle a CAI are as follows:

a. *Isolation*

(1) Upon observing a spill, leak, or discharge of the contents of a container of any size, TEU will immediately don their masks,

proceed to a safe distance upwind, direct other personnel away from the site, and initiate appropriate emergency response actions.

(2) Ignition sources, including motor vehicles, will be extinguished immediately within 50 feet of the CWM.

(3) Persons who may have had contact with the spilled materials will undergo decontamination consistent with the extent and nature of the contact.

(4) The TEU will take action to identify the contamination and mitigate leaking CWM.

b. *Notification.*

(1) TEU will notify the SBCCOM EOC who will in turn contact the Memphis Depot if the emergency occurs in Tennessee or PBA if the emergency occurs in Arkansas. The Memphis Depot or the PBA Operations Center will contact the state emergency management as specified in the Memphis Depot Emergency Response and Contingency Plan and the PBA CAIRA Plan.

(2) As conditions dictate and in accordance with their operating procedures, the authorities will declare an emergency, initiate remediation, request assistance, and make offsite notifications.

c. *First Aid.*

(1) If workers are unable to evacuate themselves, their rescue will be the responders' first priority.

(2) Responders will wear the PPE appropriate to the circumstances to conduct the rescue.

d. *Characterization.*

(1) The TEU will investigate the CAI site to determine the condition of the involved cargo and areas of possible contamination. Material will be presumed to be hazardous until determined otherwise. Reentry to the area will be conducted in a level of PPE appropriate to the conditions

(2) At the discretion of the TEU, samples will be collected for field or laboratory testing.

(3) The area of the spill will be determined and documented. The quantity of spilled material will be estimated. The area will be marked with stakes and barrier tape. The TEU will assist in appropriate traffic control around the area until responders arrive.

(4) The spread of materiel will be contained as soon as circumstances permit. Loose sorbent or sorbent pads may be used to prevent the spread of spilled materiel.

e. *Cleanup and Disposal.* Damaged containers will be placed in larger MRCs or in drums of compatible construction that contain suitable loose sorbent. Contaminated tools and equipment for decontamination or disposal will be collected. Disposal will depend on the identity of the spilled material.

7.6.2 Fire. In the unlikely event that fire occurs during CWM transport, procedures for responding to fire events are as follows:

a. *Notification.* The local fire department will be notified as soon as possible of the location, size, and nature of the fire. As conditions dictate, fire department personnel will declare an emergency, initiate remedial procedures, request assistance, and make necessary notifications.

b. *Rescue.* Rescue of persons unable to evacuate themselves shall be the first priority of responders.

c. *Firefighting Procedures.*

(1) Stop the vehicle.

(2) Sound the alarm.

(3) Evacuate – If human life appears to be in danger or the spread of fire appears to be rapidly progressing, personnel will be moved further upwind, away from the fire.

(4) Use fire extinguisher – No attempt should be made to extinguish large fires. These should be handled by the fire department.

(5) Request assistance from the fire department.

d. *Fire Extinguishing.* There are three classes of fire. Examples of extinguishers acceptable for extinguishing each class of fire are listed below.

(1) Class A – Burning wood, cloth, paper, rubber, many plastics, and other ordinary combustibles can be extinguished with:

- Water
- Water with 1-percent aqueous film forming foam (AFFF)
- Water with 5-percent AFFF or fluoroprotein foam
- ABC dry chemical
- Halon 1211.

(2) Class B – Flammable liquid, gas, and grease fires can be extinguished with:

- ABC dry chemical
- Purple K
- Halon 1211
- Carbon dioxide
- Water with 6-percent AFFF.

(3) Class C – Energized electrical equipment fires can be extinguished with:

- ABC dry chemical
- Halon 1211
- Carbon dioxide.

e. *Protective Clothing.* Based on the conditions, the TEU and the fire department will determine appropriate safe distances and PPE. Firefighting turn-out gear may be required. Other protective gear may be worn, depending on the potential for chemical agent release.

f *Decontamination.* At the conclusion of firefighting activities, the TEU or other response personnel will determine, to the extent practicable, the nature of the contaminants encountered during the incident and will arrange for equipment to be decontaminated or labeled and isolated for further action.

7.6.3 Material Handling. The onsite emergency response will be performed by the TEU and the Memphis Depot or PBA/PBCA personnel as appropriate. When a leak or spill occurs, immediate containment and preventive measures must be taken. Procedures for material handling are specified in TEU SOPs. Upon completion of cleanup efforts for the accident, responsible personnel should notify the local authorities, collapse the exclusion area, and give the order to resume the transportation operation.

7.7 Medical Emergencies

Seriously injured or ill persons should not be moved, unless their lives are endangered, until an assessment has been made by a person trained in first aid and CPR. If the injury or illness is minor, full decontamination should be completed and first aid should be administered before transport. First aid should be administered while awaiting an ambulance or paramedics. All injuries and illnesses must be reported to local authorities Any person transporting an injured or exposed person to a clinic or hospital should have directions to the hospital and information concerning the nature of the injury or illness.

Coordination with facilities is outlined in the PBA CAIRA and the Memphis Depot Emergency Response and Contingency Plan. The following medical facilities may be contacted for emergency care:

a. In the vicinity of Memphis, Tennessee

Baptist Central
899 Madison Ave.
Memphis, TN 38146

901-227-2727
Methodist Central
1265 Union St.
Memphis, TN 38104
901-726-7000.

b. In the vicinity of Pine Bluff, Arkansas

Jefferson Regional Medical Center
1515 West 42nd St.
Pine Bluff, AR 71603
870-541-7100.

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SECTION 8
ROLES AND RESPONSIBILITIES

Many of the participating organizations involved with performing offsite transportation of recovered Memphis Depot CWM have both shared and individual roles and areas of responsibilities. The primary participating organizations include PMNSCM, the Memphis Depot, PBA, PBCA, and SBCCOM/TEU. The organization is shown in figure 2-1.

Common responsibilities among the participants include:

a. Coordinating with other participants

b. Performing duties in accordance with accepted health and safety procedures

c. Using established supply procedures and providing the supplies necessary to support their operations

d. Providing emergency response support

e. Developing training plans for use by emergency response teams.

Specific responsibilities for each key organization are presented in the following paragraphs.

8.1 U.S. Army Program Manager for Chemical Demilitarization

PMCD is responsible to ensure that the CWM is handled in a safe and environmentally acceptable manner. A PMNSCM coordinator will be identified for the Memphis Depot transportation effort to ensure all required coordination is conducted and responsibilities are fulfilled. Other PMNSCM responsibilities are to:

a Develop an HA that addresses the relative risk associated with this plan. This assessment should identify variables that impact selection of landing areas and air corridors. It should assess transportation activities along selected truck and air routes, and risks associated with the vehicles or aircraft selected for the mission. The HA is provided in annex A.

b. Coordinate to ensure that all transportation operations are conducted in a safe and environmentally acceptable manner.

c. Coordinate to ensure that the recovered CWM is properly packaged and repackaged, if required.

d Coordinate to ensure that standby decontamination and medical support is available during all phases of the transport operation.

e. Coordinate CWM movement with the TEU.

f. Monitor the status movement of the CWM in coordination with SBCCOM EOC.

g. Notify the Memphis Depot upon receipt of the cargo at PBA.

8.2 Former Defense Depot Memphis, Tennessee

As the supported organization, the Memphis Depot will:

a. Provide proper notifications and coordination to the U.S. Environmental Protection Agency (USEPA), the State of Tennessee, and local authorities regarding the transportation operation.

b. Provide physical security and emergency response capabilities for movement from the Memphis Depot IHF to the Memphis Depot helipad based on the route and mode of transportation presented in this plan.

c. Prepare the hazardous waste manifest. The Memphis Depot retains accountability until the recovered CWM is transferred to PBCA.

d. Notify the National Response Center of CWM spills while transporting material from the Memphis Depot to the Memphis Depot helipad if releases exceed the reportable quantity.

e. Ensure that the TEU has all required permits to transport the cargo through each jurisdiction that will be entered.

f. Report spills of regulated substances to the TDEC.

8.3 U.S. Army Soldier and Biological Chemical Command

SBCCOM will support the transport of CWM from the Memphis Depot to PBA. SBCCOM will:

a. Arrange for all aircraft and provide trained crews required to support this Transportation Plan.

b. Coordinate air transportation with the appropriate agencies.

c Transport recovered CWM from the Memphis Depot to PBA via UH-1N helicopter.

d. Operate an operations center to monitor the complete movement of the recovered CWM to PBA.

e. Implement loading, transloading, and unloading plans for all operational activities.

f. Provide additional support as required.

g. Make required notifications to the National Response Center to achieve compliance with public law.

8.3.1 Operator, Driver, or Pilot. The operator, driver, or pilot will be responsible for the safe operation of the carrier and for compliance with regulations regarding transportation of CWM. The operator will perform preoperational checks, inspect load tie-downs in accordance with specifications, obtain document packets, verify and sign documents, and check for proper placarding. The operator will be trained in self-protection, emergency first aid, and spill abatement procedures. The flight crew will be trained and certified as required by the TEU.

8.3.2 Assistant Operator or Navigator. A copilot, navigator, or assistant operator will be used for aircraft operation to safely accomplish the mission and to comply with Federal Aviation Administration requirements. The assistant operator will be required to perform preoperational checks, to verify that communication equipment is functional, and to carry and be familiar with route maps. The assistant operator will be able to perform operator, driver, or pilot duties, and will be trained in self-protection, first aid, and spill abatement procedures. During ground transportation, the assistant driver may be provided based on the length or complexity of the route.

8.3.3 Maintenance Personnel. Maintenance will be the responsibility of the owner or operator of the aircraft or ground vehicle. Maintenance personnel who are capable of responding to locations that may be used for unscheduled stops and that do not have repair services will be identified in contingency plans.

8.4 U.S. Army Technical Escort Unit

The TEU is a specialized unit of SBCCOM that has historically been the sole escort of CWM as required by AR 50-6.

The TEU will follow established lines of authority. TEU has responsibility for the cargo and escort personnel. During air transportation, the pilots will have command of the aircraft. The TEU will maintain accountability for the cargo and command of escort personnel.

During a CAI, the TEU will act as the onsite safety coordinator and first responder until relieved by local authorities. Once relieved, TEU will serve as safety advisors regarding the cargo. TEU personnel may be used to assist during emergencies, but they will remain under command and control of the senior military representative. This is to ensure that DoD members do not violate aspects of the Posse Comitatus Act, prohibiting military enforcement of civil law.

Specific TEU responsibilities are to:

a. Provide qualified escort personnel and trained emergency response teams to travel with the recovered CWM from the Memphis Depot IHF until it reaches its final destination. The TEU will perform emergency response duties as required en route.

b. Ensure that all personnel have completed required certification training prior to commencement of the mission.

c. Select specific equipment to load, transload, and unload cargo and prepare an SOP for its use. The TEU will be required to develop inspection criteria to ensure equipment is operable.

d. Maintain radio contact with the SBCCOM EOC and provide notification, if required, to initiate emergency response actions.

e. Provide maintenance for communications equipment or provide backup communication.

f. Provide personnel and equipment for ground transportation of the recovered CWM from the PBA helicopter landing zone to the storage facility.

The TEU will travel with the recovered CWM and will perform the following:

a. *Monitoring.* The shipping containers will be inspected before they are loaded onto transport vehicles in accordance with specific monitoring instructions (section 6).

b. *Container Inspection.* The cargo will be inspected during transportation as needed to determine the integrity of the containers and cargo tie-downs.

c. *Spill Abatement.* The occurrence of a spill is highly unlikely. However, if a spill occurs, the TEU will respond as the initial entry party to preserve health and safety, contain and render safe hazardous material, and protect the environment in accordance with approved contingency plans.

d. *First Aid.* As the initial entry party, the TEU will be trained to provide first aid and to apply these skills as needed until relieved by competent medical authorities in accordance with approved contingency plans.

8.5 Pine Bluff Arsenal

PBA will be responsible for providing security and emergency response capabilities for movement from the PBA helicopter landing zone to the PBCA storage facility based on the route and mode of transportation presented in this plan. PBA will also be responsible for signing the hazardous waste manifest.

8.6 Pine Bluff Chemical Activity

PBCA will be responsible for the following:

a. Receiving the CWM at the PBA helicopter landing zone

b. Accepting accountability of the recovered CWM upon receipt of the CWM at the PBCA storage facility

c. Providing a storage facility to receive the CWM

d. Providing primary emergency response capabilities for chemical accidents/incidents.

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SECTION 9
PUBLIC OUTREACH

The PMNSCM is committed to public input and to timely and accurate information exchange with all stakeholders. As a demonstration of this commitment PMNSCM has initiated a national strategy that encompasses exchanging information with partners at the national, regional, and local levels prior to implementing chemical demilitarization options. This strategy includes a continuing, pro-active outreach program covering public safety and environmental quality. The effort also includes sensitivity training for Environmental Justice and Native American issues. These issues are being incorporated into the site-specific public outreach efforts.

Efforts are ongoing to identify interested elected officials, citizens, and groups, implement initiatives, and ensure compliance with the spirit of the laws and Presidential orders that pertain to the chemical demilitarization program. PMCD participates in a state delegate legislative working group, and an independent board of experts from the National Research Council as part of its effort to ensure public input and interaction.

Sufficient lead time and thorough coordination of public outreach activities among the agencies participating in this Transportation Plan is critical. The Memphis Depot has overall responsibility for public outreach involving recovery of CWM at the Memphis Depot and will be the focal point for public inquiries into this project. PBCA will provide input concerning receipt and storage of recovered CWM at PBCA and will be responsible for public outreach involving interests local to PBA. All participants will coordinate with the PMCD Public Outreach and Information Office prior to any public outreach activities that might impact PMCD's congressional mandate. This will allow time to share information, avoid duplication, and ensure that current national outreach activities are incorporated into site specific initiatives.

Annex G contains answers to questions that might be asked about this plan. Additional questions should be directed to the following individuals:

PMNSCM
Public Outreach and Information Office
Mr. Bob Jones
1-800-488-0648 or 410-436-7439
FAX 410-436-8738
rjones@cdra.apgea.army.mil

Former Defense Distribution Depot Memphis
Public Affairs Office
Mr. Shawn Phillips
901-544-0611

PBCA
Public Information Officer
Mr. Jeff Lindblad
870-540-2429
FAX 870-540-3886
jeffery_lindblad@pba.emh1.army.mil

SECTION 10
CONCLUSIONS

This Transportation Plan provides a scope of effort that is intended to support the removal action.at the Memphis Depot. For the CWM recovered at the Memphis Depot, this Plan describes procedures and resources to safely transport recovered CWM to PBA The recovered CWM will be managed, packaged, and transported as hazardous waste

As part of the effort to determine whether the proposed transportation operation could be performed in a safe manner, an HA was conducted to identify and evaluate the hazards associated with the proposed activities. The assessment developed a comprehensive list of hazards associated with operations.

The analysis of the potential hazards for transporting recovered CWM from the Memphis Depot to PBA yields a carrier accident probability of 6.7×10^{-5}. According to the NSCM System Safety Management Plan, this accident probability is improbable, but could have catastrophic results, resulting in a risk assessment code of 3 for the CWM transportation.

The MCE considered for this transportation plan is judged to be no more hazardous than the conditions resulting from an aircraft crash and an evaporative release of 1.34 liters HD. For this event, the MCE "no deaths" distance is 6 meters and the "no effects" distance is 84 meters.

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ANNEX A

FORMER DEFENSE DEPOT MEMPHIS, TENNESSEE

TRANSPORTATION HAZARD ANALYSIS

ANNEX A
FORMER DEFENSE DEPOT MEMPHIS, TENNESSEE
TRANSPORTATION HAZARD ANALYSIS

1. INTRODUCTION

This hazard analysis (HA) was developed to support plans for the transportation of recovered chemical warfare materiel (CWM) at the Former Defense Depot Memphis, Tennessee, to Pine Bluff Arsenal, Arkansas (PBA). The Memphis Depot is located on 642 acres in the central portion of Memphis, Tennessee. The Depot is operated by the Defense Logistics Agency (DLA). The initial mission of the Memphis Depot was to provide stock control, storage, and maintenance services for the Army Engineer, Chemical, and Quartermaster Corps. During World War II, the Depot served as an internment center for 800 prisoners of war and performed supply missions for the Signal Corps and Ordnance Corps. Since 1963, the Memphis Depot has been a principal DLA distribution center for hazardous materials; textile products; food products; electronic equipment; construction materials; and industrial, medical, and general supplies.

Chemical Agent Identification Sets (CAIS) were used by the military from the 1920s to the 1960s to train service members how to identify chemical agents in the field. At the Memphis Depot, the remains of CAIS have been identified in Dunn Field. Items from the following types of CAIS may have been disposed of in the landfill: K941, K942, K951/K952, K953/K954, and K955.

Items from these CAIS may be recovered from the landfill during remediation of the site. If CWM is recovered, it will be inspected, characterized, packaged into multiple round containers (MRCs), labeled, and manifested in accordance with applicable Tennessee Department of Environmental Conservation (TDEC) requirements, and temporarily stored in an Interim Holding Facility (IHF) until implementation of this Transportation Plan.

This transportation risk assessment was developed to support the Transportation Plan for the Memphis Depot. It is the product of an analysis of hazards associated with the transportation of CWM, and it is performed in accordance with the System Safety Management Plan (SSMP) [U.S. Army Chemical Materiel Destruction Agency (USACMDA), 1994]. In the preparation of the HA, potential mishaps that could occur during transportation operations are discussed qualitatively. To assign quantitative values to potential risk, risk assessment codes (RACs) are identified for each hazard or hazardous condition, using tables A-1, A-2, and A-3 as a basis for assigning RACs. The quantitative risk estimates are based upon range/confidence estimates. These provide an estimated probability that the actual probability lies below the estimate with a confidence level. This risk assessment encompasses only the risk potential of transporting CWM and does not consider risks associated with locating, packaging, or storing the CWM. Descriptions of ways of eliminating or mitigating likely system failures are included.

Throughout this analysis, a distinction is made between two RAC values. First is the basic RAC assigned to a hazard without accounting for accident prevention measures. The second is the controlled RAC which takes into account efforts to mitigate either the probability that the hazard will result in an accident or the severity of the accident should one occur. A RAC 3 means that the operation should be conducted safely without implementing additional safety measures. However, even when the basic RAC is a 3, reasonable efforts to reduce accident probability or severity must be implemented even when these efforts do not change the RAC.

2. CONCEPT OF OPERATIONS

2.1 Transportation Description

2.1.1 Ground Transportation. Any CWM found at the Memphis Depot still existing in a container will be packed in an MRC. The materiel will be overpacked with vermiculite before the overpack is sealed. The MRCs have been tested for integrity and the results of these tests are included in the discussion in paragraph 2 4.1 below.

Table A-1. Hazard Severity (Consequence) Categories

Description	Category	Mishap Definition
Catastrophic	I	May cause death, system loss, or severe environmental damage.
Critical	II	May cause severe injury, severe occupational illness, or major system or environmental damage.
Marginal	III	May cause minor injury, minor occupational illness, or minor system or environmental damage
Negligible	IV	May cause less-than-minor injury, occupational illness, or less-than-minor system or environmental damage

Table A-2. Hazard Probability (Frequency) Categories

Frequency of Occurrence	Level	Description
Frequent	A	Will be continuously experienced
Probable	B	Will occur frequently in the life of the system
Occasional	C	Will occur several times in the life of the system
Remote	D	Unlikely, but can reasonably be expected to occur in the life of the system
Improbable	E	Unlikely, but possible to occur in the life of the system.

Table A-3. Risk Assessment Code Matrix

Hazard Probability (Frequency) Category	Hazard Severity (Consequence) Category			
	I Catastrophic	II Critical	III Marginal	IV Negligible
A - Frequent	1	1	1	3
B - Probable	1	1	2	3
C - Occasional	1	2	3	4
D - Remote	2	2	3	4
E - Improbable	3	3	3	4

Hazard Risk Index	Risk Assessment Code	Action Required
IA, IB, IC, IIA, IIB, IIIA	1	Unacceptable - immediate corrective action required; Asst. Secretary of Army decision
ID, IIC, IID, IIIB	2	Undesirable - reduced priority, corrective action required; Project Manager NSCM decision
IE, IIE, IIIC, IIID, IIIE, IVA, IVB	3	Acceptable - low priority for corrective action (may not warrant action), System Safety Program Manager decision
IVC, IVD, IVE	4	Acceptable - no corrective action required

Note·

NSCM = Non-Stockpile Chemical Materiel

Source· NSCM SSMP (U S Army 1994)

At PBA, the CWM will be transferred from the UH-1N helicopter to a truck for transport from the helipad to the Pine Bluff Chemical Activity (PBCA) storage facility. The ground transportation route at PBA to the Bond Road Exclusion Area (BREA) is shown in figure A-1. The route from the helipad to the Resource Conservation and Recovery Act (RCRA) interim status storage facility at PBA is entirely within PBA and about 6 miles long on paved roads rated as rural, two-lane except for Doolittle Road which is a hard-packed gravel road. The transport vehicle will travel north on Doolittle Road to Webster Road and West on Webster to Rideout Road. The truck will turn left onto Rideout Road and travel to Avenue 55 where it will turn right. From Avenue 55, it will turn right onto 504 Street and travel to Roemer Road. At Roemer Road it will turn left

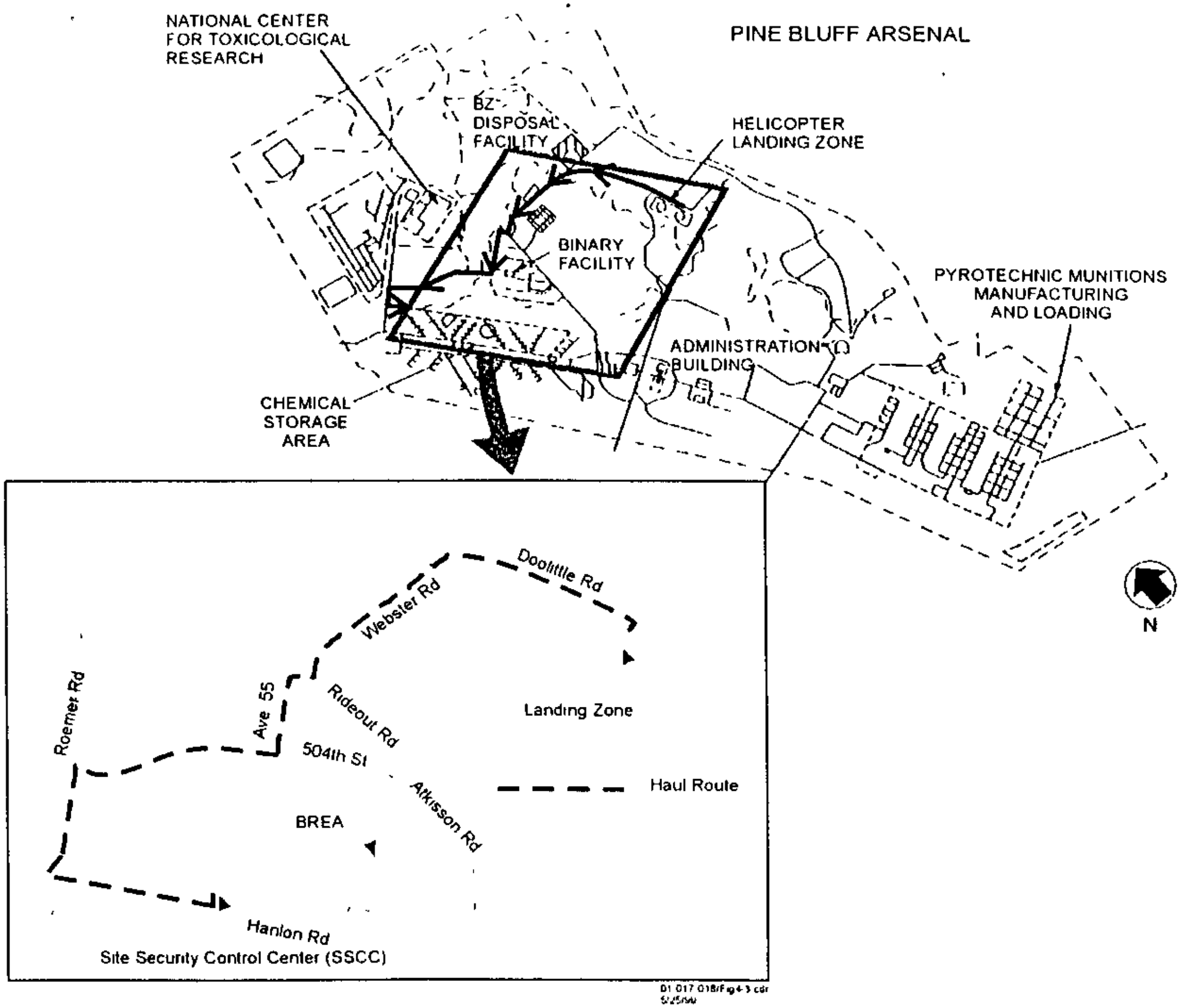

Figure A-1. Pine Bluff Arsenal Transportation Route and travel to Hanlon Road where it will turn left. From Hanlon Road, it will turn left onto Avenue 6251 and travel to the Site Security Control Center for entry into the Bond Road Exclusion Area, site of the storage facility. The probability of an accident on this route for a single trip is 1.55×10^{-7}.

2.1.2 Air Transportation. The Army intends to use one type of aircraft during this mission. The air segment, from the Memphis Depot to the helicopter pad at PBA, will be flown by the UH-1N helicopter.

The UH-1N is a twin engine single rotor helicopter with an excellent safety record. It has a load capacity of 1,000 pounds (in addition to 3 crew, 2 passengers, and 250 pounds of equipment) and a range of 200 nautical miles at a cruising speed of 90 knots (103 miles per hour) and will be flown 135 nautical miles. Sufficient historical data involving UH-1N accidents encompassing A-type accidents, including takeoff and landing accidents, are available to estimate the accident probabilities involving this aircraft. The probability of a crash on landing is 3.8×10^{-6}, while for takeoff the probability is $3\ 8 \times 10^{-6}$. The probability of an in-flight accident for this trip is 6.0×10^{-5}.

The Army's D2PC program has been used in conjunction with the historic data furnished by the Army, Navy, and Air Force Safety Centers to determine the consequences of an accident caused by the hazardous material on board the aircraft.

2.2 Airfield Locations

The Memphis Depot helipad location is a paved parking lot located at Dunn Field near the IHF. The lot will be cleared of all vehicles during transport operations. The proposed helipad location is relatively isolated from the general population with the nearest residence being approximately 300 meters away.

The PBA helipad is located on the east central portion of the Arsenal. The helipad location is relatively isolated from the general population with the nearest residence being approximately 3 miles away.

2.3 Chemical Warfare Materiel Characterization

The exact number and types of items to be transported will not be known until recovery operations are complete. Paragraph 1.4 of this Transportation Plan describes the types of items that might be recovered from the landfill. This HA is based on an example shipment consisting of 39 bottles of known or suspected chemical agent packed in two MRCs 7 x 27. In this example, one MRC contains 13 bottles of distilled mustard (HD) (a total of 1.34 liters of HD). The other MRC contains 17 bottles of sulfur mustard (HS) adsorbed onto charcoal (a total of 0.85 liters of HS) and 9 bottles of lewisite (L) adsorbed onto charcoal (a total of 0.225 liters of L).

Based on this example, the maximum credible event (MCE) was calculated for the evaporative release of 1.34 liters of HD. If the actual quantity or types of items to be transported are markedly different from this example, the MCE distances should be re-calculated using numbers for the actual items to be transported.

2.4 Containment Equipment

Recovered intact CAIS and recovered loose ampules or bottles from CAIS will be packed inside Department of Transportation (DOT)-approved containers called MRCs. Several types of MRCs are available. Figure A-2 illustrates the various MRCs. All MRC types have undergone extensive testing to demonstrate that they meet the packaging criteria set forth by DOT. The MRCs were subjected to tests in accordance with the following standards.

- American Society for Testing and Materials (ASTM) E-499-73 Method A, Helium Leak Testing
- Military Standard (MIL-STD) 453C and MIL-STD 1264B, Radiographic Testing
- Technical Provision 94-01, Transportability Testing

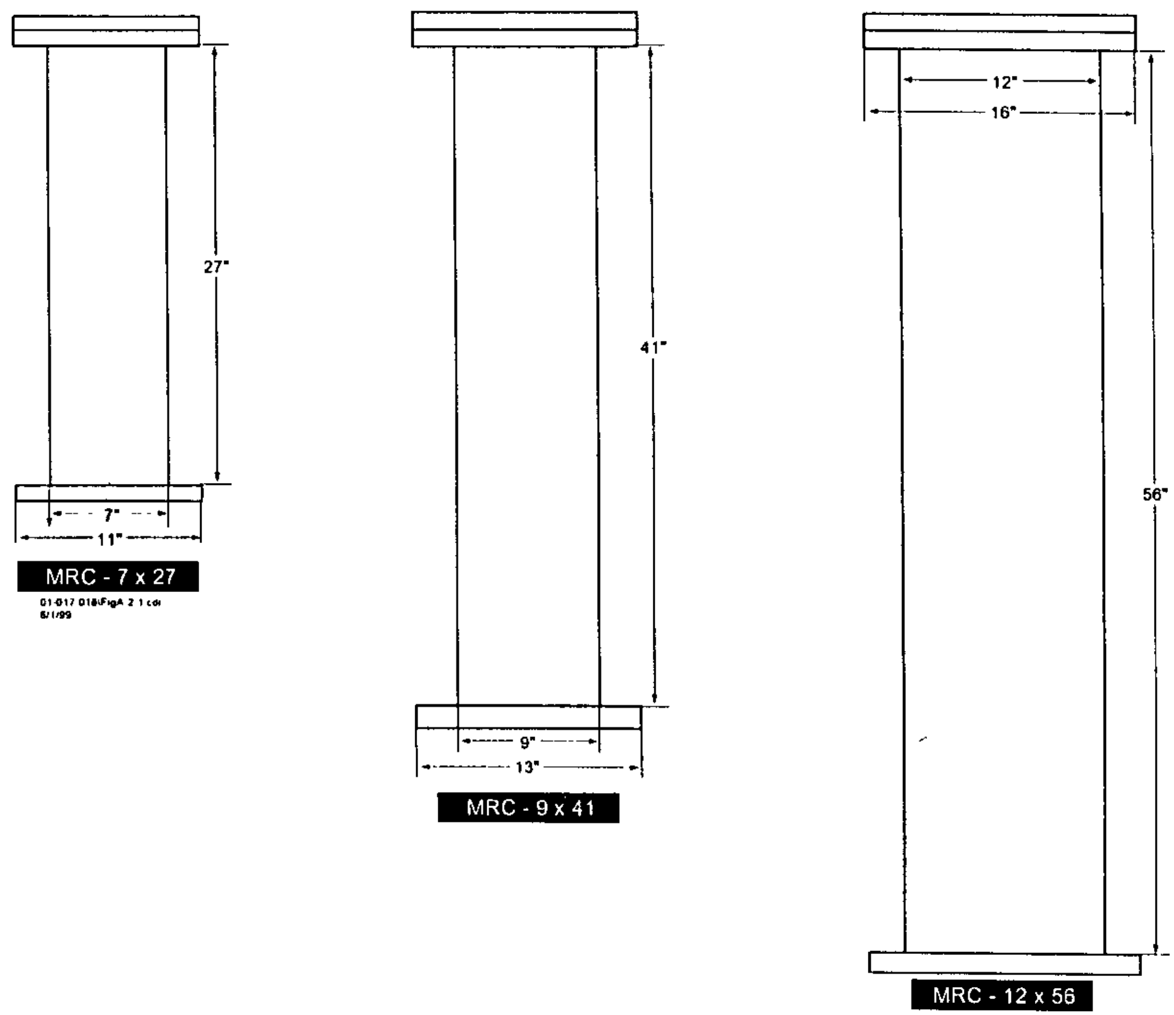

Figure A-2. Multiple Round Containers (Sheet 1 of 2)

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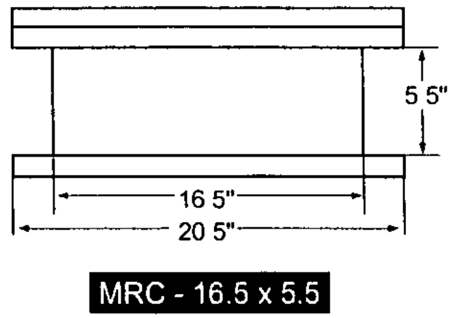

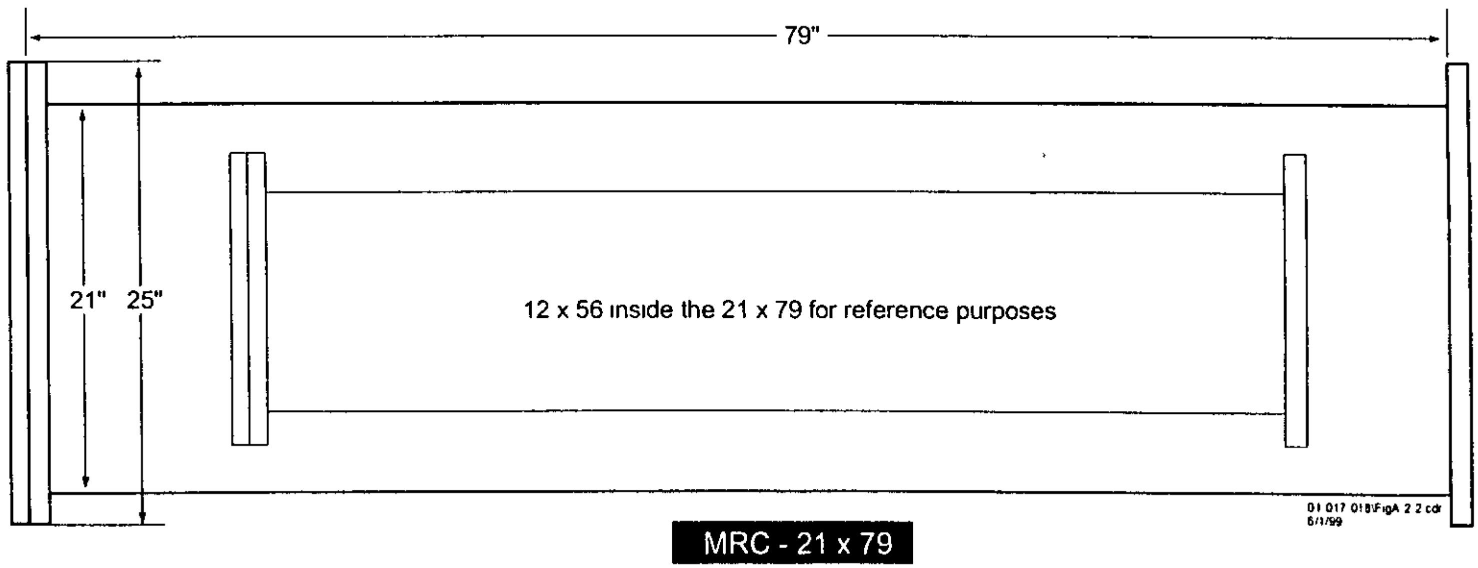

Figure A-2. Multiple Round Containers (Sheet 2 of 2)

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- MIL-STD-810E Method 14.4, Low and High Frequency Tests
- United Nations Performance Oriented Packaging Testing in accordance with 49 Code of Federal Regulations (CFR) Section 178.600
- MIL-STD-1660 Tests, First Article Tests (compression, vibration, drop, and incline plane).

As a result of meeting the requirements of this rigorous testing, all varieties of MRC have been approved by the DOT and the Army for transportation and storage of recovered CWM.

3. HAZARD ANALYSIS

Scenarios have been defined to aid in the evaluation of identified hazards, potential incidents, and accidents. RACs have been assigned based on the combination of the frequency and consequence of identified scenarios as illustrated in tables A-1 through A-3.

3.1 Hazards During Ground Transportation Phases

During the road portion of the transportation, several incidents could occur, such as a truck accident, an earthquake, a lightning strike, or an aircraft striking the truck.. They are discussed in the following paragraphs and summarized in table A-3-1, attachment A-3.

3.1.1 Truck Accidents. Truck accident rate probabilities for the specific road types and distances associated with the transport of CWM from the helipad at PBA to the interim status RCRA-permitted hazardous waste storage facility were calculated and are presented in attachment A-1. Table A-4 lists the ground route segments by road type.

Table A-4. Ground Transportation Route Segments by Road Type

Route Segment	Length (miles)	No. of trips	Type
PBA Helipad to RCRA Interim Storage Facility Doolittle Road	1.0	1	Two-lane rural, unimproved gravel
Webster Road to BREA gate	5.0	1	Two-lane rural, paved

Notes

BREA = Bond Road Exclusion Area
PBA = Pine Bluff Arsenal
RCRA = Resource Conservation and Recovery Act

The accident probability for a single trip for ground transportation as a result of truck accidents is 1.55×10^{-7} for the entire transport. It is assumed in this plan that one trip will be required to transport the CWM to the PBCA storage facility at PBA. The consequences of a truck accident are judged to be catastrophic (severity category I). The probability of such an accident occurring is judged to be improbable (probability category E). Thus, a RAC 3 is assigned to this event.

The cargo truck transporting the recovered CWM could have an accident. Possible mitigation to avoid an accident includes using an experienced driver, driving in clear weather, closing roads, limiting access to roads used, escorting the vehicle, and performing preventive maintenance on the truck. Vehicle speed will be limited to 25 miles per hour (20 percent less than the test speed of the MRC), and an escort vehicle will be used. These mitigators will reduce the hazard consequence to marginal (hazard severity category III) and result in a controlled RAC 3.

3.1.2 Earthquakes. There is the possibility that an earthquake could occur during a ground transportation segment, which could cause excessive bumping of the truck, resulting in damage to the overpacking and possible leakage of agent. Leakage of agent is automatically considered to be a catastrophic (severity category I) accident, but since the frequency of an earthquake during transport is considered improbable (probability category E), the resulting RAC is a 3. Mitigation for such a contingency includes securing the overpacks in the truck using wooden braces as well as tie-down straps to minimize the probability of the overpacks moving about. The mitigations reduce the consequence to critical (severity category II) thus resulting in a controlled RAC 3.

3.1.3 Aircraft Strikes Truck. It is possible that the truck could be struck by an aircraft. If the truck were struck by an aircraft, the overpacks could be breached, resulting in agent release. The frequency of an aircraft striking the cargo truck is considered to be improbable (probability category E), with a catastrophic consequence (severity category I) giving this event a RAC 3. Trucks used to move CWM from the helipads will not approach the landing pad until after the aircraft has landed. This will result in a controlled RAC 3.

3.1.4 Lightning Strike. The possibility of lightning striking the truck was considered. This could result in a fuel fire that could breach an overpack and release agent. Lightning striking the vehicle is considered to be improbable (probability category E), with a catastrophic consequence (severity category I) giving this event a RAC 3. Transport will occur only during clear weather. In addition, the truck will have at least one functioning all-purpose fire extinguisher available. These mitigators result in a controlled RAC 3.

3.1.5 Slow Leak of Chemical Agent. Liquid leaks from the overpacks are possible but unlikely The consequences of a slow leak are judged to be critical (hazard severity II) and are judged to be improbable (probability category E). Therefore, a RAC 3 is assigned. Overpacks have sufficient volume to contain any liquid that spills into them from leaking CWM. U.S. Army Technical Escort Unit (TEU) personnel are trained for spill response and are onsite in the event that a leak from an overpack is detected. If an overpack should leak, any significant vapor leaks would be detected by low-level, near real-time monitoring equipment. Implementation of low-level, near real-time monitoring will result in a controlled RAC 3.

3.1.6 Dropping of an Overpack. One of the most likely events to occur is the dropping of an overpack while loading or unloading the truck or aircraft. This hazard is considered to be critical (severity category II), but improbable (probability category E), and is assigned a RAC 3. Even if an overpack were dropped, the agent would be absorbed by the cushioning material. Drop testing of MRCs indicates that there is little chance of one being breached by the short drop that could occur during loading or unloading operations. Use of a forklift will minimize the lifting that the loaders must do to place overpacks in the truck. Implementation of this mitigator results in a controlled RAC 3.

3.1.7 Handling Hazards. Physical hazards that do not involve the release of agent also exist. The possibility of physical injury to workers is greatest in a situation where a worker is caught between two objects (pinch points), or for back, hand, or foot injuries

a. *Pinching Injuries.* When loading CWM onto the truck, the area will be relatively open, so that the probability of being caught between a vehicle and a stationary object is low. Pinching injuries are judged to be critical (hazard severity category II) and remote (probability category D), resulting in a RAC 2. When loading materiel to or from an IHF or aircraft, the leader should ensure that the truck is not backed within 5 feet of the IHF, storage facility, or aircraft. Use of a ground guide and installation of a backup alarm on the truck will reduce the possibility of a worker being trapped between the truck and the IHF, storage facility, or aircraft. Implementation of these mitigators, as called for in the transportation plan, results in a hazard which is improbable (probability category E), but critical (severity category II), resulting in a controlled RAC 3.

b. *Physical Hazards.* Back, hand, and foot injuries are judged to be critical (severity category II), and remote (probability category D), resulting in a RAC 2. Workers should wear leather gloves to reduce the severity of injuries to hands caused by pinching between containers, and workers should wear safety shoes to reduce injuries in the event that an overpack is dropped. Workers should be given refresher training in proper lifting techniques to avoid back injuries. Mechanical lifting aids should be used when necessary. Implementation of these mitigators as called for in the transportation plan results in a hazard which is improbable (probability category E), but critical (severity category II), resulting in a controlled RAC 3.

3.2 Aircraft Accidents

The Army, Navy, and Air Force Safety Centers provided a great deal of historical aircraft accident data that was used to determine the RAC of a crash in this report. Attachment A-2 is a summary of the accident data and is based on accident statistics reported by Bayley (Bayley, 1998). Aircraft hazards are summarized in table A-3-2, attachment A-3.

The air transportation consists of flying the CWM by UH-1N helicopter from the Memphis Depot to the CWM helipad at PBA. The 135-mile trip gives an in-flight accident probability point estimate of 6.0×10^{-5}. The single trip involves a takeoff and landing, which each have estimated accident probabilities of 3.8×10^{-6}. The probability of an accident for one trip from the Memphis Depot to the PBCA storage facility at PBA is 6.7×10^{-5}. The consequences of an UH-1N accident are judged to be catastrophic (severity category I). The probability of such an accident occurring is judged to be improbable (likelihood category E). Thus, a RAC 3 is assigned to this event. Flying from the Memphis Depot to PBA will occur in good weather. Also, extensive preventive maintenance checks and services will be performed before the flight. These mitigations will result in a controlled RAC 3.

3.2.1 Lightning Striking a Helicopter. The possibility of lightning striking the UH-1N helicopter was considered. This could result in an accident breaching the overpacks and resulting in agent release. Lightning striking the helicopter is considered to be improbable (probability category E), but catastrophic (severity category I), resulting in a RAC 3. It is recommended that flights be made only by veteran pilots during good weather Implementation of this mitigation results in a controlled RAC 3.

3.2.2 Leak of Multiple Round Container Without Accident. If an overpack were to leak, but with a release that did not result in an accident, the consequence would be critical (severity category II), but the frequency is improbable (probability category E). This would result in a RAC 3. Bracing and tie-down straps will be used to secure the overpacks onboard. This mitigator will result in a controlled RAC 3.

3.2.3 Leak of Multiple Round Container With Accident. All CWM recovered from the Memphis Depot will be overpacked in an MRC. CWM that is leaking when recovered will be decontaminated and sealed prior to placement in an overpack. Although the CWM could leak or break during transportation, CWM could only be released if the overpack is improperly sealed. The possibility of an overpack leaking during air transportation should be considered; however, tests of the overpacks demonstrated their ruggedness. Agent release in an aircraft is considered to be improbable, but were the release sufficient to incapacitate the crew and result in an accident, the consequence would be catastrophic (severity category I), but improbable (probability category E). This would result in a RAC 3. Bracing and tie-down straps will be used to secure the overpacks onboard. This mitigator will result in a controlled RAC 3.

Other mishaps that can occur during the air phase of the transportation include loading and handling mishaps described earlier in the ground portion of the assessment. A summary of the above hazards is provided in table A-5.

A potential occurrence unique to the air phase involves fueling of the aircraft. The potential for a fire is greatest during fueling and refueling operations; however, no refueling should be required.

4. MAXIMUM CREDIBLE EVENT

The MCE, as defined by Army Regulation (AR) 385-61, is the "worst-case" single accident scenario that results in the release of chemical agent and has a reasonable probability of occurrence The MCE was determined to be an aircraft accident without

Table A-5. Assigned RACs for Postulated Accident Scenarios

Item	Accident Scenario	RAC	Controlled RAC
	Ground Transportation		
1	Truck accident results in damage to overpacks and leaking of agent	3	3
2	Earthquake damages overpack causing agent release	3	3
3	Aircraft strikes truck, breaching the overpack, resulting in agent release	3	3
4	Lightning strike on truck causes fire and agent release	3	3
5	Leaking of overpacked CWM container with improper sealing	3	3
6	Dropping of overpack during loading/unloading operations	3	3
7	Pinching between containers resulting in worker being trapped	2	3
8	Physical hazards result in injuries to back, hands, and feet	2	3
	Air Transportation		
1	Crash of UH-1N helicopter	3	3
2	Lightning striking an aircraft resulting in agent release	3	3
3	Agent release from leaking overpack without an accident	3	3
4	Agent release from leaking overpack resulting in an accident	3	3
5	Physical hazards resulting in injuries to back, hands, or feet	2	3
6	Dropping container resulting in leak within the container	3	3

Notes

CWM = chemical warfare materiel
RAC = risk assessment code

a fire, resulting in evaporative release of all the agent from an MRC containing 13 K941 CAIS bottles of HD (1.34 liters of HD).

The D2PC code (Whitacre et al., 1987) was used to evaluate the potential consequences of the MCE. Meteorological data: mixing height, windspeed and direction, and temperature conditions were obtained from the U.S. Environmental Protection Agency's SCRAM bulletin board service. The "no deaths" distance is conservatively estimated at 6 meters; the "no effects" distance is 84 meters for daylight meteorological conditions. The hazard distances are summarized in table A-6.

Table A-6. D2PC Results for Various Releases

Agent/Amount (liters)	Release Type	Location	No Deaths Distance (m)	No Effects Distance (m)
HD/1 34	EVP	Memphis Depot	6	84
HD/1 34	Flash Fire	Memphis Depot	MDNA	MDNA
HD/1 34	EVP	PBA	6	84
HD/1 34	Flash Fire	PBA	MDNA	MDNA

Notes

EVP = evaporation
m = meter
MDNA = minimum dose not attained
PBA = Pine Bluff Arsenal

D2PC Parameters

Evaporative release -
WND = 3 m/s
PRESS* = 760 mm Hg
HML* = 750 m
TMP = 25°C
TEV = 60 min
SUR = CON
STB = D

Flash fire release -
HRL @ DDMT (UH-1N) = 2×10^9 cal. with full tank
HRL @ PBA (UH-1N) = 2×10^8 cal. with 10% of full tank
SEA = SUM
TMP = 25°C

* Applies to the Memphis Depot

Flash fire heat releases calculated by Science Applications International Corporation, Calc. Note SAF-452-95-0053, May 1995

No effects are predicted for releases accompanied by fire because some of the released agent would be consumed in the fire and the extreme heat from the fire would cause the plume to rise to a high altitude, where it would disperse significantly before returning to ground level. Essentially, the agent concentration downwind of the release is zero until the plume returns to ground level. By the time the plume touches ground, it has dispersed so much that concentrations have dropped below harmful levels.

5. MITIGATION OF HAZARDS

Throughout the report, as possible events and mishaps have been described, mitigating actions have been recommended. Tables A-3-1 and A-3-2 in attachment A-3 summarize the transportation events, possible mishaps, hazards associated with the mishap, and mitigating measures that can be taken. In addition, the following paragraphs offer some general information on mitigating hazards associated with transporting CWM.

The ability to fly over relatively unpopulated areas will greatly reduce the potential hazard to personnel. Routes should be carefully picked to minimize possible population exposure. In addition, constant radio contact with the ground should be maintained so that an accident can be mitigated quickly and personnel given maximum early warning if they need to evacuate an area.

The flight should be planned to coincide with all daylight hours and for a forecast of sunny weather. This combination maximizes the possibility of the air stability being considered unstable and, in turn, minimizes the hazard associated with agent release if an accident occurs.

6. CONCLUSIONS

Historical data provide a realistic assessment of the probability of an accident involving a vehicle carrying hazardous material. When used in conjunction with a hazard predictor such as D2PC, a useful estimate of the extent of hazard can be made. This analysis used available accident data for the UH-1N helicopter that is planned to be used in transporting the CWM. Takeoffs and landings present the greatest hazard. The use of the UH-1N and the short duration of the trip minimize the number of takeoffs and landings to one each, which minimizes overall risk.

The total carrier (truck and aircraft) accident probability is calculated as 6.7×10^{-5} (table A-7) for the transport of recovered CWM from the Memphis Depot IHF to the PBCA storage facility at PBA. This probability includes one flight of the UH-1N, and one trip for ground transportation at PBA. According to USACMDA, 1994, this probability is improbable (probability category E), but an accident could have catastrophic impact (severity category I), resulting in a RAC 3 for the transportation hazard probability.

The transportation of CWM by truck and aircraft can be safely performed given the mitigation steps outlined in this report.

For this event, the MCE was computed to be an evaporative release of 1.34 liters of HD following an aircraft crash at the Memphis Depot or PBA without a fire. The "no deaths" distance is conservatively estimated at 6 meters, the "no effects" distance is 84 meters for daylight meteorological conditions.

Table A-7. Total Accident Probability for Route from the Memphis Depot to PBA

Route Segment	Number of Trips	Accident Probability per Trip (incl. landing and takeoff)	Total Probability
Memphis Depot to PBA by UH-1N helicopter	1	6.7×10^{-5}	6.7×10^{-5}
Total Truck Transport			1.55×10^{-7}
Total Probability for transportation of CWM from the helipad at the Memphis Depot to the storage at PBA			6.7×10^{-5}

Notes:

CWM = chemical warfare materiel
IHF = interim holding facility
PBA = Pine Bluff Arsenal

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ATTACHMENT A-1
DERIVATION OF TRUCK ACCIDENT RATES

ATTACHMENT A-1
DERIVATION OF TRUCK ACCIDENT RATES

This attachment presents a derivation of truck accident rates for the specific road types to be used for transporting CWM from the helipad at PBA to the RCRA interim status storage facility, about 6 miles. These accident rates are derived by modifying published highway truck accident rate data to account for situation-specific factors. The modifications are made on the basis of analyst judgment and supplementary accident data. This approach is taken because no published accident rate data are available for most of the road types encountered along the chosen transport route and because the published highway truck accident rates reflect average conditions — generally better road surfaces than those encountered along the chosen routes but less-stringent controls on traffic, speed, driver training, and other factors. A similar analysis approach has previously been used for CWM transport and successfully defended (Rhyne, et al., 1985 and 1988)

The truck accident rate data used as a basis for this analysis are described in paragraph A-1.1. An analysis of the factors that affect accident rates and the development of adjusted rates for use in this HA are presented in paragraph A-1.2. In paragraph A-1.3, the adjusted accident rates are coupled with mileage estimates for the chosen transport routes to estimate the probability of a truck accident during the movement of CWM.

A-1.1 Truck Accident Rates By Highway Class

Truck accident rates have been compiled as a function of road type and surrounding population by various researchers since the early 1980s. The most widely cited values are those published by Harwood and Russell (1990). These rates are presented in table A-1-1. More recently published data were reviewed for this analysis; however, the

Table A-1-1. Truck Accident Rates by Highway Class

Highway Class		Truck Accident Rate (accidents/mile)
Area Type	Roadway Type	
Rural	Two-lane	2.19×10^{-6}
Rural	Multilane, undivided	4.49×10^{-6}
Rural	Multilane, divided	2.15×10^{-6}
Rural	Freeway	6.40×10^{-7}
Urban	Two-lane	8.66×10^{-6}
Urban	Multilane, undivided	1.39×10^{-5}
Urban	Multilane, divided	1.25×10^{-5}
Urban	One-way street	9.70×10^{-6}
Urban	Freeway	2.18×10^{-6}

Source Harwood and Russell (1990)

Harwood and Russell data are judged to be the best available. The "base" accident rate used in this analysis is the value for two-lane, rural roads, 2.19×10^{-6} accidents per mile. Approximately 1.0 miles of the transportation route on PBA will be on a two-lane, rural gravel road known as Doolittle Road. Since the Harwood and Russell data do not include this road type, it was considered conservative to estimate the accident rate for this type of road at twice that of the paved two-lane rural road.

A-1.2 Modification of Accident Rates

A partial listing of the factors that are believed to affect truck accident rates is shown in table A-1-2 (Harwood and Russell, 1990). Data are lacking to correlate accident rate with most of these factors. In addition, some of these factors (for example, time of day and type of truck) are constant for all portions of the chosen ground transportation routes.

Table A-1-2. Partial Listing of Factors Considered to Affect Truck Accident Rates

Truck Type or Configuration	Highway
Number of trailers	Function
Number of axles on tractor/trailer(s)	Access control
Cab type	Number of lanes
Cargo area configuration	Lane width
	Shoulder width
Truck Size and Weight	Shoulder surface
Width of trailer	Median width
Length, overall	Horizontal alignment
Length, trailer(s)	Vertical alignment
Empty/loaded	Surface condition (wet/dry/etc.)
Weight, gross	Pavement condition
Weight, trailer	Pavement type
Truck Operations	Traffic
Cargo type	Volume (average daily traffic)
Operator type	Volume (day/night)
Trip type	Percent trucks
Truck Driver	Environment
Age	Visibility
Experience with rig	Weather
Hours of service	Light
Driver condition	
	Temporal Factors
Location	Month/season of year
State	Day of week
Urban/rural	Time of day

Source Harwood and Russell (1990)

Fractional distributions of truck accidents by type are shown in table A-1-3 for the average conditions reflected in the published accident rates (column 2); modified distributions that reflect the effects of various administrative controls and physical factors are also presented in this table (columns 3 through 6). The modified fractional distributions shown in the table reflect the cumulative effect of the listed factors, moving from left to right across the table. For example, the distribution shown for operation-specific factors also includes the effects of safe drivers. The effects of these administrative controls and physical factors on the accident type distribution and on accident rate are described in the following paragraphs.

Effects of Safe Drivers. TEU personnel who will operate the pickup truck and escort vehicles are highly trained. Their training enables them to identify, handle, decontaminate, and monitor for CWM. They have security clearances and are enrolled in the Chemical Personnel Reliability Program. They have passed a physical examination as required by the Motor Carrier Safety Regulations. Their training includes en route procedures, routing to avoid heavily populated areas, accountability, load limitations, vehicle maintenance standards, and cargo-specific handling procedures. Before movement of any CWM, TEU personnel ensure that the vehicle maintenance documentation is current, inspect the transportation documentation, and inspect the loading of the CWM cargo. The vehicle will have a driver and one assistant. The commander has the responsibility of ensuring that both are alert. Each vehicle will proceed slowly along the entire course.

The TEU's safety practices are comparable to those of commercial trucking firms that emphasize a good safety culture. Trucking firms that strongly emphasize safety can achieve a factor of 10 reduction in accident rate (Anonymous, 1990; Anonymous, 1994; Wilson, 1990; U S Congress, Office of Technology Assessment, 1988). Truck drivers who reduce their overall accident rate do so primarily by reducing the number of accidents for which they are at fault and to a lesser extent by lowering the accident rates of other truck and car drivers by driving defensively. A driver has much more control over single-vehicle accidents than multiple-vehicle accidents; safe drivers cannot always prevent other drivers from causing multiple-vehicle accidents.

Table A-1-3. Truck Accident Type Distributions

	Fractional Distribution				
Tractor-Trailer Accident Type	Base Case	With Safe Drivers Considered	With Operation-Specific Factors Considered	With Escort Considered	With Road Closure Considered
Noncollision					
• Ran off road	0 062	0 00062	0 00012	0.00008	0 00008
• Jackknife	0 077	0 00077	0 00000	0 00000	0 00000
• Overturn	0 072	0 00072	0 00014	0 00009	0 00009
• Separation of units	0 004	0 00004	0 00000	0 00000	0 00000
• Fire	0 006	0 00006	0 00001	0.00001	0 00001
• Other	0.009	0 00009	0.00002	0 00001	0 00001
Collision					
• Fixed object	0 114	0 0014	0 00023	0 00015	0 00015
• Parked vehicle	0 093	0 00093	0 00019	0 00013	0 00013
• Train	0 005	0 00005	0.00000	0 00000	0.00000
• Nonmotorist (e g , pedestrian)	0 015	0 00015	0 00000	0 00000	0 00000
• Other	0 034	0 00034	0 00007	0 00005	0 00005
Multiple-Vehicle Accidents					
• Head-on collision	0 015	0 00280	0 00056	0 00028	0 00002
• Rear-end collision	0 133	0 02490	0 00498	0 00249	0 00025
• Sideswipe	0 185	0 03460	0 00692	0 00346	0.00017
• Angle	0 103	0 01930	0 00386	0 00193	0 00010
• Other	0 070	0 01310	0 00262	0 00131	0 00006
TOTAL	0 997	0 09960	0 01972	0 00999	0 00102
New Reduction Factor	1	10	50	100	977

Source Harwood and Russell (1990)

The second column of table A-1-3 shows the fractional distribution of accident types for average truck drivers, and the third column of this table shows the estimated distribution of accident types for safe drivers (that is, those who achieve a factor of 10 reduction in accident rate). Because safe driving practices are most effective in lowering the rate of single-vehicle accidents, the distribution in the third column was obtained by:
(1) lowering the fraction of single-vehicle accident types by a factor of 100 and
(2) lowering the fractions of multiple-vehicle accident types such that the overall accident rate reduction factor is 10, as reported in the literature. Mathematically, this procedure is expressed as follows.

$$\frac{A}{100} + \frac{B}{X} = \frac{0.997}{10}$$

where:

A = Fraction of single-vehicle accidents

B = Fraction of multiple-vehicle accidents

X = Reduction factor to be determined for multiple-vehicle accidents.

Values of A and B are obtained from the second column of table A-1-3. Application of this model yields an accident rate reduction factor of 5.34 for multiple-vehicle accidents.

Effects of Operation-Specific Factors. The following factors are expected to produce an additional factor of 5 reduction in accident rate for all accident types.

- Transport of CWM will only occur in good weather.
- Transport of CWM will only occur during daylight hours.
- Trips will be short, which will minimize boredom and fatigue.
- Line-of-sight conditions along the chosen route will be excellent.

- Drivers of vehicles with CWM cargo will be expected to be even more cautious than typical safe commercial truck drivers.

- The TEU's management is more effective than the management of the average trucking firm.

Train collisions are not considered to be credible along the chosen routes because the hazard frequency of railroad crossings is negligible and the only railroad tracks crossed are seldom used.

The net results of these considerations is an additional factor of 5 reduction in accident rate. The combination of safe drivers and these operation-specific factors can be expected to reduce the accident rate by a factor of 50 below the published value for two-lane, rural roads.

Effects of Escorting the Cargo Truck. An escort vehicle will precede the cargo truck during ground transportation of CWM. The escort vehicle is expected to be marked with warning signs Oncoming traffic will not be stopped, and same-direction passing will not be prohibited. The presence of the escort vehicle will alert drivers of other vehicles, thus reducing the rate of multiple-vehicle collisions by a factor of at least 2.

The escort vehicle will also reinforce safe driving requirements on the driver of the cargo vehicle; therefore, the rate of single-vehicle collisions is expected to be reduced by an additional factor of 1.5 The overall effect of escorting on the estimated accident rate is a factor of 2 reduction above the reductions achieved by safe driving and operation-specific factors. The cumulative effect of the global factors (safe drivers, operation-specific factors, and escorting) is then a factor of 100 reduction in accident rate, leading to a modified rate of 2.19×10^{-8} accidents per mile.

Effects of Closing Roads. The rate of most multiple-vehicle accidents could be reduced by an additional factor of 20 by closing the roads along the chosen routes to all other traffic during the CWM transfers. Such accidents would not be completely eliminated because of the possibility of persons ignoring road closure signs and barricades. The rate of rear-end collisions would only be reduced by an estimated factor of 10 by this action because the escort vehicle could be involved in a rear-end collision with the cargo truck. Single-vehicle accident rates would not be reduced by closing roads.

Road closure is not planned for transportation on PBA.

A-1.3 Route Segment-Specific Factors

PBA Ground Transportation. The ground transportation route segments by road type at PBA are described in table A-4. The route from the PBA Helicopter Landing Zone to the Chemical Storage Area is completely within the confines of PBA. The ground transportation route is as follows. Doolittle Road to Webster, Webster to Rideout Road, Rideout Road to Avenue 55, Avenue 55 to 504 Street, 504 Street to Roemer Road, Roemer Road to Hanlon Road, Hanlon Road to Avenue 6251, and from Avenue 6251 to the Site Security Control Center (SSCC). The two-lane paved portion of the route is 5.0 miles in length, and the two-lane gravel portion is 1.0 miles in length. The estimated accident rate for the paved roads to be used on PBA is 2.19×10^{-8}. Because Doolittle Road is an unimproved gravel road, an accident rate twice that calculated for the two-lane rural road was used.

A-1.4 Summary

The modified accident rates and accident probabilities for ground transportation routes are provided in table A-1-4. The product of the accident rate and the total mileage for a segment is used to compute the accident probability for a given segment. The probability for each segment is summed to give the total accident probability for the entire transport operation.

Table A-1-4. Modified Accident Rates and Accident Probabilities for Ground Transportation Routes

Route Segment	Accident Rate (per mile)	Segment Length (miles)	Accident Probability per Trip	Number of Trips	Accident Probability
Doolittle Road	$4\ 38 \times 10^{-8}$	1 0	$5\ 26 \times 10^{-8}$	1	$5\ 26 \times 10^{-8}$
Webster Road to BREA Gate	$2\ 19 \times 10^{-8}$	5 0	$1\ 03 \times 10^{7}$	1	1.03×10^{7}
Total Ground Transportation Accident Probability					$1\ 55 \times 10^{-7}$

Note

BREA = Bond Road Exclusion Area

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ATTACHMENT A-2
AIRCRAFT ACCIDENT DATA

ATTACHMENT A-2
AIRCRAFT ACCIDENT DATA

The accident data received from the respective service safety centers are summarized in table A-2-1. Table A-2-1 is a breakout of aircraft accident data compared with total number of hours flown. Statistics for the UH-1N are summarized in this table. The resulting accident rates for the in-flight portion include A-type accidents (property damage greater than or equal to $1,000,000, or a personal injury or illness resulting in death or permanent total disability), including takeoff and landing crash probabilities for A-type flights.

None of the Safety Centers furnished information regarding the role that weather played in the accidents nor the maintenance effects. For this reason, it is expected that the actual probabilities for accidents during this operation are actually lower than reported in the tables.

Table A-2-1. Flight Statistics for Transport Aircraft

Aircraft	In-Flight Rate	Distance (miles)	Accident Probability	Landing Probability	Takeoff Probability	Total Single-Trip	No of Trips	Total Probability
UH-1N	$4\ 4 \times 10^{-7}$	135	$6\ 0 \times 10^{-5}$	$3\ 8 \times 10^{-8}$	$3\ 8 \times 10^{-6}$	$6\ 7 \times 10^{-5}$	1	6.7×10^{-5}

ATTACHMENT A-3

TRANSPORTATION RISK ASSESSMENT HAZARD ANALYSIS

Table A-3-1. Ground Transportation Risk Assessment Hazard Analysis

Item	Hazardous Condition	Cause	Effect	RAC	Recommendation	Resolution	Controlled RAC
1	Truck accident	Single-vehicle accident	Personal injury; damage to overpacks; release of agent	3 (IE)	Use qualified drivers	Qualified drivers will be used	3 (IIIE)
2	Truck accident	Earthquake	Damage to overpack, leakage of agent	3 (IE)	Secure overpacks	Limit vehicle speed, secure cargo to vehicle	3 (IIIE)
3	Truck accident	Aircraft crash	Personal injury, release of agent	3 (IE)	Wait for helicopter to land before entering helipad	Helicopter will land before CWM truck enters helipad.	3 (IIIE)
4	Truck accident	Lightning	Fuel fire, release of agent	3 (IE)	Perform operations during clear weather, equip vehicle with fire extinguisher	Execute road movements during clear weather only.	3 (IIIE)
5	Leak of overpack	Improper seal	Release of agent	3 (IIE)	TEU trained in spill response.	Implement NRT monitoring	3 (IIIE)
6	Dropping of overpack	Improper handling	Inner container leaks, outside container remains intact	3 (IIE)	Use proper lifting techniques.	Provide handling equipment	3 (IIIE)
7	Pinching	Caught between vehicle and a stationary object	Personal injury	2 (IID)	Truck should not be backed within 5 ft. of IHF or aircraft	Use ground guide, install backup alarm.	3 (IIE)
8	Physical hazards	Pinching between containers	Back, hand, or foot injuries	2 (IID)	Use gloves and safety shoes.	Use proper techniques; provide mechanical lifting aids.	3 (IIE)

Notes:

CWM = chemical warfare materiel
IHF = interim holding facility
NRT = near real-time
PINS = portable isotopic neutron spectroscopy
RAC = risk assessment code
TEU = U S Army Technical Escort Unit

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Table A-3-2. Air Transportation Risk Assessment Hazard Analysis

Item	Hazardous Condition	Cause	Effect	RAC	Recommendation	Resolution	Controlled RAC
1	UH-1N accident	In-flight, takeoff, landing difficulty from the Memphis Depot to PBA	Agent release	3 (IE)	Use expert pilots; perform extensive maintenance prior to operations.	Execute mission only during favorable weather conditions; use veteran pilots.	3 (IE)
2	Aircraft accident	Lightning strike	Agent release	3 (IE)	Use expert pilots, fly during good weather; use braces and tie-downs on overpacks	Execute mission only during favorable weather conditions, use veteran pilots.	3 (IE)
3	Agent release within aircraft	Leaking overpack	Injury with no accident	3 (IIE)	Secure overpacks with tie-downs	Secure overpacks with tie-downs.	3 (IIE)
4	Agent release within aircraft	Leaking overpack	Injury to crew resulting in accident	3 (IE)	Secure overpacks with tie-downs.	Secure overpacks with tie-downs.	3 (IE)
5	Physical hazards	Pinching between containers	Back, hand, or foot injury	2 (IID)	Use gloves and safety shoes	Use proper handling techniques	3 (IIE)
6	Dropping container	Improper handling	Agent leak within container	3 (IIE)	Use proper lifting techniques.	Provide handling equipment	3 (IIIE)

Notes:

PBA = Pine Bluff Arsenal
RAC = risk assessment code

ANNEX B

CHEMICAL AND PHYSICAL DATA

Table Annex B-1. Chemical and Physical Properties of Chemical Agents of Concern

Chemical Name	Levinstein Mustard (H) 70% bis(2 –Chloroethyl) sulfide 30% Higher Molecular Weight Polysulfides	Distilled Mustard (HD) Diethyl, 2,2-dichloride sulfide (bis(2-Chloroethyl) sulfide)	Lewisite (L) Dichloro (2-chlorovinyl) arsine
Chemical Formula	$C_4H_8Cl_2S$	$C_4H_8Cl_2S$	$C_2H_2AsCl_3$
Molecular Weight	159 08 (pure mustard)	159 08	207 32
Physical State	Amber to brown oily liquid	Pale yellow oily liquid	Colorless to brownish liquid
Vapor Density (relative to air)	Generally exceeds 5 5	5.5	7 2
Liquid Density	1 27 g/mL @ 25°C	1.27 g/mL @ 25°C	1 89 g/mL @ 20°C
Solid Density	N/A	Crystal, 1 37 g/cm^3 @ 0°C	N/A
Normal Freezing Point	8°C	14 45°C	-18°C $\pm$ 0 1°C
Boiling Point	Decomposes at about 180°C	217°C extrapolated	190°C
Vapor Pressure	Impurities tend to lower vapor pressure below 0 11 mm Hg	0 11 mm Hg @ 25°C	0.394 mm Hg @ 20°C
Volatility	Approximately 920 mg/m^3 @ 25°C (reported for HD)	610 mg/m^3 @ 20°C 920 mg/m^3 @ 25°C	4,480 mg/m^3 @ 20°C
Viscosity	3 95 centistokes @ 25°C (HD)	3 95 centistokes @ 25°C	2 05 centipoise @ 77°F
Solubility	0.092 g/100 g H_2O @ 22°C. Completely soluble in acetone, CCL_4, CH_3Cl tetrachloroethane, ethyl benzoate, and ether Completely soluble in 92 5% ethanol above 28 6°C.	0 092 g/100 g H_2O @ 22°C Completely soluble in acetone, CCL_4, CH_3Cl tetrachloroethane, ethyl benzoate, and ether. Completely soluble in 92.5% ethanol above 28.6°C	Insoluble in water and dilute mineral acids Soluble in organic solvents and oils Miscible with other chemical warfare agents.
Heat of Combustion	4,500 cal/g	756 03 kcal/mole	N/A

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Table Annex B-1. Chemical and Physical Properties of Chemical Agents of Concern (Continued)

Chemical Name	Levinstein Mustard (H) 70% bis(2 –Chloroethyl) sulfide 30% Higher Molecular Weight Polysulfides	Distilled Mustard (HD) Diethyl, 2,2-dichloride sulfide (bis(2-Chloroethyl) sulfide)	Lewisite (L) Dichloro (2-chlorovinyl) arsine
Latent Heat of Vaporization	94 cal/g	94 cal/g	58 cal/g
Latent Heat of Fusion	26 5 cal/g	26 5 cal/g	Unknown
Special Properties			
Flash Point	105°C	105°C (Can be ignited by large explosive charges)	Does not flash
DOT Classification	Poison A	Poison A	Poison A
Corrosivity	Brass rapidly corroded. Cast iron poor.	Brass rapidly corroded @ 65°C; 0 0001 inch/month @ 65°C on steel	None if dry
Decontaminants	Bleaching powder, sodium hypochlorite	Bleaching powder, sodium hypochlorite, fire	Bleach powder, sodium hypochlorite, fire, caustic soda
Stabilizers Commonly Used	Can be stabilized with acridine or naphthoquinoline	Can be stabilized with acridine or naphthoquinoline	

Notes.

cal/g = calorie per gram
DOT = Department of Transportation
g = gram
g/cm^3 = gram per cubic centimeter
g/mL = gram per milliliter
kcal = kilocalorie
mg/m^3 = milligram per cubic meter
mm Hg = millimeters of mercury
N/A = not available

ANNEX C

MATERIAL SAFETY DATA SHEETS

ANNEX C
MATERIAL SAFETY DATA SHEETS

The following pages provide examples of Material Safety Data Sheets (MSDS) for the chemical agents discussed in this document. Preference was given to Department of Army data sheets prepared by the Edgewood Research, Development and Engineering Center; in the absence of such data, other information, such as the manufacturer's MSDS, Occupational Health Services MSDS, and printouts from the Hazardous Substances Database are provided. For chemicals with little available MSDS data, namely Levinstein mustard (H), portions of the Department of the Army Special Report EO-SR-7400, Chemical Agent Data Sheets, are provided.

H (Levinstein Mustard)

Department of the Army, Special Report EO-SR-74001, Chemical Agent Data Sheets, Volume 1, pp 29-31, December 1974.

HD (Distilled Sulfur Mustard)

Edgewood Research, Development and Engineering Center Material Safety Data Sheet, 28 February 1996.

L (Lewisite)

Edgewood Research, Development and Engineering Center Material Safety Data Sheet, 27 March 1996.

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1. Chemical Code or EA Number: H

2. Chemical Name: Levinstein Mustard. Composed of about 70% Bis (2-chloroethyl) sulfide and 30% of usually higher MW polysulfides.

3. Chemical Formulae:

   a. Empirical.

   b. Structural.

4 - 17. Most Levinstein H consists of about 70% pure H with about 30% of polysulfides. The percent of pure H in Levinstein H varies from sample to sample and therefore no specific data can be given on its colligative properties.

   The biological properties of H are similar to those given for HD (q.v.).

18. Molecular Weight: Average MW varies with purity, but is generally higher than that of pure mustard (159.08).

19. Purity Range (average):

   a. Laboratory Sample.

   b. Plant Sample. 64 to 69 wt%.

20. Physical Appearance: Amber to dark brown liquid.

21. Vapor Density, Relative to Air: Varies with MW, generally exceeds value for HD of 5.5.

22. Liquid Density: 1.27 g/ml 0 25° C; fairly constant, independent of product purity.

23. Solid Density:

   a. Bulk Density. Not applicable.

   b. Crystal Density. Not applicable.

Levinstein Mustard

24. Normal Freezing Point or Melting Point: approx. 8° C.

25. Boiling Point: Varies with product composition; decomposes around 130° C.

26. Vapor Pressure :

    No general value since vapor pressure varies with purity of sample. High molecular weight impurities of H tend to lower vapor pressure below 0.11 torr reported for HD.

27. Volatility: approx. 920 mg/m^3 @ 25° C (reported for HD).

28. Viscosity: See HD.

29. Flash Point: 105° C.

30. Autoignition Temperature: Unknown.

31. Latent Heat of Vaporization: In the range of 94 cal/g reported for HD.

32. Latent Heat of Fusion: See HD.

33. Vapor-Air-Explosive Hazard Range: Not available.

34. Relative Persistency:

    a. Soil. Persistent.

    b. Surface (Wood, Methal, Masonry, Rubber, Paint).

    c. Water. Persistent due to low solubility.

35. Solubility: Similar to HD.

36. Thermal Decomposition Rate (half-life): See HD.

37. Heat of Combustion: 4500 cal/g (calculated from bomb calorimetry for products given in Item 38).

38. Products of Combustion: CO_2, Cl_2, H_2O, H_2SO_4, HCl (bomb calorimetry).

39. Rate of Hydrolysis: See HD.

40. Hydrolysis Products: See HD.

41. Corrosive Properties: Brass rapidly corroded; cast iron poor.

42. Detection Methods and Equipment:

Spotted Disk (SD) Test, Dragendorff Test.

For Liquid: ABCM8 detector paper; M6A1 detector paper.
For Vapor: M15A2, M18A2, M19 kits
(DB-3 Test, blue band detector tube)

43. Decontaminants:

a. Personnel. Flush eyes with H_2O. Protective ointment M1, M5 ointment; M13 kit (liquid on skin). M13 Kit - outer clothing. Shower with soap and water.

b. Equipment. Bleaching powder, DANC, DS2, sodium hypochlorite, fire.

c. Areas. Terrain: Aeration. STB slurry applied by M9 or M12A1 decontaminating apparatus.

44. DOT Classification: Poison A.

45. Stabilizer Utilized:

a. Laboratory Sample. See HD.

b. Production Sample.

46. Types of Containers Required for Storage:

a. RDT&E Quantities. Glass.

b. Stockpile Quantities. One-ton containers, 55-gallon steel drums, steel cylinders.

47. Q-D Classification: 3
Compatability Group: A
Chemical Group: A

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MATERIAL SAFETY DATA SHEET

DISTILLED MUSTARD (HD)

POISON

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SECTION I - GENERAL INFORMATION

DATE: 22 September 1988
REVISED: 28 February 1996

MANUFACTURER'S ADDRESS:

U.S. ARMY CHEMICAL BIOLOGICAL DEFENSE COMMAND
EDGEWOOD RESEARCH DEVELOPMENT, AND ENGINEERING CENTER (ERDEC)
ATTN: SCBRD-ODR-S
ABERDEEN PROVING GROUND, MD 20101-5423

Emergency telephone #' s: 0700-1630 EST: 410-671-4411/4414
After: 1630 EST: 410- 278-5201, Ask for Staff Duty Officer

CAS REGISTRY NUMBERS: 505-60-2, 39472-40-7, 68157-62-0

CHEMICAL NAME:

Bis-(2-chloroethyl)sulfide

TRADE NAMES AND SYNONYMS:

Sulfide, bis (2-chloroethyl)
Bis(beta-chloroethyl)sulfide
1,1'-thiobis(2-chloroethane)
1-chloro-2(beta-chloroethylthio)ethane
Beta, beta'-dichlorodiethyl sulfide
2,2'dichlorodiethyl sulfide
Di-2-chloroethyl sulfide
Beta, beta'-dichloroethyl sulfide
2,2'-dichloroethyl sulfide
H, HD; HS
Iprit
Kampstoff "Lost"; Lost
Mustard Gas

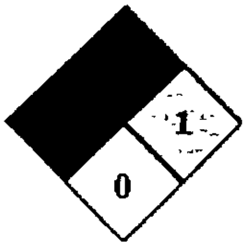
S-Lost; S-yperite; Schewefel-lost
Senfgas
Sulfur mustard; Sulphur mustard gas
Yellow Cross Liquid
Yperite
Y

CHEMICAL FAMILY: Chlorinated sulfur compound

FORMULA/CHEMICAL STRUCTURE:
C4H8Cl2S

$$ClCH_2CH_2-S-CH_2CH_2Cl$$

NFPA 704 HAZARD SIGNAL:



Health - 4
Flammability - 1
Reactivity - 1
Special - 0

SECTION II - HAZARDOUS INGREDIENTS

INGREDIENTS NAME	FORMULA	PERCENTAGE BY WEIGHT	AIRBORNE EXPOSURE LIMIT (AEL)
Sulfur Mustard	C4H8Cl2S	100	0.003 mg/m3

SECTION III - PHYSICAL DATA

BOILING POINT: 422 F 217 C

VAPOR PRESSURE (mm Hg):

0.072 mm Hg @ 20 C
0.11 mm Hg @ 25 C

VAPOR DENSITY (AIR=1): 5.5

SOLUBILITY IN WATER: Negligible. Soluble in fats and oils, gasoline, kerosene, acetone, carbon tetrachloride, alcohol, tetrachloroethane, ethylbenzoate, and ether. Miscible with the organophosphorus nerve agents.

SPECIFIC GRAVITY (H2O=1): 1.27 @ 20 C

FREEZING POINT: 14 45 C

LIQUID DENSITY (g/cc):

1.268 @ 25 C
1.27 @ 20 C

PERCENTAGE VOLATILE BY VOLUME:

610 mg/m3 @ 20 C
920 mg/m3 @ 25 C

APPEARANCE AND ODOR: Normally amber to black colored liquid with garlic or a horseradish odor. Water clear if pure. The odor threshold for HD is 0.6 mg/m3 (.0006 mg/L).

SECTION IV - FIRE AND EXPLOSION DATA

FLASHPOINT : 105 C (Can be ignited by large explosive charges)

FLAMMABILITY LIMITS (% by volume): Unknown

EXTINGUISHING MEDIA: Water, fog, foam, CO_2. Avoid use of extinguishing methods that will cause splashing or spreading of HD.

SPECIAL FIRE FIGHTING PROCEDURES: All persons not engaged in extinguishing the fire should be immediately evacuated from the area. Fires involving HD should be contained to prevent contamination to uncontrolled areas. When responding to a fire alarm in buildings or areas containing agents, firefighting personnel should wear full firefighter protective clothing (without TAP clothing) during chemical agent firefighting and fire rescue operations. Respiratory protection is required. Positive pressure, full face piece, NIOSH-approved self-contained breathing apparatus (SCBA) will be worn where there is danger of oxygen deficiency and when directed by the fire chief or chemical accident/incident (CAI) operations officer. In cases where firefighters are responding to a chemical accident/incident for rescue/reconnaissance purposes they will wear appropriate levels of protective clothing (See Section VIII).

Do not breathe fumes. Skin contact with agents must be avoided at all times. Although the fire may destroy most of the agent, care must still be taken to assure the agent or contaminated liquids do not further contaminate other areas or sewers. Contact with the agent liquid or vapor can be fatal.

SECTION V - HEALTH HAZARD DATA

AIRBORNE EXPOSURE LIMIT (AEL): The AEL for HD is 0.003 mg/m3 as found in "AR 40-173, Occupational Health Guidelines for the Evaluation and Control of Occupational Exposure to Mustard Agents H, HD, HT." To date, the Occupational Safety and Health Administration (OSHA) has not promulgated a permissible exposure concentration for HD.

EFFECTS OF OVEREXPOSURE. HD is a vesicant (causing blisters) and alkylating agent producing cytotoxic action on the hematopoietic (blood-forming) tissues which are especially sensitive. The rate of detoxification of HD in the body is very slow and repeated exposures produce a cumulative effect. HD has been found to be a human carcinogen by the International Agency for Research on Cancer (IARC)

Median doses of HD in man are:
LD50 (skin) = 100 mg/kg ICt50 (skin) = 2000 mg-min/m3 at 70 - 80 F (humid environment)
= 1000 mg-min/m3 at 90 F (dry environment)

ICt50 (eyes) = 200 mg-min/m3

ICt50 (inhalation) = 1500 mg-min/m3 (Ct unchanged with time)

LD50 (oral) = 0.7 mg/kg

Maximum safe Ct for skin and eyes are 5 and 2 mg-min/m3, respectively.

ACUTE PHYSIOLOGICAL ACTION OF HD IS CLASSIFIED AS LOCAL AND SYSTEMIC.

LOCAL ACTIONS. HD effects both the eyes and the skin. SKIN damage occurs after percutaneous absorption. Being lipid soluble, HD can be absorbed into all organs. Skin penetration is rapid without skin irritation. Swelling (blisters) and reddening (erythema) of the skin occurs after a latency period of 4-24 hours following the exposure, depending on degree of exposure and individual sensitivity. The skin healing process is very slow. Tender skin, mucous membrane and perspiration-covered skin are more sensitive to the effects of HD. HD's effect on the skin, however, is less than on the eyes. Local action on the eyes produces severe necrotic damage and loss of eyesight Exposure of eyes to HD vapor or aerosol produces lacrimation, photophobia, and inflammation of the conjunctiva and cornea.

SYSTEMIC ACTIONS: Occurs primarily through inhalation and ingestion. The HD vapor or aerosol is less toxic to the skin or eyes than the liquid form. When inhaled, the upper respiratory tract (nose, throat, tracheae) is inflamed after a few hours latency period, accompanied by sneezing, coughing, and bronchitis, loss of appetite, diarrhea, fever, and apathy. Exposure to nearly lethal doses of HD can produce injury to bone marrow, lymph nodes, and spleen as showed by a drop in white blood cell count, thus resulting in increased susceptibility to local and systemic infections. Ingestion of HD will produce severe stomach pains, vomiting, and bloody stools after a 15-20 minute latency period.

CHRONIC EXPOSURE : HD can cause sensitization, chronic lung impairment, (cough, shortness of breath, chest pain), cancer of the mouth, throat, respiratory tract and skin, and leukemia. It may also cause birth defects.

EMERGENCY AND FIRST AID PROCEDURES:

INHALATION: Hold breath until respiratory protective mask is donned. Remove from the source IMMEDIATELY. If breathing is difficult, administer oxygen. If breathing has stopped, give artificial respiration. Mouth-to-mouth resuscitation should be used when approved mask-bag or oxygen delivery systems are not available. Do not use mouth-to-mouth resuscitation when facial contamination exits. Seek medical attention IMMEDIATELY.

FIRST AID

EYE CONTACT: Speed in decontaminating the eyes is absolutely essential Remove the person from the liquid source, flush the eyes immediately with water for at least 15 minutes by tilting the head to the side, pulling the eyelids apart with the fingers and pouring water slowly into the eyes Do not

575 339

cover eyes with bandages but, if necessary, protect eyes by means of dark or opaque goggles. Transfer the patient to a medical facility **IMMEDIATELY.**

SKIN CONTACT: Don respiratory protective mask. Remove the victim from agent sources immediately. Immediately wash skin and clothes with 5% solution of sodium hypochlorite or liquid household bleach within one minute. Cut and remove contaminated clothing, flush contaminated skin area again with 5% sodium hypochlorite solution, then wash contaminated skin area with soap and water. Seek medical attention **IMMEDIATELY.**

INGESTION: Do not induce vomiting. Give victim milk to drink. Seek medical attention **IMMEDIATELY.**

SECTION VI - REACTIVITY DATA

STABILITY: Stable at ambient temperatures. Decomposition temperature is 149 C to 177 C. Mustard is a persistent agent depending on pH and moisture, and has been known to remain active for up to three years in soil.

INCOMPATIBILITY: Rapidly corrosive to brass @ 65 C. Will corrode steel at a rate of .0001 in. of steel per month @ 65 C.

HAZARDOUS DECOMPOSITION: Mustard will hydrolyze to form HCl and thiodiglycol.

HAZARDOUS POLYMERIZATION: Does not occur.

SECTION VII - SPILL, LEAK, AND DISPOSAL PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED: If spills or leaks occur, only personnel in full protective clothing will remain in the area (**See Section VIII**). In case of personnel contamination **See Section V** for emergency and first aid instructions.

RECOMMENDED FIELD PROCEDURES: The HD should be contained using vermiculite, diatomaceous earth, clay or fine sand and neutralized as soon as possible using copious amounts of 5.25% sodium hypochlorite solution. Scoop up all material and clothing and place in a approved DOT container. Cover the contents of the container with decontaminating solution as above. The exterior of the container will be decontaminated and labeled according with EPA and DOT regulations. All leaking containers will be over packed with vermiculite placed between the interior and exterior containers. Decontaminate and label in accordance with EPA and DOT regulations. Dispose of the material in accordance with waste disposal methods provided below. Dispose of the decontaminate according to Federal, state and local regulations. Conduct general area monitoring with an approved monitor to confirm that the atmospheric concentrations do not exceed the airborne exposure limits (**See Sections II and VIII).**

If 5.25 % sodium hypochlorite solution is not available then the following decontaminants may be used instead and are listed in the order of preference: Calcium Hypochlorite, contamination Solution No. 2 (DS2), and Super Tropical Bleach Slurry (STB).

WARNING. Pure, undiluted calcium hypochlorite will burn on contact with liquid HD.

RECOMMENDED LABORATORY PROCEDURES: A minimum of 65 grams of decon solution per gram of HD is allowed to agitate for a minimum of one hour. Agitation is not necessary following the first hour if a single phase is obtained. At the end of 24 hours, the resulting solution will be adjusted to a pH between 10 and 11. Test for presence of active chlorine by use of acidic potassium iodide solution to give free iodine color Place 3 ml of the decontaminate in a test tube. Add several crystals of potassium iodine and swirl to dissolve. Add 3 ml of 50 wt.% sulfuric acid:water and swirl. IMMEDIATE iodine color shows the presence of active chlorine. If negative, add additional 5.25% sodium hypochlorite solution to the decontamination solution, wait two hours, then test again for active chlorine. Continue procedure until positive chlorine is given by solution. A 10 wt.% calcium hypochlorite (HTH) mixture may be substituted for sodium hypochlorite. Use 65 grams of decon per gram of HD and continue the test as described for sodium hypochlorite. Scoop up all material and clothing and place in a approved DOT container. Cover the contents of the container with decontaminating solution as above. The exterior of the container will be decontaminated and labeled according with EPA and DOT regulations. All leaking containers will be over packed with vermiculite placed between the interior and exterior containers. Decontaminate and label in accordance with EPA and DOT regulations. Dispose of the material in accordance with waste disposal methods provided below. Dispose of the decontaminate according to Federal, state and local regulations. Conduct general area monitoring with an approved monitor to confirm that the atmospheric concentrations do not exceed the airborne exposure limits **(See Section VIII).**

NOTE: Surfaces contaminated with HD, then rinse and decontaminated may evolve sufficient HD vapor to produce a physiological response. HD on laboratory glassware may be oxidized by its vigorous reaction with concentrated nitric acid.

CAUTION
CHEMICAL STORAGE

WASTE DISPOSAL METHOD: Open pit burning or burying of HD or items containing or contaminated with HD in any quantity is prohibited. Decontamination of waste or excess material will be accomplished according to the procedures outlined above can be destroyed by incineration in EPA approved incinerators according to appropriate provisions of Federal, State and local Resource Conservation Recovery Act (RCRA) regulations.

NOTE: Some states define decontaminated surety material as a RCRA hazardous waste.

SECTION VIII - SPECIAL PROTECTION INFORMATION

RESPIRATORY PROTECTION:

CONCENTRATION	RESPIRATORY PROTECTIVE EQUIPMENT
< 0.003 mg/m3	A full face piece, chemical canister, air purifying protective mask will be on hand for escape. (The M9-, M17-, or M40-series masks are acceptable for this purpose. Other masks certified as equivalent may be used)
> 0.003 mg/m3	A NIOSH/MSHA approved pressure demand full face piece SCBA suitable for use in high agent concentrations with protective ensemble (See DA PAM 385-61 for examples)

VENTILATION:

Local Exhaust: Mandatory. Must be filtered or scrubbed. Air emissions will meet local, state and federal regulations.

Special: Chemical laboratory hoods will have an average inward face velocity of 100 linear feet per minute (lfpm) +/- 10% with the velocity at any point not deviating from the average face velocity by more than 20%. Existing laboratory hoods will have an inward face velocity of 150 lfpm +/- 20%. Laboratory hoods will be located such that cross drafts do not exceed 20% of the inward face velocity. A visual performance test using smoke producing devices will be performed in assessing the ability of the hood to contain agent HD.

Other: Recirculation of exhaust air from agent areas is prohibited. No connection between agent area and other areas through the ventilation system are permitted. Emergency backup power is necessary. Hoods should be tested semiannually or after modification or maintenance operations. Operations should be performed 20 centimeters inside hoods.

PROTECTIVE GLOVES: Butyl Rubber Gloves M3 and M4 Norton, Chemical Protective Glove Set

EYE PROTECTION: As a minimum, chemical goggles will be worn. For splash hazards use goggles and face shield.

OTHER PROTECTIVE EQUIPMENT: For laboratory operations, wear lab coats, gloves and have mask readily accessible. In addition, daily clean smocks, foot covers, and head covers will be required when handling contaminated lab animals.

MONITORING: Available monitoring equipment for agent HD is the M8/M9 detector paper, blue band tube, M256/M256A1 kits, bubbler, Depot Area Air Monitoring System (DAMMS), Automated Continuous Air Monitoring System (ACAMS),CAM-M1, Hydrogen Flame Photometric Emission Detector (HYFED), the Miniature Chemical Agent Monitor (MINICAM), and Real Time Analytical Platform (RTAP).

Real-time, low-level monitors (with alarm) are required for HD operations. In their absence, an Immediately Dangerous to Life and Health (IDLH) atmosphere must be presumed. Laboratory operations conducted in appropriately maintained and alarmed engineering controls require only periodic low-level monitoring.

SECTION IX - SPECIAL PRECAUTIONS

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING: When handling agents, the buddy system will be incorporated. No smoking, eating, or drinking in areas containing agents is permitted. Containers should be periodically inspected for leaks, (either visually or using a detector kit). Stringent control over all personnel practices must be exercised. Decontaminating equipment will be conveniently placed. Exits must be designed to permit rapid evacuation. Chemical showers, eyewash stations, and personal cleanliness facilities must be provided. Wash hands before meals and shower thoroughly with special attention given to hair, face, neck, and hands using plenty of soap and

water before leaving at the end of the work day .

OTHER PRECAUTIONS: HD should be stored in containers made of glass for Research, Development, Test and Evaluation (RDTE) quantities or one-ton steel containers for large quantities. Agent will be double-contained in liquid and vapor tight containers when in storage.

For additional information see "AR 385-61, The Army Toxic Chemical Agent Safety Program," "DA PAM 385-61, Toxic Chemical Agent Safety Standards," and "AR 40-173, Occupational Health Guidelines for the Evaluation and Control of Occupational Exposure to HD Agents H, HD, and HT."

SECTION X - TRANSPORTATION DATA

FORBIDDEN FOR TRANSPORT OTHER THAN VIA MILITARY (TECHNICAL ESCORT UNIT) TRANSPORT ACCORDING TO 49 CFR 172

PROPER SHIPPING NAME: Poisonous liquids, n.o.s.

DOT HAZARD CLASS: 6.1, Packing Group I, Hazard Zone B

DOT LABEL: Poison

DOT MARKING: Poisonous liquids, n.o.s. Bis-(2-chloroethyl) sulfide UN 2810, Inhalation Hazard

DOT PLACARD: POISON

EMERGENCY ACCIDENT PRECAUTIONS AND PROCEDURES: **See Sections IV, VII and VIII.**

PRECAUTIONS TO BE TAKEN IN TRANSPORTATION: Motor vehicles will be placarded regardless of quantity. Drivers shall be given full information regarding shipment and conditions in case of an emergency. AR 50-6 deals specifically with the shipment of chemical agents. Shipment of agents will be escorted in accordance with AR 740-32.

While the Edgewood Research Development, and Engineering Center, Department of the Army believes that the data contained herein are actual and the opinions expressed are those of the experts regarding the results of the tests conducted, the data are not to be taken as a warranty or representation for which the Department of the Army or Edgewood Research Development, and Engineering Center assume legal responsibility. They are offered solely for your consideration, investigation, and verification. Any use of these data and information must be determined by the user to be in accordance with applicable Federal, State, and local laws and regulations.

ADDENDUM A
ADDITIONAL INFORMATION FOR THICKENED HD

TRADE NAME AND SYNONYMS: Thickened HD, THD

HAZARDOUS INGREDIENTS: K125 (acryloid copolymer 5%) is used to thicken HD. K125 is not known to be hazardous except in a finely-divided, powder form.

PHYSICAL DATA: Essentially the same as HD except for viscosity. The viscosity of HD is between 1000 and 1200 centistoke @ 25 C.

FIRE AND EXPLOSION DATA: Same as HD.

HEALTH HAZARD DATA: Same as HD except for skin contact. For skin contact, don respiratory protective mask and remove contaminated clothing IMMEDIATELY. IMMEDIATELY scrape the HD from the skin surface, then wash the contaminated surface with acetone. Seek medical attention IMMEDIATELY.

SPILL, LEAK, AND DISPOSAL PROCEDURES: If spills or leaks of HD occur, follow the same procedures as those for HD, but dissolve THD in acetone before introducing any decontaminating solution. Containment of THD is generally not necessary. Spilled THD can be carefully scraped off the contaminated surface and placed in a fully removable head drum with a high density, polyethylene lining. THD can then be decontaminated, after it has been dissolved in acetone, using the same procedures used for HD. Contaminated surfaces should be treated with acetone, then decontaminated using the same procedures as those used for HD.

NOTE: Surfaces contaminated with THD or HD and then rinse-decontaminated may evolve sufficient HD vapor to produce a physiological response.

SPECIAL PROTECTION INFORMATION: Same as HD.

SPECIAL PRECAUTIONS: Same as HD with the following addition. Handling THD requires careful observation of the "stringers" (elastic, threadlike attachments) formed when the agents are transferred or dispensed. These stringers must be broken cleanly before moving the contaminating device or dispensing device to another location, or unwanted contamination of a working surface will result.

TRANSPORTATION DATA: Same as HD.

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MATERIAL SAFETY DATA SHEET

LEWISITE

SECTION I - GENERAL INFORMATION

DATE: 16 April 1988
REVISED: 27 March 1996

MANUFACTURER'S ADDRESS:

U.S. ARMY CHEMICAL BIOLOGICAL DEFENSE COMMAND EDGEWOOD RESEARCH
DEVELOPMENT, AND ENGINEERING CENTER (ERDEC)
ATTN: SCBRD-ODR-S
ABERDEEN PROVING GROUND, MD 20101-5423

Emergency telephone #' s· 0700-1630 EST: 410-671-4411/4
After: 1630 EST: 410- 278-5201, Ask for Staff Duty Officer

CAS REGISTRY NUMBER: 541-25-3

CHEMICAL NAME:

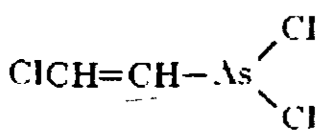
Dichloro-(2-chlorovinyl) arsine

TRADE NAME AND SYNONYMS:

Arsine, (2-chlorovinyl) dichloro-
Arsonous dichloride, (2-chloroethenyl)
Chlorovinylarsine dichloride
2-Chlorovinyldichloroarsine
Beta-Chlorovinyldichloroarsine
Lewisite
L
EA 1034

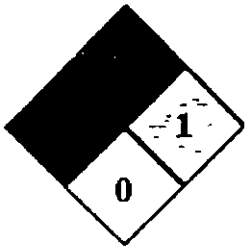
CHEMICAL FAMILY: Arsenical (vesicant)

FORMULA/CHEMICAL STRUCTURE: C2H2AsC13



575 346

NFPA 704 HAZARD SIGNAL:



Health - 4
Flammability - 1
Reactivity - 1
Special - 0

SECTION II - HAZARDOUS INGREDIENTS

INGREDIENTS NAME	FORMULA	PERCENTAGE BY WEIGHT	AIRBORNE EXPOSURE LIMIT (AEL)
Lewisite	C2H2AsCl3	100	* 0.003 mg/m3

* This is a ceiling value

SECTION III - PHYSICAL DATA

BOILING POINT: 374 F 190 C

VAPOR PRESSURE (mm Hg):

0.35 @ 25 C
0.394 @ 20 C

VAPOR DENSITY (AIR=1): 7.1

SOLUBILITY: Insoluble in water and dilute mineral acids. Soluble in organic solvents, oils. and alcohol.

SPECIFIC GRAVITY (H2O=1): 1.88 @ 25 C

FREEZING POINT: 18 C to 0.1 C depending on purity

VOLATILITY: 4,480 mg/m3 @ 20 C

MOLECULAR WEIGHT: 207.32

LIQUID DENSITY: 1.89 at 20 C (Much heavier than Mustard)

APPEARANCE AND ODOR: Pure L is a colorless oily liquid. "War gas" is an amber to dark brown liquid. A characteristic odor is usually geranium-like, very little odor when pure.

SECTION IV - FIRE AND EXPLOSION DATA

FLASHPOINT (Method Used): Does not flash

FLAMMABILITY LIMITS: N/A.

EXTINGUISHING MEDIA: Water, fog, foam, CO2. Avoid use of extinguishing methods that will cause splashing or spreading of L.

SPECIAL FIRE FIGHTING PROCEDURES: All persons not engaged in extinguishing the fire should be evacuated immediately. Fires involving L should be contained to prevent contamination of uncontrolled areas. When responding to a fire alarm in buildings or areas containing agents, firefighting personnel should wear full firefighter protective clothing (Without Tap Clothing) during chemical agent firefighting and fire rescue operations. Respiratory protection is required. Positive pressure, full face piece, NIOSH approved self-contained breathing apparatus (SCBA) will be worn where there is danger of oxygen deficiency and when directed by the fire chief or chemical accident/incident (CAI)operations officer. In cases where firefighters are responding to a chemical accident/incident for rescue/reconnaissance purposes, they will wear appropriate levels of protective clothing **(See Section VIII).**

Do not breathe fumes. Skin contact with agents must be avoided always. Although the fire may destroy most of the agent, care must still be taken to assure the agent or contaminated liquids do not further contaminate other areas or sewers. Contact with the agent liquid or vapor can be fatal.

SECTION V - HEALTH HAZARD DATA

AIRBORNE EXPOSURE LIMITS (AEL): The permissible airborne exposure concentration of L for an 8-hour workday or a 40-hour work week is an 8-hour time weighted average (TWA) of 0.003 mg/m3 as a ceiling value. A ceiling value may not be exceeded anytime. The ceiling value for Lewisite is based upon the present technologically feasible detection limits of 0.003 mg/m3. This value can be found in "DA Pam 40-173, Occupational Health Guidelines for the Evaluation and Control of Occupational Exposure to Mustard H, HD, HT, and L." To date, however, the Occupational Safety and Health Administration (OSHA) has not promulgated permissible exposure concentration for L.

EFFECTS OF OVEREXPOSURE: L is a vesicant (blister agent), also, it acts as a systemic poison, causing pulmonary edema, diarrhea, restlessness, weakness, subnormal temperature, and low blood pressure. In order of severity and appearance of symptoms, it is: a blister agent, a toxic lung irritant, absorbed in tissues, and a systemic poison. When inhaled in high concentrations, may be fatal in as short a time as 10 minutes. L is not detoxified by the body. Common routes of entry into the body include ocular, percutaneous, and inhalation.

TOXICOLOGICAL DATA:

Man:

LCt50 (inhalation, man) = 1200 - 1500 mg min/m3
LCt50 (skin vapor exposure, man) = 100,000 mg min/m3 LDLO (skin, human) = 20 mg/kg
LCt50 (skin, man): >1500 mg/min3. L irritates eyes and skin and gives
warning of its presence. Minimum effective dose (ED min) = 200 mg/m3 (30 min)
ICt50 (eyes, man): < 300 mg min/m3.

Animal:

LD50 (oral, rat) = 50 mg/kg
LD50 (subcutaneous, rat) = 1 mg/kg
LCtLO (inhalation, mouse) = 150 mg/m3 10m
LD50 (skin, dog = 15 mg/kg RTECS) or 38 mg/kg (ERDEC chemical agent data sheets)
LD50 (skin, rabbit) = 6 mg/kg
LD50 (subcutaneous, rabbit) = 2 mg/kg
LD50 (intravenous, rabbit) = 500 mg/kg
LD50 (skin, guineapig) = 12 mg/kg
LD50 (subcutaneous, guinea pig) = 1 mg/kg
LD50 (skin, domestic farm animals) = 15 mg/kg
LCt50 (inhalation, rat) = 1500 mg min/m3 (9 min)
LCt50 (vapor skin, rat) = 20,000 mg min m 25 min)
LCD50 (skin, rat) = 15 - 24 mg/kg
LD50 (ip, dog) = 2 mg/kg
EDmin (skin, dog) = 50 mg/m3 (30 min)
EDmin (eye, dog) = 20 mg/m3 (30 min)
EDmin (skin, rabbit) = 25 mg/m3 (30 min)
EDmin (eye, rabbit) = 1 mg/m3 (30 min)

ACUTE EXPOSURE:

EYES: Severe damage. Instant pain, conjunctivitis and blepharospasm leading to closure of eyelids, followed by corneal scarring and iritis. Mild exposure produces reversible eye damage if decontaminated instantly. More permanent injury or blindness is possible within one minute of exposure.

SKIN: Immediate stinging pain increasing in severity with time. Erythema (skin reddening) appears within 30 minutes after exposure accompanied by pain with itching and irritation for 24 hours. Blisters appear within 12 hours after exposure with more pain that diminished after 2-3 days. Skin burns are much deeper than with HD. Tender skin, mucous membrane, and perspiration covered skin are more sensitive to the effects of lewisite. This, however, is counteracted by L's hydrolysis by moisture, producing less vesicant, higher vapor pressure product.

RESPIRATORY TRACT: Irritating to nasal passages and produces a burning sensation followed by profuse nasal secretion and violent sneezing. Prolonged exposure causes coughing and production of large quantities of froth mucus. In experimental animals, injury to respiratory tracts, due to vapor exposure is similar to mustard's; however, edema of the lung is more marked and frequently accompanied by pleural fluid.

SYSTEMIC EFFECTS: L on the skin, and inhaled vapor may cause systemic poisoning. A manifestation of this is a change in capillary permeability, which permit's loss of sufficient fluid from the bloodstream to cause hemoconcentration, shock and death. In nonfatal cases, hemolysis of erythrocytes has occurred with a resultant hemolytic anemia. The excretion of oxidized products into the bile by the liver produces focal necrosis of that organ, necrosis of the mucosa of the biliary passages with periobiliary hemorrhages, and some injury to the intestinal mucosa. Acute systematic poisoning from large skin burns cause's pulmonary edema, diarrhea, restlessness, weakness, subnormal temperature, and low blood pressure in animals.

CHRONIC EXPOSURE: Lewisite can cause sensitization and chronic lung impairment. Also, by comparison to agent mustard and arsenical compounds, it can be considered as a suspected human carcinogen.

EMERGENCY AND FIRST AID PROCEDURES:

INHALATION: Hold breath until respiratory protective mask is donned. Remove from the source IMMEDIATELY. If breathing has stopped give artificial respiration. Mouth-to-mouth resuscitation should be used when approved maskbag or oxygen system are not available. Do not use mouth-to-mouth resuscitation when facial contamination exists. Seek medical attention IMMEDIATELY.

EYE CONTACT: Speed in decontaminating the eyes is essential. Remove the person from the liquid source, flush the eyes immediately with water for at least 15 minutes tilting the head to the side, pulling eyelids apart with fingers and pouring water slowly into the eyes. Do not cover eyes with bandages, if necessary, protect eyes by means of dark or opaque goggles. Seek medical attention IMMEDIATELY.

SKIN CONTACT: Remove the victim from the source immediately and remove contaminated clothing. Immediately decon affected areas by flushing with 10% sodium carbonate solution or liquid household bleach within one minute. After 3-4 minutes, wash off with soap and water to protect against erythema. Seek medical attention IMMEDIATELY.

INGESTION: Do not induce vomiting. Give victim milk to drink. Seek medical attention IMMEDIATELY.

SECTION VI - REACTIVITY DATA

STABILITY: Stable in steel or glass containers.

INCOMPATIBILITY: Corrosive to steel at a rate of 1 x 10 -5 to 5 x 10-5 in/month at 65 C.

HAZARDOUS DECOMPOSITION PRODUCTS: Reasonably stable; however, in presence of moisture, it hydrolyses rapidly, losing its vesicant property. It also hydrolyses in acidic medium to form HC1 and non-volatile (solid) chlorovinylarsenious oxide, which is less vesicant than Lewisite. Hydrolysis in alkaline medium, as in decontamination with alcoholic caustic or carbonate solution or Decontaminating Agent, DS(DS2), produces acetylene and trisodium arsenate (Na3AS04). Therefore, decontaminated solution would contain toxic arsenic.

SECTION VII - SPILL, LEAK, AND DISPOSAL PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED: Only personnel in full protective clothing (See Section VIII) will be allowed in area where L is spilled. See Section V for emergency and first aid procedures.

RECOMMENDED FIELD PROCEDURES: The L should be contained using vermiculite, diatomaceous earth, clay, or fine sand and neutralized as soon as possible using copious amounts of alcoholic caustic, carbonate, or DS2. Caution must be exercised when using these decontaminates since acetylene will be given off. Household bleach can also be used if accompanied by stirring to allow contact. Scoop up all contaminated material and clothing and place in approved DOT containers. Cover with additional decontaminant. Decontaminate the outside of the container and label according to DOT and EPA requirements. All leaking containers will be over packed with vermiculite placed between interior and exterior containers. Decontaminate and lable according to EPA and DOT regulations. Dispose of as specified below. Dispose of decontaminate according to Federal, State, and local regulations. Conduct general area monitoring with an approved monitor to confirm that the atmospheric concentrations do not exceed the airborne exposure limit (See Sections II and VIII).

RECOMMENDED LABORATORY PROCEDURES: A 10 wt. % alcoholic sodium hydroxide solution is prepared by adding 100 grams of denatured ethanol to 900 grams of 10 wt.% NaOH in water. A minimum of 200 grams of decon is required for each gram of L. The decon/agent solution is agitated for a minimum of one hour. At the end of one hour the resulting pH should be checked and adjusted to above 11.5 using additional NaOH, if required. It is permitted to substitute 10 wt.% alcoholic sodium carbonate made and used in the same ratio as the NaOH listed above. Reaction time should be increased to 3-hours with agitation for the first hour. Final pH should be adjusted to above 10. It is permitted to substitute 5.25% sodium hypochlorite for the 10% alcoholic sodium hydroxide solution above. Allow one hour with agitation for the reaction. Adjustment of the pH is not required. Scoop up all contaminated material and place in an approved DOT container. Cover with additional decontaminant. Decontaminate the outside of the container and label according to DOT and EPA requirements. All leaking containers will be over packed with vermiculite placed between the interior and exterior containers. Decontaminate and label according to EPA and DOT regulations. Dispose of as specified below. Dispose of the decontaminate according to Federal, state, and local regulations. Conduct general area monitoring to confirm that the atmospheric concentrations do not exceed the airborne exposure limit (See Section VIII).

WASTE DISPOSAL METHOD: All neutralized material should be collected and contained for disposal according to land ban RCRA regulations or thermally decomposed in an EPA permitted incinerator equipped with a scrubber that will scrub out the chlorides and equipped with an electrostatic precipitator or other filter device to remove arsenic. Collect all the arsenic dust from the electrostatic precipitator or other filter device and containerize and label according to DOT and EPA regulations. The arsenic will be disposed of according to land ban RCRA regulations. Any contaminated materials or protective clothing should be decontaminated using alcoholic caustic, carbonates, or bleach analyzed to assure it is free of detectable contamination (3X) level. The clothing should then be sealed in plastic bags inside properly labeled drums and held for shipment back to the DA issue point.

NOTE: Some states define decontaminated surety material as an RCRA hazardous waste.

SECTION VIII - SPECIAL PROTECTION INFORMATION

RESPIRATORY PROTECTION:

CONCENTRATION	RESPIRATORY PROTECTIVE EQUIPMENT.
< 0.003 mg/m3	A full face piece, chemical canister, air purifying protective mask will be on hand for escape (The M9-, M17-, or M40-series masks are

	acceptable for this purpose. Other masks certified as equivalent may be used)
> 0.003 mg/m3 or unknown	A NIOSH/MSHA approved, full face piece SCBA suitable for use in high agent concentrations with a protective ensemble. (See DA Pam 385-61)

VENTILATION

Local exhaust: Mandatory. Must be filtered or scrubbed to limit exit concentration to non-detectable level. Air emissions will meet local, state and federal regulations.

Special: Chemical laboratory hoods will have an average inward face velocity of 100 linear feet per minute (lfpm) +/- 10% with the velocity at any point not deviating from the average face velocity by more than 20%. Existing laboratory hoods will have an inward face velocity of 150 lfpm +/- 20%. Laboratory hoods will be located such that cross drafts do not exceed 20% of the inward face velocity. A visual performance test utilizing smoke producing devices will be performed in the assessment of the inclosure's ability to contain Lewisite.

Other: Recirculation of exhaust air from agent areas is prohibited. No connection between agent area and other areas through the ventilation system is permitted. Emergency backup power is necessary. Hoods should be tested semiannually or after modification or maintenance operations. Operations should be performed 20 centimeters inside hoods. Procedures should be developed for disposal of contaminated filters.

PROTECTIVE GLOVES: Norton, Chemical Protective Glove Set, Butyl Rubber Gloves M3 and M4

EYE PROTECTION: As a minimum, chemical goggles will be worn. For splash hazard use goggles and face-shield.

OTHER PROTECTIVE EQUIPMENT: For laboratory operations, wear lab coats, gloves and have a mask readily accessible. In addition, daily clean smocks, foot covers, and head covers will be required when handling contaminated lab animals.

MONITORING: Available monitoring equipment for agent L is the M18A2 (yellow band), bubblers (arsenic and GC method), and M256 & A1 Kits.

Real-time, low-level monitors (with alarm) are required for L operations. In their absence, an Immediately Dangerous to Life and Health (IDLH) atmosphere must be presumed. Laboratory operations conducted in appropriately maintained and alarmed engineering controls require only periodic low-level monitoring.

SECTION IX - SPECIAL PRECAUTIONS

EMERGENCY SHOWER

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING: When handling agents, the buddy system will be incorporated. No smoking, eating, or drinking in areas containing agents is permitted. Containers should be periodically inspected for leaks, either visually or using a detector kit. Stringent control over all personnel handling L must be exercised. Decontaminating equipment will be conveniently placed. Exits must be designed to permit rapid evacuation. Chemical showers, eye wash stations, and personal cleanliness facilities must be provided. Wash hands before meals and shower thoroughly with special attention given to hair, face, neck, and hands, using plenty of soap before leaving at the end of the workday.

OTHER PRECAUTIONS: L should be stored in containers made of glass for Research, DevelopmentTest and Evaluation (RDTE) quantities or one-ton steel containers for large quantities. Agent will be double contained in liquid and vapor tight containers when in storage or during transportation.

For additional information see "AR 385-61, The Army Toxic Chemical Agent Safety Program," "DA Pam 385-61, Toxic Chemical Agent Safety Standards," and "DA Pam 40-173, Occupational Health Guidelines for the Evaluation and Control of Occupational Exposure to Mustard H, HD, HT, and L."

SECTION X - TRANSPORTATION DATA

PROPER SHIPPING NAME: Poisonous liquids, n.o.s.

DOT HAZARDS CLASSIFICATION: 6.1, Packing Group I

DOT LABEL: Poison

DOT MARKING: Poisonous liquids, n.o.s. Dichloro-(2-chlorovinyl)arsine UN 2810

DOT PLACARD: POISON

EMERGENCY ACCIDENT PRECAUTIONS & PROCEDURES: See Sections IV, VII and VIII.

PRECAUTIONS TO BE TAKEN IN TRANSPORTATION: Motor vehicles will be placarded regardless of quantity. Drivers will be given full information regarding shipment and conditions in case of an emergency. AR 50-6 deals specifically with the shipment of chemical agents. Shipment of agents will be escorted according to AR 740-32.

ANNEX D

HAZARDOUS WASTE MANIFEST FORMS AND INSTRUCTIONS AND OTHER TRANSPORTATION FORMS

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ANNEX D

HAZARDOUS WASTE MANIFEST FORMS AND INSTRUCTIONS AND OTHER TRANSPORTATION FORMS

The following pages provide the following forms and instructions to support the transportation and storage of chemical warfare materiel (CWM):

- Hazardous Waste Manifest Forms and Instructions
- DD Form 626 Motor Vehicle Inspection
- The Memphis Depot Site Igloo Inspection Checklist
- DD Form 1911, Materiel Courier Receipt.

BEST AVAILABLE COPY

575 356

STATE OF ARKANSAS
Department of Pollution Control and Ecology
P O Box 8913 Little Rock, Arkansas 72219-8913
Telephone 501-562-7444

1

Form Approved. OMB No. 2050-0039 EXPIRES 9-30-96

Please print or type (Form designed for use on elite (12-pitch) typewriter)

UNIFORM HAZARDOUS WASTE MANIFEST	1. Generator's US EPA ID No.	Manifest Document No.	2. Page 1 of	Information in the shaded areas is not required by Federal law
3. Generator's Name and Mailing Address				A. State Manifest Document Number AR-805033
				B. State Generator's ID
4. Generator's Phone ( )				
5. Transporter 1 Company Name	6. US EPA ID Number			C. State Transporter's ID
				D. Transporter's Phone
7. Transporter 2 Company Name	8. US EPA ID Number			E. State Transporter's ID
				F. Transporter's Phone
9. Designated Facility Name and Site Address	10. US EPA ID Number			G. State Facility's ID
				H. Facility's Phone

11. US DOT Description (Including Proper Shipping Name, Hazard Class, and ID Number)	12. Containers No.	Type	13. Total Quantity	14. Unit Wt/Vol	I. Waste No.
a.					
b.					
c.					
d.					

J. Additional Descriptions for Materials Listed Above

K. Emergency Response Information

If no alternate TSDF, return to generator

15. Special Handling Instructions and Additional Information

16. GENERATOR'S CERTIFICATION: I hereby declare that the contents of this consignment are fully and accurately described above by proper shipping name and are classified, packed, marked, and labeled, and are in all respects in proper condition for transport by highway according to applicable international and national government regulations and Arkansas state regulations.
If I am a large quantity generator, I certify that I have a program in place to reduce the volume and toxicity of waste generated to the degree I have determined to be economically practicable and that I have selected the practicable method of treatment, storage, or disposal currently available to me which minimizes the present and future threat to human health and the environment; OR, if I am a small quantity generator, I have made a good faith effort to minimize my waste generation and select the best waste management method that is available to me and that I can afford.

Printed/Typed Name	Signature	Month Day Year

17. Transporter 1 Acknowledgement of Receipt of Materials

Printed/Typed Name	Signature	Month Day Year

18. Transporter 2 Acknowledgement of Receipt of Materials

Printed/Typed Name	Signature	Month Day Year

19. Discrepancy Indication Space

20. Facility Owner or Operator Certification of receipt of hazardous materials covered by this manifest except as noted in Item 19

Printed/Typed Name	Signature	Month Day Year

GENERATOR — TRANSPORTER — FACILITY

EPA Form 8700-22 (Rev. 9-88) Previous edition is obsolete

NOTICE: THE ORIGINAL AND NOT LESS THAN TWO (2) COPIES MUST MOVE WITH THE HAZARDOUS WASTE SHIPMENT. ONCE DELIVERED, THE TREATMENT/STORAGE/DISPOSAL FACILITY MUST RETURN THIS ORIGINAL COPY TO THE GENERATOR.

BEST AVAILABLE COPY

Appendix I to Section 262 — Uniform Hazardous Waste Manifest and Instructions (Arkansas/EPA Forms 8700-22 and 8700-22A and Their Instructions)

Arkansas/EPA Form 8700-22

Read all instructions before completing this form

This form has been designed for use on a 12-pitch (elite) typewriter; a firm point pen may also be used — press down hard

State and Federal regulations require generators and transporters of hazardous waste and owners or operators of hazardous waste treatment, storage and disposal facilities to use this form (Arkansas/EPA 8700-22) and, if necessary, the continuation sheet (Form 8700 22A) for both inter- and intrastate transportation

State and Federal regulations also require generators and transporters of hazardous waste and owners or operators of hazardous waste treatment, storage and disposal facilities to complete the following information

* * * * *

The following statement must be included with each Uniform Hazardous Waste Manifest, either on the form, in the instructions to the form, or accompanying the form

Public reporting burden for this collection of information is estimated to average 37 minutes for generators, 15 minutes for transporters, and 10 minutes for treatment, storage and disposal facilities. This includes time for reviewing instructions, gathering data, and completing and reviewing the form. Send comments regarding the burden estimate, including suggestions for reducing this burden, to: Chief, Information Policy Branch, PM-223, U S Environmental Protection Agency, 401 M Street SW, Washington, DC 20460, and to the Office of Information and Regulatory Affairs, Office of Management and Budget, Washington, DC 20503

<u>GENERATORS</u>

Item 1 Generator's U.S. EPA ID Number — Manifest Document Number
Enter the generator's U S EPA twelve digit identification number and the unique five digit number assigned to this Manifest (e g , 00001) by the generator

Item 2 Page 1 of ——
Enter the total number of pages used to complete this Manifest, i e , the first page (Arkansas/EPA Form 8700-22) plus the number of Continuation Sheets (EPA Form 8700-22A), if any

Item 3 Generator's Name and Mailing Address
Enter the name and mailing address of the generator. The address should be the location that will manage the returned Manifest forms

Item 4 Generator's Phone Number
Enter a telephone number where an authorized agent of the generator may be reached in the event of an emergency

Item 5 Transporter 1 Company Name
Enter the company name of the first transporter who will transport the waste

Item 6. U.S. EPA ID Number
Enter the U S EPA twelve digit identification number of the first transporter identified in item 5

Item 7 Transporter 2 Company Name
If a second transporter is used during this shipment, enter the company name of the second transporter who will transport the waste. If more than two transporters are used to transport the waste, use a Continuation Sheet(s) (EPA Form 8700-22A) and list the transporters in the order they will be transporting the waste

Item 8. U.S. EPA ID Number
If applicable, enter the U S EPA twelve digit identification number of the second transporter identified in item 7

Note If more than two transporters are used, enter each additional transporter's company name and U S EPA twelve digit identification number in items 24-27 on the Continuation Sheet (EPA Form 8700 22A). Each Continuation Sheet has space to record two additional transporters. Every transporter used between the generator and the designated facility must be listed

Item 9 Designated Facility Name and Site Address
Enter the company name and site address of the facility designated to receive the waste listed on this Manifest. The address must be the site address, which may differ from the company's mailing address

Item 10 U.S EPA ID Number
Enter the U S EPA twelve digit identification number of the designated facility identified in item 9

Item 11 U.S DOT Description [Including Proper Shipping Name, Hazard Class, and ID Number (UN/NA)]
Enter the U S DOT Proper Shipping Name, Hazard Class, and ID Number (UN/NA) for each waste as identified in 49 CFR 171 through 177

Note If additional space is needed for waste descriptions, enter these additional descriptions in item 28 on the Continuation Sheet (EPA Form 8700 22A)

Item 12 Containers (No and Type)
Enter the number of containers for each waste and the appropriate abbreviation from Table I (below) for the type of container

Table I - Types of Containers

DM = Metal drums, barrels, kegs	DW = Wooden drums, barrels, kegs
DF = Fiberboard or plastic drums, barrels, kegs	TP = Tanks portable
TT = Cargo tanks (tank trucks)	TC = Tank cars
DT = Dump truck	CY = Cylinders
CM = Metal boxes, cartons, cases (including roll-offs)	CW = Wooden boxes, cartons, cases
CF = Fiber or plastic boxes, cartons, or cases	BA = Burlap, cloth, paper or plastic bags

Item 13 Total Quantity
Enter the total quantity of waste described on each line

Item 14. Unit (Wt/Vol.)
Enter the appropriate abbreviation from Table II (below) for the unit of measure

Table II — Units of Measure

G = Gallons (liquids only)	P = Pounds
T = Tons (2000 lbs)	Y = Cubic yards
L = Liters (liquids only)	K = Kilograms
M = Metric tons (1000 kg)	N = Cubic meters

Item 15. Special Handling Instructions and Additional Information
Generators may use this space to indicate special transportation, treatment, storage, or disposal information or Bill of Lading information States may not require additional, new, or different information in this space For international shipments, generators must enter in this space the point of departure (City and State) for those shipments destined for treatment, storage, or disposal outside the jurisdiction of the United States

Item 16. Generator's Certification
The generator must read, sign (by hand), and date the certification statement If a mode other than highway is used, the word "highway" should be lined out and the appropriate mode (rail, water, or air) inserted in the space below If another mode in addition to the highway mode is used, enter the appropriate additional mode (e g , and rail) in the space below

Primary exporters shipping hazardous wastes to a facility located outside of the United States must add to the end of the first sentence of the certification the following words "and conforms to the terms of the EPA Acknowledgment of Consent to the shipment "

In signing the waste minimization certification statement, those generators who have not been exempted by statute or regulation from the duty to make a waste minimization certification under section 3002(b) of RCRA are also certifying that they have complied with the waste minimization requirements

Generators may preprint the words "On behalf of" in the signature block or may hand write this statement in the signature block prior to signing the generator certifications

Note All of the above information except the handwritten signature required in item 16 may be preprinted

* * * * *

__TRANSPORTERS__

Item 17. Transporter 1 Acknowledgement of Receipt of Materials
Enter the name of the person accepting the waste on behalf of the first transporter That person must acknowledge acceptance of the waste described on the Manifest by signing and entering the date of receipt

Item 18. Transporter 2 Acknowledgement of Receipt of Materials
Enter, if applicable, the name of the person accepting the waste on behalf of the second transporter That person must acknowledge acceptance of the waste described on the Manifest by signing and entering the date of receipt

Note International Shipments — Transporter Responsibilities

Exports — Transporters must sign and enter the date the waste left the United States in item 15 of Form 8700-22

Imports — Shipments of hazardous waste regulated by RCRA and transported into the United States from another country must upon entry be accompanied by the U S EPA Uniform Hazardous Waste Manifest Transporters who transport hazardous waste into the United States from another country are responsible for completing the Manifest (40 CFR 263 10(c)(1))

__OWNERS AND OPERATORS OF TREATMENT, STORAGE, OR DISPOSAL FACILITIES__

Item 19. Discrepancy Indication Space
The authorized representative of the designated (or alternate facility's owner or operator must note in this space any significant discrepancy between the waste described on the Manifest and the waste actually received at the facility

Owners and operators of Arkansas facilities should contact the Department for information on State Discrepancy Report requirements

Item 20. Facility Owner or Operator: Certification of Receipt of Hazardous Materials Covered by This Manifest Except as Noted in Item 19
Print or type the name of the person accepting the waste on behalf of the owner or operator of the facility That person must acknowledge acceptance of the waste described on the Manifest by signing and entering the date of receipt

__Arkansas' Additional Requirements for Completing the Hazardous Waste Manifest:__

(1) The following items shall be completed as State manifest reporting requirements (the following instructions refer to items A-K on the hazardous waste manifest report form (Arkansas/EPA Form No 8700-22) and are to be completed for all inter- and intrastate shipments of hazardous waste)

(a) ITEM B If an EPA identification number is not required, enter the PCB identification number or Arkansas provisional identification number assigned by ADPC&E

(b) ITEMS C and E Enter the Transportation Permit number issued by the Arkansas Highway and Transportation Department

(c) ITEMS D and F The phone number of the transporter

(d) ITEM H The phone number of the designated facility

(e) ITEM I The EPA Waste Code, or the letters

"PCB" for PCB shipments

(f) ITEM J The name, address and I D number of an alternate treatment, storage or disposal facility (if any)

(g) ITEM K Emergency response contact (individual's name and telephone number)

(2) For rail transportation, the first and last rail transporter delivering the shipment must sign and date the manifest or continuation sheet in the appropriate space on the manifest

INSTRUCTIONS — CONTINUATION SHEET, U.S. EPA FORM 8700-22A

ADPC&E does not supply manifest continuation forms Should a continuation form be required, generators may use a uniform manifest continuation form as shown in 40 CFR 262 Appendix I, and completed in accordance with these directions ***The Continuation form is only valid when accompanied by a Manifest (AR/EPA Form 8700-22) and when the corresponding manifest serial number is clearly indicated on each page of the continuation form.***

Read all instructions before completing this form

This form has been designed for use on a 12-pitch (elite) typewriter, a firm point pen may also be used — press down hard

This form must be used as a continuation sheet to U S EPA Form 8700-22 if

More than two transporters are to be used to transport the waste,

More space is required for the U S DOT description and related information in Item 11 of Arkansas/EPA Form 8700-22 Federal regulations require generators and transporters of hazardous waste and owners or operators of hazardous waste treatment, storage, or disposal facilities to use the uniform hazardous waste manifest (Arkansas/EPA Form 8700-22) and, if necessary, this continuation sheet (EPA Form 8700-22A) for both inter- and intrastate transportation

GENERATORS

Item 21. Generator's U.S. EPA ID Number — Manifest Document Number
Enter the generator's U S EPA twelve digit identification number and the unique five digit number assigned to this Manifest (e g , 00001) as it appears in item 1 on the first page of the Manifest

Item 22. Page —
Enter the page number of this Continuation Sheet

Item 23. Generator's Name
Enter the generator's name as it appears in item 3 on the first page of the Manifest

Item 24. Transporter —— Company Name
If additional transporters are used to transport the waste described on this Manifest, enter the company name of each additional transporter in the order in which they will transport the waste Enter after the word "Transporter" the order of the transporter For example, Transporter 3 Company Name Each Continuation Sheet will record the names of two additional transporters

Item 25. U.S. EPA ID Number
Enter the U S EPA twelve digit identification number of the transporter described in item 24

Item 26. Transporter —— Company Name
If additional transporters are used to transport the waste described on this Manifest, enter the company name of each additional transporter in the order in which they will transport the waste Enter after the word "Transporter" the order of the transporter For example, Transporter 4 Company Name Each Continuation Sheet will record the names of two additional transporters

Item 27. U.S. EPA ID Number
Enter the U S EPA twelve digit identification number of the transporter described in item 26

Item 28. U.S. DOT Description Including Proper Shipping Name, Hazardous Class, and ID Number (UN/NA)
Refer to item 11

Item 29. Containers (No. and Type)
Refer to item 12

Item 30. Total Quantity
Refer to item 13.

Item 31. Unit (Wt./Vol.)
Refer to item 14

Item 32. Special Handling Instructions
Generators may use this space to indicate special transportation, treatment, storage, or disposal information or Bill of Lading information States are not authorized to require additional, new, or different information in this space

* * * * *

TRANSPORTERS

Item 33. Transporter —— Acknowledgement of Receipt of Materials
Enter the same number of the Transporter as identified in item 24 Enter also the name of the person accepting the waste on behalf of the Transporter (Company Name) identified in item 24 That person must acknowledge acceptance of the waste described on the Manifest by signing and entering the date of receipt

Item 34. Transporter —— Acknowledgement of Receipt of Materials
Enter the same number as identified in item 26 Enter also the name of the person accepting the waste on behalf of the Transporter (Company Name) identified in item 26 That person must acknowledge acceptance of the waste described on the Manifest by signing and entering the date of receipt

MOTOR VEHICLE INSPECTION
(TRANSPORTING HAZARDOUS MATERIALS)

	ORIGIN	DESTINATION
GBL NO.		
NAME OF CARRIER		
NAME OF DRIVER		
DATE AND HOUR		
INSTALLATION/ACTIVITY		
DRIVER'S STATE PERMIT NO.		
MEDICAL EXAMINER'S CERTIFICATE AND DATE		

VEHICLE

TYPE OF VEHICLE	TRUCK NUMBER	TRAILER(S) NUMBER	SLEEPER CAB:
☐ TRUCK ☐ TRUCK AND FULL TRAILER			☐ YES ☐ NO
☐ TRACTOR AND DOUBLE TRAILERS	ORIGIN	ORIGIN	VALID LEASE
☐ TRACTOR AND CLOSED SEMITRAILER	DESTINATION	DESTINATION	☐ YES ☐ NO
☐ TRACTOR AND FLAT-BED TRAILER			I.C.C. NUMBER

NOTE: All of the following items shall be checked on empty equipment prior to loading. Items with an asterisk (*) shall be checked on incoming loaded equipment.

ITEM NO.	CHECK APPROPRIATE COLUMN *(See reverse side for explanatory notes)*	ORIGIN SAT	ORIGIN UNSAT	DESTINATION SAT	DESTINATION UNSAT	REMARKS *(Explain unsatisfactory items; use reverse side if necessary)*
1.	ENGINE, BODY, CAB AND CHASSIS CLEAN					
2.	STEERING MECHANISM					
3.	HORN OPERATIVE					
4.	WINDSHIELD AND WIPERS					
5.	SPARE ELECTRIC FUSES AVAILABLE					
6.	REAR VIEW MIRRORS INSTALLED					
7.	HIGHWAY WARNING EQUIPMENT					
*8.	FULL FIRE EXTINGUISHER INSTALLED					
9	LIGHTS AND REFLECTORS OPERATIVE					
10	EXHAUST SYSTEM					
*11.	LIQUID PETROLEUM GAS POWERED VEHICLES					
*12.	FUEL TANK; LINE AND INLET					
13.	COUPLING DEVICES - KINGPIN LOCK					
*14.	ALL BRAKES OPERATIVE					
*15.	LANDING GEAR ASSEMBLY OPERATIVE					
16.	SPRINGS AND ASSOCIATED PARTS					
*17.	TIRES					
18	CARGO SPACE*					
*19.	ELECTRIC WIRING					
*20.	TAIL GATE AND DOORS SECURED					
*21.	FIRE AND WATER RESISTANT TARPAULIN					
22.	ANY OTHER DEFECTS *(Specify)*					

☐ APPROVED. ☐ REJECTED *(If rejected give reasons on reverse under "Remarks". Equipment shall be approved if deficiencies are corrected prior to loading.)*	SIGNATURE *(of Inspector)* ORIGIN	SIGNATURE *(of Inspector)* DESTINATION

	ITEMS TO BE CHECKED PRIOR TO RELEASE OF LOADED VEHICLE	ORIGIN	DESTINATION
23.	MIXTURES OF MATERIAL PROHIBITED BY DOT REGS. ARE NOT LOADED ONTO THIS VEHICLE		
*24.	LOAD IS SECURED TO PREVENT MOVEMENT		
25.	WEIGHT IS PROPERLY DISTRIBUTED AND VEHICLE IS NOT OVERWEIGHT		
*26.	SEAL(S) APPLIED TO CLOSED VEHICLE, FIRE AND WATER RESISTANT TARPAULIN APPLIED ON OPEN VEHICLE*		
*27.	SPECIAL INSTRUCTIONS *(DD Form 836)* FURNISHED DRIVER		
*28.	COPY OF VEHICLE INSPECTION *(DD Form 626)* FURNISHED DRIVER		
*29.	PROPER PLACARDS APPLIED		
*30.	SHIPMENT MADE UNDER DOT EXCEPTION ###		

SIGNATURE *(of Inspector)* ORIGIN	SIGNATURE *(of Driver)* ORIGIN
SIGNATURE *(of Inspector)* DESTINATION	SIGNATURE *(of Driver)* DESTINATION

DD FORM 626, 1 APR 76 — REPLACES EDITION OF 1 JUN 72, WHICH IS OBSOLETE.

01-017-027/dd626 cdr 3/30/96

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EXPLANATORY NOTES

REFERENCES IN ITALICS BELOW ARE THE APPLICABLE PORTIONS OF THE DOT MOTOR CARRIER SAFETY REGULATIONS *(M.C.S.R.)* AND THE CODE OF FEDERAL REGULATIONS *(C.F.R.)*: DOD REQUIREMENTS ARE ESTABLISHED BY THE D[illegible]ARTMENT OF DEFENSE *(DOD)*

THE INSPECTOR MUST BE FAMILIAR WITH THE CITED PORTIONS OF THE SAFETY AND EXPLOSIVE REGULATIONS

MEDICAL EXAMINER'S CERTIFICATE — Certificate must not be over 24 months old. (M.C.S.R.)

Item 1. ENGINE, BODY, CAB, AND CHASSIS CLEAN (i.e., no excessive oil or grease) - Inspect to see that engine and compartment are clean, check cab to see that no excessive grease is on cab and cab floor is free of debris; check under cab and chassis for excessive grease. (DOD Requirement)

Item 2. STEERING MECHANISM — Inspect to see that steering mechanism is in good condition, in proper adjustment, correctly and securely mounted, and whether the steering gear case is leaking lubricant. Pay particular attention to the pitman arm and tie rod assembly to see that they are securely mounted and not bent out of normal shape. (DOD Requirement)

Item 3. HORN OPERATIVE — Inspect to see that horn is securely mounted and of sufficient volume to serve its purpose. (M.C.S.R.).

Item 4. WINDSHIELD AND WIPERS — Inspect to see that the windshields of the tractors are free from breaks, cracks or defects which would make operation of the vehicle unsafe, that the view of the driver is not obscured by stickers, that wipers operate properly, and that wiper blades are of proper kind and in good condition. Defroster operative when conditions require it. (M.C.S.R.)

Item 5. SPARE ELECTRIC FUSES AVAILABLE — Check to see that at least one spare fuse for each kind and type of installed fuse is carried on vehicle as a spare, or it is equipped with an overload protective device (circuit breaker) (M.C.S.R.)

Item 6. REAR VIEW MIRRORS INSTALLED — Every truck and truck tractor shall have installed two rear vision mirrors, one at each side, firmly attached and so located as to reflect to the driver a view of the highway to the rear along both sides of the vehicle. Mirrors must not be cracked or dirty. (M.C.S.R.)

Item 7. HIGHWAY WARNING EQUIPMENT — This equipment must include either three red electric lanterns in operating condition and two red flags or three red emergency reflectors and two red flags with standards adequate to maintain them in an upright position, or three red emergency reflective triangles or three bidirectional emergency reflective triangles. Flame producing equipment is prohibited. (M.C.S.R.)

Item 8. FULL FIRE EXTINGUISHER INSTALLED — Inspect to see that one full fire extinguisher having an Underwriters' Laboratories rating of 10 B:C or more is securely mounted and readily accessible. (M.C.S.R.)

Item 9 LIGHTS AND REFLECTORS OPERATIVE — (Head-Stop-Trail-Front and Rear Clearance) — Inspect all lights and switches, including clearance lights and turn signals; make sure they are not obscured by dirt or grease or have broken lens. High and low beam switch must be operative. EMERGENCY flashers operating on front and rear of vehicle. (M.C.S.R.)

Item 10. EXHAUST SYSTEM — Inspect the exhaust system to see that no part is so located as would be likely to result in burning, charring, or damaging the electrical wiring, the fuel supply, or any combustible part of the vehicle. The exhaust system shall discharge to the atmosphere at a location to the rear of the cab or, if the exhaust projects above the cab, at a location near the rear of the cab. (M.C.S.R.)

Item 11 LIQUID PETROLEUM GAS POWERED VEHICLES — Inspect LPG burning system to insure compliance with DOT standards prescribed in 49 CFR 393.69. (M.C.S.R.)

Item 12. FUEL TANK, LINE, AND INLET — Inspect tanks and fuel lines to see that they are in completely serviceable condition free from leaks or evidence of leakage and surely mounted. Examine caps for defective gaskets or plugged vents. Inspect the filler necks to see that they are in completely serviceable condition, securely supported and not leaking at joints. (M.C.S.R.)

Item 13. COUPLING DEVICES - KINGPIN LOCK — Inspect without uncoupling to see that the fifth wheel rocker plate and bed are in good condition, properly assembled and mounted, and adequately lubricated. Kingpin lock must operate freely and properly, lock securely, and not show excessive wear. (M.C.S.R.)

Item 14. ALL BRAKES OPERATIVE — (Including hand brakes and air pressure warning devices) — Inspect for oil or grease leaks around drum flanges, pedal travel, air or vacuum line leaks, moisture in tanks, compressor build up and governor cut off. Test for proper and adequate brake application. (M.C.S.R.)

Item 15. LANDING GEAR ASSEMBLY OPERATIVE — Landing gear assembly must be in good condition, correctly assembled, adequately lubricated, and properly mounted.

Item 16. SPRINGS AND ASSOCIATED PARTS — Examine visually the springs, suspension hanger mechanisms, torsion bar assemblies, and auxiliary parts such as U-bolts, shackles, center bolts and hangers, for breakage, improper adjustment, and, as appropriate, lack of lubrication. Air suspensions should not be leaking. (DOD Requirement)

Item 17. TIRES — Examine all tires for cuts, bruises, breaks, and blisters. All tires with cuts or injuries extending into the cord body and those worn smooth in the center of the tread are not acceptable. Insure that stones are removed from between duals. Tires must be properly matched on dual-equipped tractors and trailers. (M.C.S.R.)

Item 18. CARGO SPACE — Inspect to see that cargo space is clean and in good condition to prevent damage to lading from exposed bolts, nuts, screws, nails, or other inwardly projecting parts. Check floor to make sure it is tight and free of holes. Floors shall not be permeated with oil or gasoline. (C.F.R.)

Item 19. ELECTRIC WIRING — Electric wiring must be clean and properly secured, insulation must not be frayed or otherwise in poor condition. There must be no uninsulated wires or improper splices or connections. Wires and electric fixtures inside the body must be protected from the lading. (M.C.S.R.)

Item 20. TAILGATE AND DOORS ON CLOSED EQUIPMENT SECURED — Inspect to see that all hinges are tight in body. Check for broken latches and safety chains. Doors must close securely. (M.C.S.R.)

Item 21. FIRE AND WATER RESISTANT TARPAULIN — If shipment is made on open equipment, check to make sure the lading is properly covered with a fire and water resistant tarpaulin. Explosive material packed in fire and water resistant containers and transported on flat-bed vehicles are not required to be covered with fire and water resistant tarpaulins. (C.F.R.)

Item 22. ANY OTHER DEFECTS (Specify) — Self Explanatory.

Item 23. MIXTURES OF MATERIAL PROHIBITED BY DOT REGS. ARE NOT LOADED ONTO THIS VEHICLE — Check carefully to prevent loading of incompatible explosives. (C.F.R.)

Item 24. LOAD IS SECURED TO PREVENT MOVEMENT — Self Explanatory.

Item 25. WEIGHT IS PROPERLY DISTRIBUTED AND VEHICLE IS NOT OVERLOADED — Lading shall be distributed in accordance with the approved load plan, when available, or when not available, a plan agreed upon by the shipper and the carrier. The weight of the load shall not exceed the capacity of the vehicle established by the carrier. The gross axle weights and the gross vehicle weight shall not exceed the limits imposed by the states through which the vehicle is routed. The carrier shall inform the shipper of the state(s) law requirements. (DOD Requirement)

Item 26, 27, and 28 — Self Explanatory.

Item 29. PROPER PLACARDS APPLIED — Four standard placards applicable to the load will be furnished the carrier and insure they are conspicuously displayed, one in front, rear, and each side. (C.F.R.)

Item 30. SHIPMENT MADE UNDER DOT EXCEPTION 868 — This item will be checked when a shipment is made under the provisions of DOT Exception 868. When checked, it signifies that the shipment was loaded in compliance with carrier's advice on maximum weight and that the driver is relieved from certifying to Items 22, 24, and 25. (DOD Requirement)

REMARKS

• U.S.GPO:1987-0-182 780

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The Memphis Depot Site
Igloo Inspection Checklist

Period Covered From ________ to ________

	MON		TUES		WED		THUR		FRI		SAT		SUN	
Inspector: Date Time														
	Pass	Fail	Pass	Fail	Pass	Fail	Pass	Fail	Pass	Fail	Pass	Fail	Pass	Fail
Outside														
Signs posted on igloo entrance gate	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Area Secure, gate closed and locked, igloo door closed and locked	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Storage Area														
Building structurally sound	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Area clean of debris	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Aisle space adequate for emergency response	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
All containers on pallets	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
All containers sealed	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
No leaks, spills, leaking containers, or residue	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Containers turned so that labels are visible	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Inspect container labels														
composition of waste	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
quantity of waste	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
generator	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
date of acceptance	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Inspect secondary containment sumps	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

The Memphis Depot Site
Igloo Inspection Checklist

Period Covered From ________ to ________

	MON		TUES		WED		THUR		FRI		SAT		SUN	
Inspector Date. Time														
	Pass	Fail	Pass	Fail	Pass	Fail	Pass	Fail	Pass	Fail	Pass	Fail	Pass	Fail
Equipment														
Emergency shower/eyewash operable														
Absorbent available														
Inspect fire extinguishers														
Gloves available														
Eye protection available														
Respirators available														
Protective clothing available														
Spill kit available and complete														
Tool kit available and complete														
Records/Reports														
Waste logs complete, accurate and up-to-date														
Manifests logged and filed														
Copies of returned manifests														
Emergency Response Contingency Plan on file														
Sample records on file														
Discrepancy reports prepared and filed														
Incident reports for spills on file														

Comments:

____

____

The Memphis Depot Site
Igloo Inspection Checklist (Continued)

Corrective Action:

Mon	Item	____________	Action Taken	____________
	Date	____________	Signature:	____________
Tue	Item:	____________	Action Taken	____________
	Date	____________	Signature:	____________
Wed	Item	____________	Action Taken.	____________
	Date	____________	Signature	____________
Thur:	Item	____________	Action Taken:	____________
	Date	____________	Signature	____________
Fri	Item	____________	Action Taken.	____________
	Date	____________	Signature.	____________
Sat	Item:	____________	Action Taken:	____________
	Date	____________	Signature:	____________
Sun	Item	____________	Action Taken:	____________
	Date	____________	Signature:	____________

MATERIEL COURIER RECEIPT	SHIPPER'S CONTROL/DOCUMENT NO
SHIPPER	SUPPLY ACCOUNT NUMBER
DESTINATION	SUPPLY ACCOUNT NUMBER

PRIVACY ACT STATEMENT

AUTHORITY 5 U S C , Sec 552a (PL 93 579)

PRINCIPLE PURPOSES To provide a receipt for transfer of controlled materiel The use of the SSAN is required and is necessary to provide positive identification of the individuals receipting for the materiel

ROUTINE USES To document transfer of materiel from a shipper to a courier, courier to courier and/or receiver

DISCLOSURE IS VOLUNTARY Since the SSAN must be used, refusal to provide SSAN may be grounds for action to

I certify by my signature that I have received the materiel listed on this form and am aware of the applicable safety and security requirements

SHIPMENT TRANSFERS

FIRST	LOCATION OF TRANSFER	DATE(YR/MO/DAY)
RECIPIENT'S PRINTED NAME (LAST, FIRST, M I)		ORGAN OR ACCOUNT NO
SIGNATURE		SOCIAL SECURITY NUMBER
SECOND	LOCATION OF TRANSFER	DATE (YR/MO/DAY)
RECIPIENT'S PRINTED NAME (LAST, FIRST, M I)		ORGAN OR ACCOUNT NO
SIGNATURE		SOCIAL SECURITY NUMBER
THIRD	LOCATION OF TRANSFER	DATE (YR/MO/DAY)
RECIPIENT'S PRINTED NAME (LAST FIRST M.I)		ORGAN OR ACCOUNT NO
SIGNATURE		SOCIAL SECURITY NUMBER
FOURTH	LOCATION OF TRANSFER	DATE (YR/MO/DAY)
RECIPIENT'S PRINTED NAME (LAST, FIRST, M I)		ORGAN OR ACCOUNT NO
SIGNATURE		SOCIAL SECURITY NUMBER
FIFTH	LOCATION OF TRANSFER	DATE (YR/MO/DAY)
RECIPIENT'S PRINTED NAME (LAST, FIRST, M I)		ORGAN OR ACCOUNT NO
SIGNATURE		SOCIAL SECURITY NUMBER

SHIPMENT DESCRIPTION

LINE NUMBER	QUANTITY	SERIAL NUMBERS	REMARKS

DD FORM 82 MAY 1911 — PREVIOUS EDITION MAY BE USED UNTIL 31 DEC 82

DD Form 1911, Materiel Courier Receipt

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ANNEX E

ACRONYMS AND ABBREVIATIONS

ANNEX E

ACRONYMS AND ABBREVIATIONS

AFFF	aqueous film forming foam
AR	Army Regulation
BREA	Bond Road Exclusion Area
CAI	chemical accident/incident
CAIRA	Chemical Accident or Incident Response and Assistance
CAIS	chemical agent identification set
CAM	chemical agent monitor
cc/sec	cubic centimeter per second
CFR	Code of Federal Regulations
CG	phosgene
CN	chloroacetophenone
CPR	cardiopulmonary resuscitation
CWM	chemical warfare materiel
DA	Department of the Army
DAAMS	Depot Area Air Monitoring System
DLA	Defense Logistics Agency
DM	adamsite
DoD	Department of Defense
DOT	Department of Transportation
EDT	1,2-ethanedithiol
EOC	Emergency Operation Center

GA	tabun
GC	gas chromatograph
H	mustard agent
HA	hazard analysis
HD	distilled mustard
HS	sulfur mustard
IHF	interim holding facility
L	lewisite
MCE	maximum credible event
MIL-STD	Military Standard
mg/m^3	milligram per cubic meter
MRC	multiple round container
MSDS	material safety data sheet
NRT	near real-time
NSCM	non-stockpile chemical materiel
OSHA	Occupational Safety and Health Administration
Pam	Pamphlet
PAO	Public Affairs Office
PBA	Pine Bluff Arsenal, Arkansas
PBCA	Pine Bluff Chemical Activity
PMCD	U.S. Army Program Manager for Chemical Demilitarization
PMNSCM	Product Manager for Non-Stockpile Chemical Materiel
POIO	Public Outreach and Information Office
PPE	personal protective equipment

PS	chloropicrin
psig	pounds per square inch gauge
RAC	risk assessment code
RCRA	Resource Conservation and Recovery Act
SBCCOM	U.S. Army Soldier and Biological Chemical Command
SOP	standing operating procedure
SSCC	Site Security Control Center
SSMP	System Safety Management Plan
TDEC	Tennessee Department of Environmental Conservation
TEU	Technical Escort Unit
TM	Technical Manual
TWA	time-weighted average
USACMDA	U.S. Army Chemical Materiel Destruction Agency
USEPA	U.S. Environmental Protection Agency
XSD	halogen selective detector

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ANNEX F
REFERENCES

ANNEX F
REFERENCES

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ANNEX G

QUESTIONS AND ANSWERS

FOR FORMER DEFENSE DEPOT MEMPHIS TRANSPORTATION PLAN

ANNEX G
QUESTIONS AND ANSWERS
FOR FORMER DEFENSE DEPOT MEMPHIS TRANSPORTATION PLAN

Q: What items at the Former Defense Depot Memphis are being shipped?

A: *The items are bottles of material that used to belong to chemical agent identification sets.*

Q: What are chemical agent identification sets?

A: *Chemical agent identification sets were training aids used from the 1920s to the 1960s to train military personnel in the safe handling and detection of chemical agents.*

Q: What chemicals are in these bottles?

A: *The chemicals in these bottles include the chemical warfare agents mustard and lewisite. Mustard and lewisite are blister agents that can cause severe irritation to the eyes, nose, and lungs. They also can cause blisters on exposed skin.*

Q: How did the items come to be at the Former Defense Depot Memphis?

A: *The items were discovered in an old landfill on the depot. The Former Defense Depot Memphis was established in 1942 as a distribution center for military equipment including chemical warfare materiel. Wastes generated on the depot were disposed of in the landfill. This was an accepted practice before the 1960s.*

Q: How were the items discovered?

A: *The Former Defense Depot Memphis is cleaning up areas of the depot that were contaminated by past activity. The landfill where these items were found was being cleaned up because of contamination caused by petroleum products that had been placed in the landfill. There is no contamination by chemical agents.*

Q: What threats to the public are posed by these items?

A: *The items are safe because the chemicals are inside sealed glass bottles that have been packed inside of steel containers. The steel containers are specially designed to contain leaks should any of the bottles break.*

Q: Where are the items now?

A: *When the items were discovered, they were packed inside of the steel containers and stored in a building specifically designed for the temporary storage of hazardous wastes. The items will remain inside of this building until they are shipped.*

Q: Where are the items being shipped?

A: *The items are being shipped to Pine Bluff Arsenal, Arkansas.*

Q: Why are they being shipped?

A: *In accordance with Pubic Law 103-337, recovered chemical warfare materiel will be shipped to the nearest military installation with the necessary permits for storing the materiel until it can be destroyed.*

Q: How will the items be shipped?

A: *A truck will move the items from their current holding facility to a military UH-1N helicopter that will land at the Depot. The helicopter will fly the items to Pine Bluff Arsenal. At Pine Bluff Arsenal, another truck will move the items from the helicopter to a State of Arkansas permitted hazardous waste storage facility on Pine Bluff Arsenal.*

Q: Who will ship the items?

A: *The U.S. Army Technical Escort Unit will transport the items. They are specially trained individuals skilled in all aspects of storage, handling, and transport of chemical warfare materiel.*

Q: What safeguards will be used to protect the public?

A: *The items are packed inside steel cylinders called multiple round containers. These steel containers were specially designed to withstand impact and contain leakage. A specially trained Army unit will monitor the containers before shipment begins and upon arrival at Pine Bluff Arsenal. Throughout the shipping process, medical and hazardous materiel response teams will be on standby should their assistance be needed. Personnel trained in hazardous materiel detection and spill response will accompany the items in transit.*

Q: When will the items be shipped?

A: *The items will be shipped during the week of TBD. The exact date will depend on weather and the availability of the Technical Escort personnel and aircraft.*

Q: How long will the flight take?

A: *The flight will last approximately one and one-half hours.*

Q: What laws govern the shipment of these items?

A: *These items are being handled under the environmental laws governing hazardous waste and shipped according to the transportation laws governing transport of hazardous waste.*

Q: Will local authorities and the public be informed when the transport is to take place?

A: *Yes. State environmental agencies and federal aviation officials will be informed. Local emergency response agencies along the transportation route will also be told when the shipment is going to be passing through their jurisdiction. Approval must come from the states before the items will be transported.*

Q: Has the Army shipped similar items in the past?

A: *Yes, the Army has conducted similar operations without incident. Over 200 items similar to those being shipped from the Memphis depot were safely moved from Jackson, Mississippi. Other shipments include removing 428 items from Edison, New Jersey, 12 items from Fort Ord, California, and 39 items from Ellsworth Air Force Base, South Dakota.*

Q: What will happen to the items after they arrive at the destination?

A: *The items will be stored in a permitted hazardous waste storage facility pending fielding of the Army's portable treatment system.*

Q: How will the items be destroyed?

A: *The items will be placed inside a treatment system where the steel shipping containers will be opened and the individual bottles separated according to the material they contain. The bottles will be opened and mixed with a caustic solution that will destroy the chemical agent.*

Q: When will the items be destroyed?

A: *The treatment system for destruction of these items is being tested in Utah. Approval from Utah state officials is expected soon. When that occurs, the system will be deployed to dispose of the recovered items.*

Q: What options were considered instead of transporting the items to Pine Bluff Arsenal?

A: *The Army considered leaving the items in storage at the Former Defense Depot Memphis until the treatment system could be brought to the depot to destroy the chemical agents. However, this option posed a greater risk to depot workers and the public, and was more expensive than transporting the items. The Former Defense Depot Memphis is in an urban area surrounded by homes and businesses. The Army chose to transport the items in order to reduce risk to the public.*

Q: Who can I call for more information?

A: *For the Former Defense Depot Memphis specific questions, contact the Depot Public Affairs Office, Mr. Shawn Phillips, 901-544-0611. For information about Chemical Agent Identification Sets and the transport of chemical warfare materiel, contact the Product Manager for Non-Stockpile Chemical Materiel, Public Outreach and Information Office, Ms. Louise Dyson, 800-488-0648.*

TAB

Teu Support Plan

AMSSB-OTE-PTO

MEMORANDUM FOR Commander, U.S. Army Engineering and Support Center, Huntsville, ATTN: CEHNC-PM-ED (Mr.), P.O. Box 1600, Huntsville, AL 35807-4301

SUBJECT: Submittal of U.S. Army Technical Escort Unit Support Plan to Work Plan/Site Safety Submission, Volume I - Work Plan, Defense Distribution Depot Memphis, Tennessee.

1. Reference subject work plan. Enclosure 1 provides the U.S. Army Technical Escort Unit Support Plan for Operable Unit 1 Defense Distribution Depot Memphis, Tennessee.

2. POC at this organization is Mr. Rehmert, DSN 584-4383, Coml 410-436-4383.

Encl

DOUGLAS J. NORTON
LTC, CM
Commanding

SECTION 1
U.S. ARMY TECHNICAL ESCORT UNIT (TEU) SUPPORT PLAN

1.1 **PURPOSE.**
To outline the procedures to be used by U.S Army Technical Escort Unit (TEU) in support of remediation efforts at OU 1 Defense Distribution Memphis, Tennessee.

1.2 **PROJECT TASKS.**
The statement of work identifies the tasks outlined below which will be performed by TEU.

1.2.1 Assume control of the site when suspect Chemical Warfare Materiel (CWM) is encountered.

1.2.2 Use D2PC to determine the current distance to no significant effects (NOSE) daily.

1.2.3 Assess suspect CWM materiel and munitions.

1.2.4 Package suspect CWM materiel and munitions.

1.2.5 Transport suspect CWM materiel and munitions.

1.2.6 Perform continuous low-level air monitoring in the Exclusion Zone (EZ) in support of ECBC.

1.3 **PERSONNEL.**
The personnel listed below will be utilized to perform the tasks identified above. The total number of personnel on site may be less than the total of these subparagraphs since most toxic materiel control operators at TEU are crossed-trained to do several different tasks.

1.3.1 One Wage Supervisor maintains control of TEU assets and assumes site control when suspect CWM is encountered.

1.3.2 Two TEU EOD Specialist conduct assessment and destruction of suspect chemical munitions as necessary.

1.3.3 Five Toxic Material Handlers conduct packaging of suspect CWM materiel and munitions, PINS assessment, transport of packaged material to the IHF, low-level (MINICAM) monitoring in the EZ, transport of suspect CWM to its final destination.

<u>NOTE:</u> TEU personnel, while not performing their primary task, may assist the prime contractor with other duties. This coordination will be made between the wage supervisor and the prime contractor's work leader. Examples of these duties are to

provide rescue party, assist with soil sampling, and/or assist with decontamination operations.

1.3.4 **PROCEDURES.**

The procedures outlined below and subsequent attachments will be used to complete the tasks listed in paragraph 1.2.

1.3.4.1 **Assume Control of the Site.**

The TEU wage supervisor (WS) will assume control of the site when it has been determined that suspect CWM or ammunition with a suspect fill has been encountered. The SSHO and the CENHC safety specialist will make this determination. The TEU WS will direct all activities until the suspect item has been assessed and if CWM packaged, or properly disposed of. These actions will include but are not limited to:

1.3.4.1.1 The WS will dispatch a team to assess the item or hazard. PPE will be selected in accordance with the site health and safety plan for the suspected hazard. Munitions will be assessed only by TEU EOD personnel. Non-munition items may be assessed by toxic material control operators.

1.3.4.1.2 If a spill occurs, a response team in the appropriate level of PPE will begin mitigation actions immediately.

1.3.4.1.3 Suspect munition(s) or item(s) will be packaged and transported to the IHF if safe to store. Unsafe munitions will be rendered safe prior to movement.

1.3.4.1.4 If the munition or item is determined to be non-CWM it will be turned over to the contractor for proper disposal.

1.4.2 Control of the site will returned to the SSHO when all necessary actions have been completed.

1.4.3 D2PC modeling will utilize current weather conditions obtained from the TEU weather station located at the work site. The data input will be made by a trained operator only, in accordance with the procedures out lined in the D2PC and Hazard Analysis Reference Manual. The quantities and type of release data will be the maximum credible event (MCE) as defined in the scope of work. If actual quantities and type of release are available they will be used.

1.4.4 **Assessment of Suspect Items and Munitions.**

Suspect munitions will be assessed using the procedures outlined in paragraph 1.4.8, EOD Response to Ordnance Items and TEU SOP 385-11 provided in paragraph 1.4.9. Suspect CB containers will be assessed using the Portable Isotopic Neutron Spectroscopy (PINS) procedures. All assessment teams will be dressed in the appropriate PPE as determined by the SSHO and the TEU WS. Munitions or items which can be positively identified as non-CWM will be turned over to the contractor for proper disposal. PINS assessment should be completed, if possible, prior to packaging if safety conditions permit. Chemical Agent Identification Set (CAIS) vials will be assessed using the RAMANS system. The system is operated by a contractor , with the assistance of TEU. The assessment will be done at the completion of the project. Project manager for Non-Stockpile Materiel (PMNSCM) will contract for this service. Vials, which contain non CWM, will be turned over to the installation for disposal. Vials containing CWM or suspect CWM will be re-packaged and returned to the IHF to wait final disposition.

1.4.5 **Packaging of Suspect Items and Munitions.**

Munitions will be packaged only after they have been assessed and it has been determined that they are safe to transport and store. This decision will be made by the TEU EOD team leader. Suspect munitions will be double-bagged prior to placing it into the appropriate size multiple round container (MRC). Suspect containers will be cleaned and double-bagged as soon as practical. Bottles or vials will be packaged individually in fiberboard tubes with absorbable material and over packed in the appropriate MRC. Like items may be packed in the same container. The packaging procedures including vermiculite for the MRC's are outlined in paragraph 1.4.10. Upon completion of packaging, the MRC will be labeled with the following information:

Date and time (e.g., year/month/day/time)
Description of contents (e.g., 12 ea CAIS vials, 4.2 in. mortar w/o fuze, etc.)
Location and number (e.g., SW corner of SWMU #00, #00-123)
Any additional Information (e.g., Packaging Info: double-bagged and 2 lb vermiculite)

1.4.6 Chain of custody will be established using DD Form 1911. When final analysis is completed, MRC's will be labeled for shipment.

1.4.7 **Continuous Low-Level Air Monitoring in the Exclusion Zone (EZ).**

TEU will monitor the excavation site using the MINICAM within the EZ IAW the ECBC Monitoring Plan (Sec _ SSHP).

1.4.8 **EOD Response to Ordnance Items.**

1.4.8.1 Coordination. Upon arrival at the designated location, the TEU EOD Team Leader will coordinate with the TEU WS and notify the WS of intended departure down range.

1.4.8.2 Equipment. As a minimum, all EOD team members will have the following equipment on the vehicle:

a. Proper PPE as specified in the site safety and health plan or as dictated by the suspected hazard.

b. Protective mask.

c. Toxicological Agent Protective (TAP) gloves.

d. Body Armor and Kevlar helmet

e. Eye protection.

f. CPUs, TAP Apron, TAP boots.

1.4.8.3 General Procedures.

a. Approach the item from an upwind direction, if possible.

b. Mark the site, preferably with a wind direction indicator (streamer).

c. Position your vehicle on the upwind direction, if possible.

d. Always use caution when approaching a UXO. Field glasses may be used to help identify a UXO from a safe distance.

e. Prepare the site for easy access by follow-up teams. Indicate upwind avenues of approach, excavate large step trench to remove round, etc.

CAUTION: If the filler of the item cannot be immediately determined, assume the worst hazard and take the necessary precautions. Appropriate PPE will be worn when handling the UXO. Kevlar helmets are not required when wearing a mask.

f. Take the necessary precautions listed in TM 60A-1-1-22 and TM 60A-1-1-11 for the UXO encountered and refer to the attached Logic Tree.

g. The primary concern is the fuze. Once the fuze has been rendered safe or determined to be safe, attempt to determine the filler.

h. When performing initial reconnaissance on suspected items, perform the following functions provided that the performance of such does not expose personnel to additional and unnecessary risk

(1) Photograph ordnance items that cannot be positively identified on first look. Take a minimum of two good photographs. Include a recognizable sizing guide (tape measure) near the item. Photograph the length and diameter. Take both pictures as close to the item as possible. All efforts will be made to ensure that the photographs cover the most pertinent identification features visible on the ordnance item.

(2) Measure the ordnance item. Recommended measurements are listed below:

(a) Overall length, including fuzing and fin assemblies.

(b) Overall width/diameter, including protruding areas, fins, etc.

(c) Width/diameter minus fins.

(d) Length minus fuze and fins.

(e) Length of fuze

(f) Width of fuze.

(g) X-ray all areas of item (i.e., nose, fuze, body and tail) IAW MARB standards.

(3) Weigh the item in order to help determine its fill.

i. If the UXO is a conventional munition, proceed with the approved treatment procedures or transport to a safe holding area.

j. Proceed in accordance with procedures outlined in the site safety and health plan.

k. After performing UXO research, if the filler cannot be positively identified as conventional, the UXO will be treated as having a chemical fill. If the on-site team leader determines the munition is considered safe for storage, the munition will be overpacked IAW paragraph 1.4.10 and turned over to the proper facility. If the fuze type and condition warrant an on-site disposal procedures, explosive weight ratio will be at a minimum of 5 to 1. Before disposal procedures on a suspected chemical filler can be initiated by detonation or thermal destruction, formal approvals must be obtained by the SSHO from appropriate authorities.

1.4.8.4 Procedures used when working with White Phosphorus (WP).

a. Have buckets and water on site in the event the munition starts smoking.

b. Do not approach a smoking WP munition. Burning WP may detonate the burster charge at any time.

c. If it starts to smoke while you are with the item, fuze condition permitting, submerge a smoking WP munition in water or cover it with we mud, sand, dirt or foam as quickly and gently as possible, should it be necessary to handle such an item.

d. The following personal protective equipment will be available when working with WP filled munitions.

(1) Leather gloves, loose fitting.

(2) Kevlar, face shield.

(3) Flame retardant clothing.

(4) Flak jacket.

(5) Protective mask.

1.4.8.5 Procedures used when working with Incendiaries.

a. Wear a protective mask or appropriate PPE when there is a possibility to inhale the smoke or fumes of burning pyrotechnics or incendiary materials.

b. Protect eyes by looking away from the flame if visible exposure to burning pyrotechnics is probable.

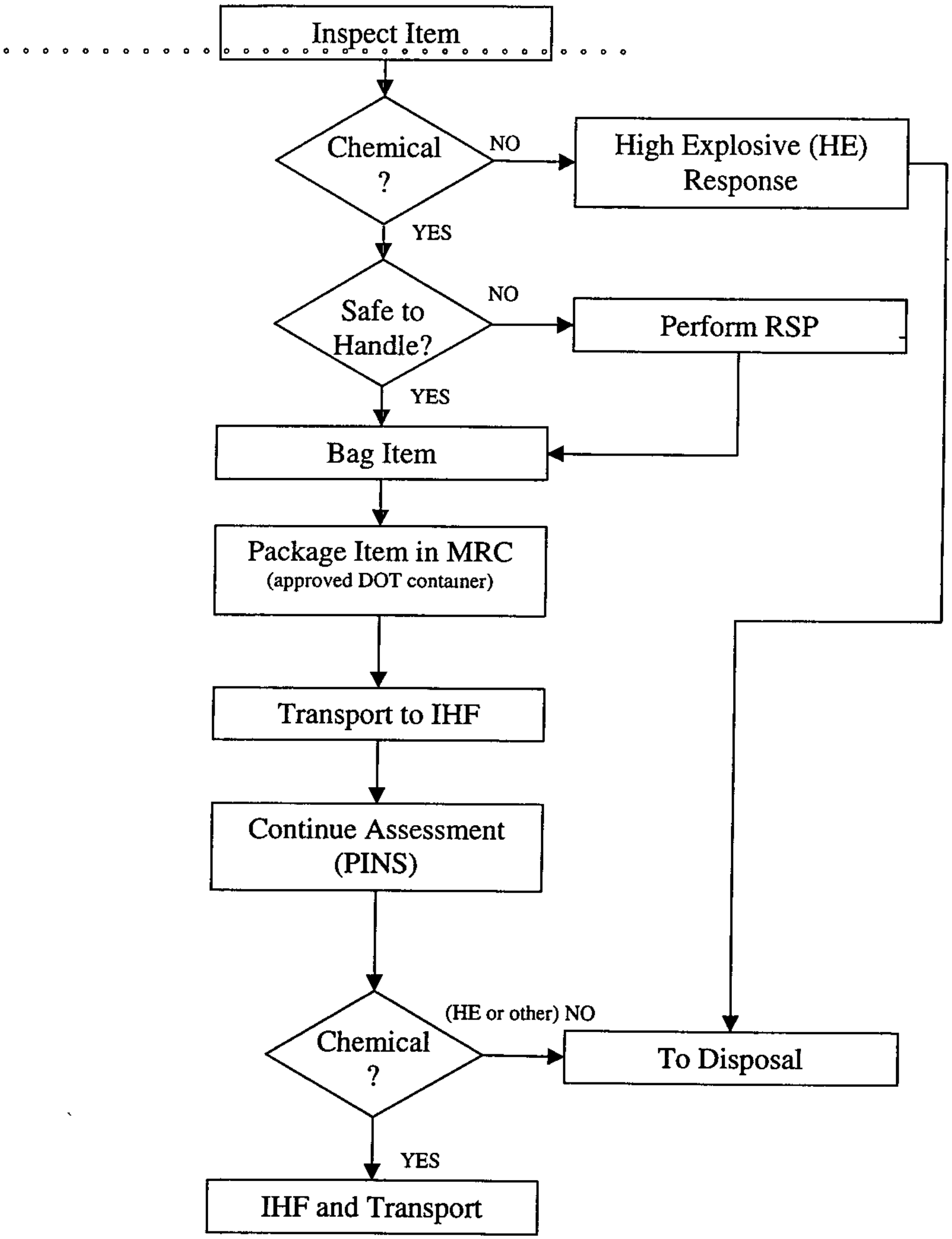
c. If incendiary has to be extinguished, use sand to smother. Do not use water. Water may induce hypergolic reactions or be completely ineffective.

d. Bury incendiary loaded munitions in sand when transporting them. This will smother any fire which may start, until other corrective action can be taken.

1.4.8.6 A protective mask or appropriate PPE will be worn in areas where strong concentrations of screening smokes can develop. Strong concentrations of screening smokes generally irritate the eyes and respiratory tract.

1.4.8.7

EOD Logic Tree



1.4.9 **TEU SOP 385-11,** Radiation Safety Program for the Use of the Portable Isotopic Neutron Spectroscopy (PINS).

1.4.10 Letters of Instruction for Containerization of Recovered Chemical Warfare Materiel in Multiple Round Containers (MRC).

1.4.10.1 7 inch x 27 inch MRC (100 lb net weigth).

1.4.10.2 12 inch x 56 inch MRC (211 lb net weight).

1.4.10.3. 9 inch x 41 inch MRC (210 lb net weight).

TAB

Protective Action Plan

1 INTRODUCTION

The purpose of the Protective Action Plan (PAP) is to delineate the roles and responsibilities of the various entities that will be involved in the Chemical Warfare Removal Action at Dunn Field, former Defense Distribution Depot Memphis, Tennessee.

The planned intrusive operations at Dunn Field, former Defense Distribution Depot Memphis, Tennessee fall under the Base Realignment and Closure (BRAC) Program. Chemical warfare materiel (CWM) is suspected to exist on this property formerly by the Department of the Army and currently operated by the Department of Defense.

All operations associated with the CWM investigation/removal action operation will be performed in a manner consistent with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), the National Priority List (NPL), the Federal Facilities Agreement (FFA) between Memphis Depot, Environmental Protection Agency (EPA), and the State of Tennessee; and the National Contingency Plan (NCP). For any actions on site, administrative requirements of federal, state, or local permits are not required, but applicable or relevant and appropriate requirements will be met. The provisions of 29 CFR 1910.120 shall apply to all actions taken at this site.

The PAP is part of the Dunn Field, Defense Depot Memphis, Tennessee Safety Submission which includes the Site Specific Work Plan, Site Safety and Health Plan, Interim Holding Facility Plan, Transportation Plan and other Plans that address all aspects of operations to ensure that the utmost safety for workers, the public, and the environment is maintained.

The Safety Submission will be approved by Department of Defense Explosive Safety Board (DDESB) prior to the start of intrusive work on site. Applicable parts of the Safety Submission are referenced throughout this PAP.

A meeting will be held prior to the start of operations by representatives of key supporting agencies to address any questions or concerns regarding the proposed operations. The Memphis Depot will continue to provide information to the surrounding communities on significant activities throughout the duration of operations in accordance with the Community Relations Plan.

2 KEY AGENCY RESPONSIBILITIES

2.1 Agency responsibilities.

2.1.1 U.S. Army Engineering and Support Center, Huntsville (CEHNC):

The U.S. Army Engineering and Support Center, Huntsville as the life-cycle project manager, is in charge of the overall operation at Dunn Field, former Defense Depot

- Be on-site during the CWM intrusive and removal activities;

- Provide safety oversight during CWM investigation and removal activities at Dunn Field and during intrusive operations within the exclusion zone (EZ);

- Provide U.S. Government Quality Assurance of EZ activities.

2.1.2 U.S. Army Program Manager for Chemical Demilitarization.

U.S. Army Program Manager for Chemical Demilitarization is responsible for the destruction of all United States chemical warfare materiels (CWM). Before the beginning of investigation/removal activities the Program Manager for Chemical Demilitarization will provide a contractor to train medical support personnel in chemical agent casualty care.

2.1.3 U.S. Army Project Manager for Non-Stock Pile Chemical Materiel (PMNS).

- The Project Manager for Non-Stockpile Chemical Materiel is responsible for storage, transportation, and destruction of recovered chemical warfare materiels.

- Program Manager for Non-stockpile Chemical Materiel is responsible for arranging the interim storage and off-site transportation of CWM recovered at Dunn Field. Recovered CWM will be stored in an interim holding facility and transported off site in accordance with the Interim Holding Facility Plan and Transportation Plan.

2.1.4 U.S. Army Soldier and Biological Chemical Command (SBCCOM)

The SBCCOM medical officer reviews the medical support arrangements and provides consultation on medical support issues that arise during the course of this project.

2.1.4.1 U.S. Army Technical Escort Unit (TEU)

- The U.S. Army Technical Escort Unit is a specialized unit of SBCCOM and provides the Department of Defense with a worldwide capability of responding to, neutralizing, and disposing of chemical agent, munitions, and other hazardous materials.

- The U.S. Army Technical Escort Unit in conjunction with UXB international is responsible for performing all intrusive operations on site. TEU is responsible for the assessment in conjunction with the contractor, for the appropriate packaging and transport of any recovered CWM to the interim holding facility.

meteorological conditions.

3.2 No Significant Effects (NOSE) Distance.

The distance beyond which the public would not experience any adverse health effects in association with a chemical agent release.

3.3 Pre-Operational Survey.

A formal review and assessment of an operation that has the potential for CWM exposure. For additional Information see section 5.11.

The pre-operations survey provides for an adequate level of safety and will ascertain if:

a. Personnel, equipment, and materials required for work activities are on site.
b. Personnel are trained and qualified to perform their work assignments
c. Work procedures and safety controls are appropriate for the tasks anticipated at the job site.

3.4 Chemical Accident/Incident (CAI)

Chemical Accidents/Incidents are chemical events involving chemical agent materiel.

a. Chemical Accident. A chemical event resulting from non-deliberate acts where safety is of primary concern.
b. Chemical Incident. A chemical event resulting from deliberate acts (terrorism or criminal) where security is of concern.

3.5 Chemical Agent.

Chemical agents as defined in Army Regulation 50-6 , Appendix B, includes sulfur and nitrogen mustards and Lewisite. They are chemical substances that are intended for use in military operations to kill, seriously injure or incapacitate a person through their physiological properties. Excluded from consideration are industrial chemicals, riot control agents, chemical herbicides, smoke and flame.

3.6 Chemical Warfare Materiel (CWM)

As defined in the Sept 5, 1997, Interim Guidance for Biological Warfare Material and Non-Stockpile Chemical Warfare Material Response Activities, the term CWM is defined as an item configured as a munition containing a chemical substance that is intended to kill, seriously injure, or incapacitate a person though its physiological effects. The term CWM includes V-and G series nerve agent, H-and HN-series, blister agent, and lewisite in other-than-munition configuration. Due to their hazards, prevalence, and military-unique application, chemical agent identification sets (CAIS) are also considered CWM.

liquids. Following WWII the CWS section carried out a variety of missions which included flame thrower maintenance, CWM storage, and CWM disposal.

Available historical records indicate that only the Dunn Field Area of DDMT was used to destroy or bury conventional ordnance and CWM. The first known destruction of CWM was recorded in 1946 in Operable Unit 1 (OU-1). This site was noted to have been used in the neutralization and destruction of German Mustard Bombs. The last known disposal of CWM in OU1 was the disposal of Chemical Agent Identification Sets (CAIS) sometime in 1955 or 1956. Further investigation of the available documentation reveals that other chemicals associated with CWM were also buried in OU1 and may have included food stocks, medical waste, and 'War Trophies' following WWII.

Records indicate that in July of 1946, eight railcars containing German Mustard bombs were brought to DDMT. Closer examination revealed that some of the bombs were leaking and a decision was made to move the railcars to the Memphis General Depot for further action. Leaking bombs found in these cars were unloaded, drained, detonated and buried after decontamination.

4.2 Contaminants of Concern

The CWM of concern include mustard and lewisite and their associated breakdown products. Other contaminants of concern include industrial chemicals, semi-volatile organic compounds (SVOCs), arsenic and heavy metals. The toxicological effects of the contaminants of concern are described in the Site Safety and Health Plan.

4.3 Additional Information

Additional information regarding the details of the operation can be found in the Safety Submission and by contacting the Memphis Depot.

5 PROTECTIVE ACTIONS AND PROCEDURES

To ensure safety of the public and all personnel supporting the CWM investigation/removal activities at Dunn Field, Memphis Depot, the following protective actions and procedures will be taken.

5.1 Maximum Credible Event (MCE).

5.1.1 The U.S. Army Engineering and Support Center at Huntsville will determine the maximum credible events for operations. The magnitude of the potential hazards depends upon the type and quantity of chemical warfare materiel uncovered and the meteorological conditions. Based upon the maximum credible event, a computer model is used to predict the no significant effects distance radius from the point of origin. This computer model considers such things as the types of chemical or high explosive hazards most likely to be encountered, meteorological data, any measures taken to mitigate the

- Monitoring equipment for each contaminant or hazard to be monitored;
- Activities to be monitored;
- Locations to be monitored; and
- Specific actions to be taken should a positive result or ring-off occur.

5.4 No Significant Effects Distance

The NOSE distance will remain the same, for AOC 1 and 2, for the duration of the project unless something other than the MCE (5 gallons of Mustard) in a non-explosive configuration is found on site.

The NOSE distance will remain the same, for AOC 3, for the duration of the project unless something other than the MCE (40ml of phosgene) in a non-explosive configuration is found on site.

5.5 Emergency Response Notification Plan.

"UNDER DEVELOPMENT"

5.6 Interim Holding Facility (IHF)

The U.S. Army Technical Escort Unit will containerize recovered CWM removed during CWM investigation/removal activities using Department of Transportation (DOT) approved overpacks.

The U.S. Army Technical Escort Unit will escort and transport the recovered CWM to the interim holding facility.

The IHF will be designed according to Department of the Army Chemical Munitions Safety and Security Standards. Material stored in the IHF will be suspect CWM and therefore, must be treated as such.

5.7 Generator Hazardous Waste Manifest

All waste generated on site will be appropriately manifested. These manifests will serve as an inventory of materials stored in the Interim Holding Facility and other waste stored on site.

There could be several different waste streams generated on site. There could be recovered CWM which would be maintained in approved DOT overpack containers within the interim holding facility. If grossly CWM contaminated soil were generated during the operations, it would be stored in appropriate hazardous waste storage training for emergency medical technicians and medical personnel. Other site personnel are not required to receive medical training but will receive a site safety briefing prior to beginning any work on site.

5.11.2 Pre-Operational Survey

A Pre –Operational Survey is a formal review and assessment of an operation that has the potential for chemical agent exposure. It examines all provisions of the Site Safety Submission to ensure that all appropriate regulations have been addressed. Procedures involved in a pre-operational survey include:

- Review of Pertinent Documents
- Inspection of Equipment and Facilities
- Verification of Employee Training and Site Procedures
- Witnessing of Selected Systems Testing and Operations

Team Members may include:

- Department of the Army Safety
- Army Technical Center for Explosive Safety
- Project Manager for Non-stockpile Chemical Material
- Program Manager for Chemical Demilitarization
- Edgewood Chemical and Biological Center
- U.S. Army Technical Escort Unit
- Headquarters U.S. Army Corps of Engineers
- U.S. Army Engineering and Support Center at Huntsville
- U.S. Army Soldier and Biological Chemical Command

Other Partners in this effort are:

- U.S. Environmental Protection Agency
- U.S. Department of Health and Human Services
- UXB International, Inc.
- Local Emergency Response Personnel

5.11.3 Table Top Exercise

The purpose of the Table Top exercise is to evaluate emergency plans and procedures and to resolve questions of coordination and assignment of responsibility. Participants include all agencies conducting intrusive operations and agencies with emergency management responsibility. The table top exercise will take place in a Meeting Room. The Table Top exercise will include discussion of various simulated emergency situations in a nonthreatening format. Local emergency response personnel will attend. The Table - Top exercise will probably last between 2 and 4 hours.

directed by the on-site EMT in coordination with the medical staff at Regional Medical Center.

Emergency medical technicians and hospital staff will have received medical training for treating chemical warfare materiel casualties from the Army as outlined above.

On site and hospital medical treatment will be provided on an as needed basis in accordance with the MOA between the U. S. Army Engineering and Support Center, Huntsville (USAESCH), University of Tennessee Medical Group, and Regional Medical Center.

6.2 Emergency Preparedness Drills.

Prior to the start of the intrusive activities, all emergency response personnel will be given the opportunity to participate in a Table Top Exercise and a Pre-Operational Survey as outlined in sections 5.11.2 and 5.11.3.

CEHNC will coordinate the tabletop exercise. A Pre-Operational Survey will be conducted by the U.S. Department of the Army Safety Office (or their designee).

The Table Top exercise and Pre-Operational Survey will be scheduled at Dunn Field, Memphis Depot Memphis, Tennessee location before CWM investigation/removal operations begin and will include several emergency scenarios for the operations.

7 KEY CONTACT PERSONNEL

Personnel. The following personnel are designated as key contact personnel for the Protective Action Plan:

(1) Steve Dunn (256) 895-1144
Project Manager
U.S. Army Engineering and Support Center at Huntsville
Attn: Safety Office (CEHNC-OE-DC)

(2) Tim Blades (410) 671-4676
Chief, Chemical Support Division
Aberdeen Proving Ground (ECBC-CSA)

(3) Michael A. Rehmert (410) 671-4383
Technical Escort Unit
Aberdeen Proving Ground (CBDCOM-TEU)

(4) Jeff Harris (410) 436-7189
Non-Stockpile Chemical Materiel
Systems Operating Group

575 403

PROTECTIVE ACTION PLAN

CHEMICAL WARFARE MATERIEL INVESTIGATION/REMOVAL ACTION

FOR OU1

FORMER DEFENSE DISTRIBUTION DEPOT MEMPHIS, TENNESSEE

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Community Relations Plan

THE MEMPHIS DEPOT
(formerly Defense Distribution Depot Memphis, Tennessee)

Community Relations Plan
for the
Final Engineering Evaluation/Cost Analysis at Operable Unit 1 (Chemical Warfare Materiel Removal at Dunn Field)

COMMUNITY RELATIONS OVERVIEW

The purpose of the Memphis Depot's community involvement program is to identify public concerns and to provide for meaningful and proactive involvement in decision-making regarding the Depot's environmental restoration program. A Community Relations Plan (CRP) was developed in 1994 for the Defense Distribution Depot Memphis, Tennessee to identify issues of community concern related to the Depot's restoration program. The plan was recently updated to include issues related to closure activities resulting from the 1995 Base Realignment and Closure program including transfer of the property to the Depot Redevelopment Corporation.

Effective communication and timely information exchanges with the public are essential for establishing and maintaining the community's trust, understanding and support. The CRP provides the Memphis Depot guidance for community relations activities throughout the continuing environmental investigation and cleanup as well as closure and property transfer. Through the activities described in the plan, the Depot staff will respond to community concerns in an appropriate and timely manner, and will ensure that the information is presented clearly, concisely and accurately for the community. The CRP is an evolving document and may be revised again in the future to address ongoing community needs and requirements.

Removal of Chemical Warfare Materiel

Highlights of the Depot's Community Relations Plan are discussed below as they relate to community involvement activities to be conducted during the removal of chemical warfare materiel at Dunn Field. A copy of the complete CRP dated April 1999 is available for review by calling Ms. Alma Black Moore, Memphis Depot Community Relations Specialist, at (901) 544-0613. The complete CRP is also available at the Memphis Depot's Information Repositories located at the Memphis/Shelby County Public Library Main Branch on Peabody Avenue, Memphis/Shelby County Public Library Cherokee Branch on Sharpe Avenue and the Memphis/Shelby County Health Department Pollution Control Division on Jefferson Avenue.

The goals of the community relations activities are:

- To listen to concerns of neighbors, community groups, church groups, individuals and other interested parties regarding proposed work plans, schedules, remedial activities and health and environmental issues;
- To inform all interested parties about remedial activities, the potential for environmental and health impacts caused by the preferred method of removal, ongoing regulatory activities, and opportunities for ongoing public involvement;
- To address community concerns in a timely manner and incorporate public concerns, the extent possible, in selecting, designing and implementing remedial actions;
- To increase awareness of the public comment process and participation by the community in the public comment meeting through the use of traditional community relations procedures; and
- To update and revise this plan as needed as a result of new communications tools and information exchange opportunities identified by the Depot or the community.

ACTIVITIES

- **Restoration Advisory Board** - The Depot Restoration Advisory Board (RAB) meets the third Thursday of every month, unless RAB members decide otherwise, in the Depot Commander's Conference Room. The RAB welcomes members of the public to attend these meetings. The RAB serves as a forum for discussion of environmental cleanup and property reuse information between the public and the government agencies involved. RAB members assist the Depot in funneling information to the local community. The community is well represented by leaders of local community groups, environmental groups, and local public officials. Other members of the RAB include EPA, TDEC, Memphis/Shelby County Health Department, and Memphis Light, Gas, and Water Division. General information regarding CWM disposed of at Dunn Field has been reported and discussed by the RAB in previous meetings. The June17, 1999 pubic comment meeting will be held in conjunction with the regularly scheduled RAB meeting.

- **Community Relations Information Line** - The Depot has established a Community Relations Information line that enables the public to speak to our Community Relations specialist concerning environmental issues. The number is (901) 544 - 0613.

- **Announcements/Promotion** – The community will be informed of all CWM removal activities, opportunities to provide comment on the final Engineering Evaluation/Cost Analysis at Operable Unit 1 (CWM removal) and timely announcements of the public meeting. The Depot will utilize communication resources including:
    - Print ads;
    - Flyers;
    - Fact sheets;
    - Radio commercials;
    - PTA meetings;
    - Neighborhood Association meetings; and
    - EnviroNews, published in May, July, September, November/99

- **Fact Sheets/Newsletters/ Others** - The Depot is committed to providing simple, clear explanations of public comment process, recommendations, risk information, and remedial technologies in the form of fact sheets, newsletters, and progress reports to address the concerns expressed by the community. This information will be distributed to the Depot mailing list, presented at RAB meetings, and placed in the Information Repositories. A summer edition of the EnviroNews will be published with responses to Frequently Asked Questions relating to the CWM removal.

- **Public Comment Period** – Once the final Engineering Evaluation/Cost Analysis at Operable Unit 1 (CWM removal) is issued from the Depot the public will have a 30-day period to review and provide comments on the document or preferred cleanup method.

- **Public Meetings** – A public meeting will be held during required 30-day public comment period for the final Engineering Evaluation/Cost Analysis at Operable Unit 1 to provide the public an opportunity to comment on the preferred alternative. The meeting will be held June 17, 1999 in conjunction with the regularly scheduled RAB meeting. Minutes of these meetings will be prepared and made available to the public at RAB meetings and in the Information Repositories.

- **Public Outreach/Community Meetings** - The Depot will continue to arrange meetings, workshops, and special events to discuss the status of the CWM removal on a required or as-needed basis. Bi-monthly availability sessions/visits will be coordinated at Depot area schools, churches and community centers throughout the Summer and Autumn 1999 to inform the community of CWM removal plans.

- **Information Repositories** – Copies of the final Engineering Evaluation/Cost Analysis at Operable Unit 1 report will be placed in each of the four (4) Information Repositories (IR). The IR allow the public open and convenient access to site related documents so that the public may stay better informed about the CWM removal and the environmental cleanup process.

- **Media Relations Plan** – A detailed media relations plan is included in the Community Relations Plan. The plan establishes guidelines to provide the media with timely and accurate information about the Depot's environmental activities and to address and clarify inaccuracies in order to achieve fair and balanced reporting of Depot issues. Media relations activities specific to the CMW removal will include:
  - spokesperson preparation and key message development;
  - coordination of access by media to facility/escorted site visits;
  - conduct editorial board meetings with primary media;
  - distribution of media information kits that include:
    - EnviroNews (back issues)
    - COE CWM fact sheet
    - PM Non-Stockpile CWM fact sheets
    - Acronym list
    - Groundwater Program fact sheet
    - Schedule of RAB meetings
    - Depot Contact list
    - Depot *Our Commitment* handout
  - development of responses to Frequently Asked Questions (FAQs);
  - coordination of primary media interviews;
  - distribution of media advisories (announcement of events);
  - distribution of news releases;
  - circulation of fact sheets;
  - address and clarify inaccuracies in media reports through letters to editor;
  - continue on-going media monitoring; and
  - seek opportunities for profile in public affairs programming.

TAB

ECBC Monitoring Plan

575 411

EDGEWOOD RESEARCH, DEVELOPMENT, AND ENGINEERING CENTER

CHEMICAL SUPPORT DIVISION

MONITORING BRANCH

MONITORING PLAN
FOR
DEFENSE DEPOT
MEMPHIS, TENNESSEE

OCTOBER, 1999

Edgewood Chemical Biological Center

575 412

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1.0 INTRODUCTION.

This document presents a monitoring plan for the U.S. Army Corps of Engineers, Huntsville remediation efforts at the Defense Depot Memphis, Tennessee (DDMT).

1.1 PURPOSE.

The purpose of this plan is to illustrate the strategy used by U. S. Army Corps of Engineers to monitor the airborne concentrations of recovered chemical warfare materiel during operations at DDMT.

1.2 SCOPE.

This plan establishes the policies, objectives, procedures, and responsibilities for the execution of a monitoring program at DDMT. This plan describes the rationale for monitoring strategies for area and general area air monitoring and choice of monitoring equipment. This monitoring plan applies to all facilities and operations within the DDMT involving air sampling and screening of soil and surface water containing suspected recovered chemical warfare material (RCWM).

1.3 OBJECTIVES.

The objectives of this plan are:

A. To illustrate the monitoring method used for each RCWM operation performed at the DDMT.

B. To assure that workers and public safety and health are maintained by providing adequate environmental monitoring as specified in AR-50-6, AR 385-61, and ER 385-1-92.

2.0 RESPONSIBILITIES.

Soldiers, Biological, Chemical Command (SBCCOM) will:

Collect and retain all CWM-related air monitoring data generated during this project.

Provide guidance on monitoring operations conducted on-site.

Conduct on-site analysis and confirmation for air samples, headspace samples collected from soil and surface water samples, if necessary, and extracts of soil and surface water samples.

Provide equipment and trained and certified personnel to operate MINICAMS and maintain certification data as part of the Monitoring Branch 40-year database.

Provide trained and certified personnel to set-up, and calibrate monitoring equipment and collect monitoring samples for general area and historical monitoring stations.

Perform air-monitoring procedures as outlined in the Corps of Engineers Scope of Work, and consistent with SBCCOM monitoring capabilities.

3.0 MONITORING.

The intent of air monitoring is to indicate to workers when a hazardous atmosphere is present and to maintain a record of employee exposure to airborne RCWM, thus ensuring the safety of the operators, the environment, and the surrounding communities. The choice of monitoring equipment is based on the type of monitoring to be performed and the types of agent involved. The location of monitors or sample ports is based on the operation, the airflow in the area, and the location of the source of agents.

IN THE EVENT OF A POSITIVE RESPONSE TO AGENT, IN EXCESS OF 1 TIMES THE AEL FROM AIR MONITORING AND/OR SOLID SORBENT ANALYSIS, ECBC MONITORING BRANCH PERSONNEL WILL IMMEDIATELY NOTIFY THE SITE SAFETY OFFICER (SS0)

3.1 TERMS.

3.1.1 Airborne Exposure Limit (AEL).

The AEL is the maximum allowable concentration in the air for occupational and general population exposures of any Chemical Warfare Material. Airborne exposure limits (AEL) for agents are contained in AR 385-61 and Department of the Army (DA) Pamphlets 40-8 and 40-173. Unless otherwise noted, AEL in this document refers to the 8-hour Time Weighted Average (TWA) for unmasked agent workers.

3.1.2 General Area Monitoring.

General area monitoring provides notification to personnel that there is a problem and that action must be taken. The monitoring device or sampling port is placed in strategic locations in the work area where there is a potential for encountering agent vapors. The sample locations are determined based on such factors as the agent involved, the airflow patterns in the area, the operation(s) being performed, and the location of the source of the potential release. In addition for RCWM operations, a sampling train is attached to the worker. The train consists of two or four Depot Area Air Monitoring System (DAAMS) tubes, which are connected to a dual-port sampler. Tygon or Teflon tubing to a general area air pump attaches the dual port sampler. The train is calibrated to a specified air flow rate (liters per minute, LPM).

3.1.3 Depot Area Air Monitoring System (DAAMS).

DAAMS is a portable air-sampling unit, which is designed to draw a controlled volume of air through a glass tube filled with a collection material (for example Tenax GC). As the air is passed through the solid sorbent tube, agent is collected on a sorbent bed. After sampling for the predetermined period of time and flow rate, the tube is removed from the vacuum line. The tube is transferred to the RTAP or MEAP where it is analyzed (approximately one hour process time) or, if necessary to prevent work stoppages, sent to the ECBC Monitoring Branch laboratory. The purpose of the analysis is to determine the presence, type, and quantity of agent collected in the sampling tubes. This technique will sample down to the AEL (Mustard (HD) = 0.003 mg/m^3, Lewisite (L) = 0.003 mg/m^3, Chloropicrin (PS) = 0.00) and provides low-level detection capability for HD, L and PS.

3.1.4 Fenceline Open-path Fourier Transform Infrared Spectrometry Air Monitoring (Op-FTIR).

Open-path air monitoring of gaseous compounds is a direct extension of laboratory spectroscopy systems that identify and quantify gases based on their spectral absorption characteristics. Typically open-path systems send a beam of light through the open air, to a reflector and then back to a receiver. If gases that absorb light are present in the beam, they can be identified and quantified. (This technique will sample down to the AEL for phosgene and Chloropicrin (O.1 PPM) and real time detection for mustard (HD: 0.03 mg/m^3) and Lewisite (L: 0.02mg/m^3). The levels for Mustard and Lewisite are not at the AEL, but the wide ban path (150 meters long and 0.3 meters wide) makes this a valuable technique to support the Near Real Time (NRT) point source monitoring techniques capable of reaching the AELs for the RCWM compounds.

3.1.5 Flow Log.

The Flow Log is an ECBC, Monitoring Branch record of the flow measurements taken during the set up and operations of monitoring stations.

3.1.6 Immediately Dangerous to Life and Health (IDLH).

A condition posing an immediate threat to life or health regardless of PPE use, including situations where concentrations of contaminants (including military toxic chemical agents) require self-contained, full facepiece, positive pressure supplied air respirators. This condition represents the maximum concentration from which, in the event of respirator failure, the wearer could escape without the respirator and without experiencing any escape impairing or irreversible health effects. For the purpose of the military toxic chemical agent program, IDLH includes atmospheres where oxygen content by volume is less than 19.5 percent.

3.1.7 Internal Operating Procedures (IOP).

Previously approved written monitoring and analysis procedures used by the SBCCOM at remediation sites.

3.1.8 Low-level Alarm.

Low-level alarm is a device used in conjunction with a low-level monitor or detector, which produces an audible sound and flashing light when the appropriate concentration at or above the AEL is detected.

3.1.9 Low-level Detectors.

Low-level detectors are those detection devices that can provide detection capability for concentrations at or below the established AEL for Chemical Warfare Material. Examples include DAAMS and the instrumentation used in the RTAP and MINICAMS.

3.1.10 Mobile Environmental Analytical Platform (MEAP).

The MEAP is a self-contained mobile platform that can be moved from site to site. It contains all the equipment necessary to analyze and confirm samples taken with DAAMS tubes and extracts of soil and surface water samples. It is designed as a fully functional trailer laboratory to cover the critical on-site chemical analysis and monitoring needs of this project.

3.1.11 Miniature Chemical Agent Monitoring System (MINICAMS).

MINICAMS is an automatic air monitoring system that collects compounds on a solid sorbent trap, thermally desorbs them into a capillary gas chromatography column for separation, detects the compounds with a Flame Photometric Detector (FPD) or Halogen Specific Detector (XSD). It is a lightweight, portable, low-level monitor designed to respond in less than ten minutes with alarm capability.

3.1.12 Personnel Roster.

The personnel record is a record of the people on-site during the conduct of operations at DDMT.

3.1.13 QL.

A Quality Laboratory sample is a quality control sample that has been spiked with a solution of an analyzed dilute chemical agent in the laboratory but which has not been aspirated at a sampling site.

3.1.14 QP.

A Quality Process sample is a quality control sample that has been spiked with a solution of an analyzed dilute chemical agent and exposed to the sampling environment.

3.1.15 Real Time Analysis Platform (RTAP).

The RTAP provides an automatic, continuous, environmental monitoring system that collects compounds on a solid sorbent trap, thermally desorbs them into a capillary gas chromatography column. The GC detects eluting compounds with simultaneous phosphorous and sulfur, dual headed Flame Photometric Detector (FPD), or an Electron Capture Detector (ECD). The RTAP is a self-contained mobile platform that can be moved from site to site. It is a mobile, low level monitor designed to respond in less than 10 minutes with alarm capability.

3.1.16 Scratch Log.

The Scratch Log is an ECBD, Monitoring Branch record that contains all pertinent information on a short of analytical results. Also used as tracking device for samples and chain of custody.

3.1.17 Time Weighted Average (TWA).

TWA is the maximum allowable concentration in the air for occupational exposures of any Chemical Warfare Material in any eight-hour work shift of a forty-hour workweek. CWM concentrations above the TWA level require the employees in this environment to don protective clothing or leave the work.

3.1.18 3X (XXX).

XXX indicates that the item has been surfaced decontaminated by approved procedures, bagged or contained, and that appropriate tests or monitoring have verified that vapor concentrations above the AEL or TWA limits for the specific agent(s) do not exist. Does not apply to a decontaminated liquid, detoxified liquid, soil, or a gas. Some items may be released from Government control if all Federal, State and local provisions have been met.

3.2 Types of Monitoring for DDMT.

3.2.1 Operations will be conducted IAW Monitoring Branch IOPs: Operations will be conducted IAW Monitoring Branch IOPs: MT-10 "Site Monitoring Procedures Using DAAMS Tubes and the Real Time Analytical Platform (RTAP)", which is included as Appendix A to this plan, MT-16 Operation and Maintenance Procedures for MINICAMS Mounted in a Mobile Vehicle which is included as Appendix B to this plan, MT-17 Operation and Maintenance Procedures for Real Time Monitoring Support During On-Site Operations, if needed, which is attached as Appendix C, and MT-18 Field Operating and Maintenance Procedure for Open Path Fourier Transform Infrared Spectrometer (Op-FTIR) where applicable, which is attached as Appendix D.

3.2.2 All monitoring operations will be conducted in accordance with the ECBC's Monitoring Branch's Quality Control Plan. All certification data will be maintained as part of the

Monitoring Branch 40-year database.

3.2.3 Real Time Monitoring.

SBCCOM will conduct real time monitoring at DDMT in support of remediation efforts as needed. The exclusion zone (EZ) and selected locations in the contamination reduction zone (CRZ) will be monitored in real time with MINICAMS, Op-FTIRs, and/or RTAP as dictated by the work scenarios. Primary monitoring will be provided by a mobile platform equipped with MINICAMS monitoring for Mustard, Lewisite, and the industrial chemicals Phosgene (CG) and Chloropicrin (PS). A back up unit, an Op-FTIR, will be positioned downwind from the monitoring site. The Op-FTIR has the capability to monitor for Phosgene at the AEL, but will also will provide real time (at levels above the AEL) and historical monitoring for Lewisite and Mustard.

3.2.3.1 Work performed within a ventilated structure will be monitored real time at the inlet to each filter system providing negative pressure to the enclosure. The MINICAMS will monitor each filter unit on a rotating basis. After the completion of a full sample and analysis cycle, the stream selection system will switch to the next filter unit. The MINICAMS will make a complete cycle of all filter systems in 40 minutes. The first MINICAMS will monitor behind the HEPA filter and prior to the first carbon filter. A second MINICAMS will operate in the identical fashion but will monitor between the first and second filters. If a alarm is encountered between the first and second filters, the heated sampling line (HSL) connected there will be switch to a sampling point behind the second filter, until the confirmation of the alarm is completed. If the confirmation is negative, the HSL will be returned to the sampling location immediately behind the first filter.

3.2.4 Confirmation/Historical.

Historical monitoring will be achieved through general area monitoring using DAAMS tubes, and Op-FTIR air monitoring. Because of the high volatility of phosgene DAAMS tubes are not amenable for collection of this compounds. It is recommended that Dragger tubes be used for these compounds. DAAMS tubes can be used for the collection and analysis of Chloropicrin. The DAAMS samples will not be used to immediately warn of hazardous conditions, but they will be used to document conditions over time and to confirm the results of the real time monitors. The DAAMS samples for Mustard, Lewisite and Chloropicrin may be analyzed in the RTAP/MEAP that will be on site. If the analytical equipment is not operational and in need of repair or should a positive response need confirmation by Mass Spectrometry and the MEAP is not on site or operational, the DAAMS tubes will be mailed via Federal Express to and analyzed in the ECBC Laboratory. The Op-FTIR will provide near real time monitoring for Lewisite and Mustard above the AEL, but it does have the capability to monitor for Phosgene at the AEL. A subsequent review, analysis, and verification of the Op-FTIR records will be conducted at ECBC's Chemical Applications Division for these compounds if requested by the Corps of Engineers, Huntsville.

3.2.5 Soil and Water Sample Headspace Monitoring and Verification.

Prior to shipment off site, headspace monitoring of soil and water samples will be completed through the use of MINICAMS and/or DAAMS tubes for Mustard and Lewisite.

3.2.6 General Area Monitoring.

DSAAMS tubes will be attached to two members of the crew working in the EZ. DAAMS tubes for Mustard, Lewisite, and Chloropicrin will be collected.

3.2.7 Quality control over analysis is maintained and verification testing is performed according to the Monitoring Branch Quality Control Plan or the off-site laboratory's Quality Control Plan.

3.2.8 Damaged sample containers, sample-labeling discrepancies will be noted on the COC form. The laboratory will contact the Project Manager if a problem develops for resolution.

3.3 MONITORING PROCEDURES/ANALYSIS.

3.3.1 Upon receipt of the DAAMS sample tubes and signing of the proper chain-of-custody sheets, the DAAMS tubes will be desorbed on a Dynatherm ACEM 900 thermal desorption unit and analyzed on a Hewlett-Packard 5890 GC with a dual Flame Photometric Detector or electron Capture Detector per IOP #MT-10. The MINICAMS will be calibrated for Mustard, Lewisite, Phosgene, and Chloropicrin using the XSD detector per MINICAMS IOP # MT-16. ECBC will maintain control over all results and data generated from the analyses. A matrix of monitoring procedures is attached as Table 1. The Op-FTIR air monitors will be calibrated per Op-FTIR IOP # MT-18. During the project, ECBC will maintain control over all results and data generated from the analyses. All data generated during the project will be tabulated, formalized and turned over to the Huntsville Corps of Engineers after completion of the project. ECBC will incorporate the data generated into the Monitoring Branch 40 year data storage program, should access to additional information be required. The levels for Mustard, and Lewisite are not at the AEL, but the wide ban path (150 meters long and 0.3 meters wide) makes this a valuable technique to support the Near Real Time (NRT) point source monitoring techniques capable of reaching the AELs for the RCWM compounds.

3.3.2 Real Time.

3.3.2.1 Real time air monitoring will be accomplished by using the MINICAMS and RTAP set to alarm at 20 percent of TWA hazard level for H and L and 80 percent of the hazard level for CG and PS. The MINICAMS/RTAP system will provide warning of airborne exposure hazards at the work site. Op-FTIR air monitors will provide continuous real-time air monitor along the downwind perimeter of the site.

3.3.2.2 The MINICAMS can detect H, L, CG, and PS at either IDLH (immediately dangerous to life and health) or TWA (time weighted average) levels. The system consists of a monitor (sample collection, analysis, detection, and alarm equipment), vacuum pump, heated sample transfer lines, compressed gases, and computer. In the sampling cycle, a vacuum pump draws air into the MINICAMS system through a heated sample transfer line. The transfer line is heated to prevent condensation of any CWM material on the walls of the transfer line. The air sample is drawn through an automated gas chromatograph that first collects agent on a solid sorbent and then thermally desorbs the agent into a separation column for analysis. A Halogen Specific Detector (XSD), which responds to Chlorine containing compounds or a Flame Photometric Detector (FPD) which responds to Phosphorous and Sulfur containing compounds, detects the components eluting from the column. A direct readout, in units of the hazard level, is provided. A permanent trace of the chromatogram is stored in the computer. If RCWM is detected at the hazard level preprogrammed by the operator, the MINICAMS system alarm will activate and the workers will take immediate actions. The MINICAMS does not sample continuously because sampling is stopped during the thermal-desorption step.

3.3.2.3 Each MINICAMS/RTAP unit shall be checked daily to determine if calibration is required. Appropriate action shall be taken to correct any malfunctions found. After completion of the instrument observation, an agent challenge shall be made to verify that the MINICAMS/RTAP performance is acceptable and to see whether calibration is necessary. An aliquot of a Quality Control (QC) standard solution of the agent(s) of interest is injected. The concentration of the standard solution shall be such that the injection contains 1.0 +/- 10% TWA or IDLH of the agent, depending on the hazard level the MINICAMS/RTAP is programmed to detect. If the MINICAMS/RTAP response is within 25% of the challenge level, it is not necessary to calibrate the MINICAMS/RTAP unit. If the response is not within 25% of the actual challenge level, the unit shall be challenged again. If it fails a second challenge, it shall be recalibrate.

3.3.2.4 The MINICAMS/RTAP unit shall be calibrated IAW the instructions given in the Monitoring Branch IOP MT-16 or MT-17. After the calibration has been completed, an injection containing 1 TWA of the agent shall be made. If the MINICAMS response is between .75 and 1.25 TWA, the calibration is considered satisfactory.

3.3.2.5 Data Evaluation

The performance of the MINICAMS/RTAP is monitored daily. Each day a QL challenge is made to the MINICAMS/RTAP using standards of known concentration. Each standard is prepared to reflect the 1 TWA level for the agent being monitored. The area, peak height, retention time, peak width and injection size and the name of the technician are recorded on a log sheet.

3.3.2.6 Control Samples

3.3.2.6.1 Each day when the instrument is functioning properly, a QP challenge shall be injected in the heated sample line of the MINICAMS using standard solutions of chemical agents at concentrations which will give readings of one TWA.

3.3.2.6.2 A MINICAMS/RTAP sample is defined as the volume of air, which is sampled during one automatic cycle of the instrument for the agent being monitored. To prepare a challenge sample for the MINICAMS/RTAP, known volumes of standards of dilute chemical agent are injected into the sample inlet.

3.3.2.7 Quality Control of Agent Sample Lines

3.3.2.7.1 All agent sample lines will be challenged daily with chemical agent to verify that their transmission efficiency remains high and the results are documented. A calibrated MINICAMS/RTAP as the detector will be used to test the sample line. Prior to testing the sample line, the MINICAMS/RTAP will be challenged so that the transmission efficiency of the sample line may be determined directly. Spiking levels are the same as those normally used for daily challenges. All injections will be at the sample collection end of the sample line.

3.3.2.7.2 A record of the test date, time, and result will be maintained for each sample line. This record will be maintained at the monitoring station to which the sample line is connected.

3.3.2.7.3 Agent Challenge Log Sheet

All challenges of chemical agent monitors with agent will be recorded on an agent challenge log sheet.

3.3.2.8 Op-FTIR Monitoring

Open-path air monitoring of gaseous compounds can detect and quantify chemical agent, their precursors and breakdown products on a real-time basis. The systems that identify and quantify gases based on their spectral absorption characteristics. Typically open-path systems send a beam of light through the open air, to a reflector and then back to a receiver. If gases that absorb light are present in the beam, they can be identified and quantified. The system will be set up downwind of the work site and will provide a record of any gaseous emissions crossing the fenceline. A zeropath is taken at the site just prior to continuous air monitoring. Due to the short (<1m) path, any atmospheric pollutants are minimized and therefore insignificant compared to the long path measurements. These zeropaths will be used as the "clean" reference only in cases where other background correction techniques are unavailable.

3.3.2.8.1 Data Evaluation

Data will be evaluated in two phases if requested by the Corps of Engineers, Huntsville. The first phase will include daily reports on H, L, and CG. These data will be given to the SSO or his designee as soon as they are available. This will normally be the morning after the samples have been collected. The second phase is a subsequent review, analysis, and verification of the Op-FTIR records conducted at ECBC's Chemical Applications Division for these and related compounds if requested by the Corps of Engineers, Huntsville.

3.3.2.9. Control Samples

The Op-FTIR is challenged daily with standard solutions of two calibrated gas standards that absorb infrared light in the same absorbance spectral region as H, L, and CG.

Table 1
SBCCOM Monitoring Matrix

	MINICAMS (real time)	DAAMS (perimeter)	DAAMS (General Area)	RTAP (Real time)	Op-FTIR
Locations	4 - Work site 2 - PDS	4 – perimeter outside the containment structure	1-2 personnel inside the structure	1- Connected to shore power for backup use and analysis of DAAMS tubes	Down wind from the work site.
Frequency	Continuous On site. RTAP in standby	Up to 8 hours	Up to 8 hours	Continuous During operation as needed	5 minute averages
Analysis Time	Approximately 10 minutes	Approximately 15 minutes	Approximately 15 minutes	Approximately 10 minutes	Approximately 5 minutes
# People	2 MINICAMS operators	2 Sample Collection technicians	1 RTAP operator	1 RTAP operator	1 Op-FTIR operator
Target Agent	Mustard (HD) Lewisite (L) Phosgene (CG) Chloropicrin (PS)	Mustard (HD) Lewisite (L) Chloropicrin (PS)	Mustard (HD) Lewisite (L)	Mustard (HD) Lewisite (L) Phosgene (CG) Chloropicrin (PS)	Mustard (HD) Lewisite (L) Phosgene (CG) Chloropicrin (PS)
Lowest Level Of Detection	HD - 0.00075mg/m^3 L - 0.00075mg/m^3 CG - 0.06 PPM PS - 0 06 PPM	HD: 2 ng L : 20 ng PS: 2 ng	HD: 2 ng L: 20 ng PS: 2 ng	HD - 0.00075mg/m^3 L - 0 00075mg/m^3 CG - 0 06 PPM PS - 0 06 PPM	HD:0.03 mg/m^3 L :0.01 mg/m^3 CG:0.07 mg/m^3
Action Level	HD: 0.003 mg/m^3 CG: 0.1 PPM PS: 0.1 PPM L: Any positive reading.	HD: 0.003 mg/m^3 L: 0.003 mg/m^3 CG: 0.1 PPM PS: 0.1 PPM	HD: 0.003 mg/m^3 L: 0.003 mg/m^3 CG: 0.1 PPM PS: 0 1 PPM	HD: 0.003 mg/m^3 CG: 0.1 PPM PS: 0 1 PPM L: Any positive reading.	HD:0.03 mg/m^3 L :0.01 mg/m^3 CG:0.07 mg/m^3

3.3.3 Confirmation/Historical.

Historical air samples may be collected over several hours, as in background samples or a few minutes, as in soil sample headspace. Also, they can be collected on a daily basis or periodically.

3.3.3.1 DAAMS sampling stations that will be located along the perimeter of the work area will collect samples to confirm real time alarms for H and L. These will also provide historical records. DAAMS analysis consists of sampling stations, solid sorbent tubes, and a gas chromatograph. At each DAAMS station, a vacuum pump will be used to continuously draw air through the DAAMS tube at a controlled flow rate. After the required time (per Monitoring Branch QC Plan and IOP # MT 10), the DAAMS tube will be collected and transported to the RTAP or, when necessary, the ECBC laboratory for sample analysis using a gas chromatograph. The tube is a then heated and trapped chemical desorbed from the DAAMS tube. Nitrogen is forced through the tube to carry the desorbed CWM into a capillary column for chromatographic separation. The separated chemical agents elute into the detector, where they will be identified and quantified.

3.3.3.2 Notification.

Notify the Site Safety Officer (SSO) at DDMT of all confirmed detections of Mustard and Lewisite. This includes concentration levels below the TWA or AEL value.

3.3.3.3 Air Sampling Records.

Maintain copies of all general area air sampling results. Forward a copy of the results to the USACE- Huntsville, Project Health and Safety Manager for further disposition.

3.3.4 Soil Headspace Monitoring.

Under normal conditions soil sample headspace analysis will be conducted using the MINICAMS. DAAMS tubes will be used to confirm all positive MINICAMS readings.

Headspace Monitoring Procedures of soil samples using the RTAP or MINICAMS.

1. Contractor delivers soil sample to monitoring personnel.

2. Place up to six samples in a sample box heated to 90° ± 10 degrees Fahrenheit. Open bags and remove sample jar lids. Close sample box lid and allow samples to equilibrate for 15 minutes.

3. Connect MINICAMS probe to sample port of the heated sample box. Run two complete cycles on the MINICAMS.

   a. If MINICAMS reading is below the AEL (clear), go to step 16.

   b. If MINICAMS reading is above the AEL (hot) for agent, go to step 4.

4. Don Mask and Gloves.

5. Open sample box and replace lids on sample containers.

6. Allow samples to re-equilibrate for 15 minutes.

7. Connect MINICAMS to sample port of heated sample box until a clear reading is obtained on the MINICAMS.

8. Don mask and gloves, open lid of sample box. Samples will be monitored one at a time.

9. Remove lid from sample container. Insert MINICAMS probe. Run one cycle on the MINICAMS. Close the sample jar and repeat this procedure on the next sample. All samples must be monitored to assure the hot samples are located. Segregate the samples giving a hot response. If a hot sample cannot be identified, go to step 11.

10. Collect DAAMS tubes on the hot samples. Collect tubes at 500 milliliters per minute for 30 minutes. Give tubes to the monitoring technician for analysis.

11. Place split samples in the heated sample box.

12. Allow samples to re-equilibrate for 15 minutes.

13. Connect MINICAMS to sample port of heated sample box until a clear reading is obtained on the MINICAMS.

14. Don mask and gloves, open lid of sample box. Samples will be monitored on at a time.

15. Remove lid from sample container. Insert MINICAMS probe. Run one cycle on the MINICAMS. Close the sample jar and repeat this procedure on the next sample. All samples must be monitored to assure the hot samples are located. Segregate the samples giving a hot response.

16. Give clear samples to the contractor for proper disposition.

17. If DAAMS tubes are used in place of MINICAMS, follow the same sequence of steps.

3.3.4.1 Notification.

Notify the Site Safety Officer (SSO) at DDMT of all confirmed detections of Mustard. This includes concentration levels below the TWA or AEL value.

3.3.4.2 *Air Sampling Records.*

Maintain copies of all general area air sampling results. Forward a copy of the results to the USACE- Huntsville, Project Health and Safety Manager for further.

3.3.5 *General Area Monitoring.*

General Area sampling will be used for confirmation monitoring for two of the workers in the exclusion zone or work zone. These workers will be ones actually involved in the digging. Each person is fitted with portable sampling pumps. Each pump is set with two - four DAAMS tubes to monitor for Mustard Lewisite and Chloropicrin. Monitoring pumps are run for a maximum of eight hours and a minimum of one hour and fifteen minutes per day. Flow rates for monitoring pumps are determined in accordance with the internal operating procedures used by the Monitoring Branch personnel. See MT-10 attached as Appendix for Set up procedures.

3.3.5.1 Notification.

Notify the Site Safety Officer (SSO) at DDMT of all confirmed detections of Mustard. This includes concentration levels below the TWA or AEL value.

3.3.5.2 *Air Sampling Records.*

Maintain copies of all general area air sampling results. Forward a copy of the results to the USACE Huntsville, Project Health and Safety Manager for further disposition.

3.3 Historical Records. Monitoring branch technicians shall maintain the electronic database for all samples collected with DAAMS tubes, records of MINICAMS, and Op-FTIR analyses, the flow calibrations, and challenges of the MINICAMS, Op-FTIR, RTAP, and MEAP. Monitoring branch personnel shall be responsible for certifying that monitoring operations are conducted according to this plan or the site-specific QC plan. ECBC will prepare a final report, if requested, in support of the DDMT project and forward copies of all analytical results to the USACE - Huntsville Project Manager.

3.4 Quality Control. At least two QP samples shall be run daily for each type of analysis performed. A 1.0 TWA QP sample shall be run every 20 samples on the DAAMS system and for instruments that are conducting real time monitoring, a minimum of every four hours on the MINICAMS and RTAP monitors.

3.5 Monitoring Contingency. In the event of unforeseen circumstances, the Monitoring group will notify the On-Site Safety Officer to briefly halt operations in order to catch up in the analysis of field samples.

APPENDIX A

SITE MONITORING PROCEDURES USING DAAMS TUBES

AND

THE REAL TIME ANALYTICAL PLATFORM (RTAP)

575 428

Internal Operating Procedure: Operations Directorate

Monitoring Branch

Title: Site Monitoring Procedures Using DAAMS tubes and the Real Time Analytical Platform (RTAP)

Division: Chemical Operations

Branch: Monitoring Branch

Building/Area: In vicinity of E3346 and other areas nationwide

This internal operating procedure covers operations, methods and procedures of a general nature not covered by a standing operating procedure. This procedure will be effective until rescinded or superseded.

Changes to this procedure will be accomplished by submission of revisions or amendments for approval.

Submitted by:

K. Maguire
Monitoring Team

Approved by:

F. G. Lattin
Chief, Monitoring Branch

Date: December 4, 1998

IOP Number: MT-10

Revision Number: 1

Prepared by: K. Maguire
X8428

Approved by: F. G. Lattin
X4479

Title: Site Monitoring Procedures Using DAAMS Tubes and the Real Time Analytical Platform

Operator's Statement: I have read, or have had read to me the procedures in this IOP. I, by my signature below, indicate that I thoroughly understand and agree to abide by these instructions.

Signature	Date	Signature	Date

Supervisor's Statement: I have personally reviewed this IOP and, to the best of my knowledge, believe that the information listed herein is correct.

Supervisor: ______________________ Date: ______________________

F. G. Lattin

REAL TIME ANALYTICAL PLATFORM

General Information. For responsibilities, general safety requirements, first aid, decontamination, disposal, and emergency procedures refer to ERDECR 395-15. For hazards (general or specific) see the Material Safety Data Sheets (MSDS) at the site to be monitored.

Equipment Required:

Real Time Analytical Platform equipped with:

Gas chromatograph/dual flame photometric detector and/or GC/ECD
- Dynatherm ACEM 900
- Fume hood
- hydrogen and nitrogen/air generator
- safety equipment
- ChemStation with software

DAAMS Tubes
Sampling Pump
Calibrated Flow Meter
PC with Tag Program
Calibration Standards
Syringes and spiking block
Tubing
Gemini Dual Port Sampler
Distilled, deionized water

Detailed Procedures:

Departure to Site:

1. Ensure all loose items are secured.

2. Ensure that paper trays for all printers are filled.

3. Ensure that the label printer is filled.

4. Start up and check fuel level of power generators.

5. Check Daily Challenges and printouts to ensure instruments and data are within operating specifications IAW the Monitoring Branch QC Plan.

6. Cellular Phone in RTAP is operable and turned on.

7. Check oil level in vehicle and electrical power generators prior to starting

Initial Site Set-Up: DAAMS Tubes

1. Remove DAAMS tubes from the protective carriers. Inspect tubes to ensure there are no chipped ends or cracks and verify that the frit is clean. Do not use damaged tubes.

2. Write DAAMS tube numbers on upper right hand corner of the sample tag. NOTE: Dual tubes will be used for all samples. List the lowest numbered tube first, with the second tube being listed below the first (See Figure A1). The lowest numbered DAAMS tube will be analyzed by the analyst/operators first, once the sampled is received. The second tube will be used for confirmation, if required

Figure A1. Field Tag

Bldg. No. Date			1st Tube No. 2nd Tube No.	
Flow Rate		Sample ID	Flow Rate	
1st Tube	2nd Tube		1st Tube	2nd Tube
(3 flow rates are required before samples are placed adjust flow with Gemini)			(3 flow rates are required after samples are picked DO NOT ADJUST FLOWS)	
Time On _______			Time Off _________	
			Pump # _________	

3. Check sampling pumps for proper sampling time (Up to 8 hours for perimeter and general area monitoring). Check that the harness is attached and that the Gemini Dual Port Samplers are connected.

4. Connect the downstream end of the tygon tubing harness to the air monitoring pump.

5. Connect the GLASS WOOL side of the DAAMS tube to the Gemini Dual Port Sampler (Gemini). Two DAAMS tubes will be used concurrently during the monitoring procedure. The analysis of the DAAMS tube during desorption is a one-shot occurrence. If the desorbed sample is not analyzed as anticipated, the sample cannot be recovered. Therefore, a second tube is used as a backup.

6. Using a calibrated flowmeter, adjust the flows through the DAAMS tubes by adjusting the setscrews on the Gemini to the required rates. Take three (3) readings with the calibrator. If the third reading is within 10 percent of the first two readings record the flow rates on the sample tag as indicated in Figure A1. Flow rates for specific sampling procedures are shown in Table 1.

Table 1. MONITORING FLOW AND SAMPLE RATES

Sample Type	Description and Preparation Procedures Prior to Sampling	Pump Sample Time	Flow Rates
1X Items (small)	Size should be limited to less than 3' x 3' x 3'.	30 min.	500 mls/min.
Soil Samples	Sample jar of soil shall be doubled bagged. Dual tubes shall be run on all soil samples.	30 min.	500 mls/min.
TAP Clothing	TAP clothing shall be double-bagged and sealed.	30 min.	500 mls/min.
1X Items (large)	Items shall be larger than 3 x 3 x 3 feet. Items should be placed on a pallet and wrapped in plastic. For extremely large items 2 samples should be taken on the items.	1 hour	250 mls/min.
Dual DAAMS Tubes Shall be Used for All Monitoring Listed			
General Area Monitoring	Monitors shall be placed on the person or in the work area in close proximity to the worker.	2 hours 4 hours 8 hours	200 mls/min 100 mls/min 50 mls/min.
Perimeter Monitoring for Clean-up Sites	A minimum of 4 positions shall be set up. First position shall be located at the point source.	2 hours 4 hours 8 hours	200 mls/min 100 mls/min 50 mls/min.
Area/Perimeter Monitoring	Area shall be monitored for 4 or 8 hours. A minimum of three positions shall be set up. Pumps can be set to run for 4 or 8 hours.	4 hours 8 hours	100 mls/min. 50 mls/min.

7. Locate and secure the pump on the area to be monitored so that it cannot be knocked over or entangled with personnel or equipment. Place perimeter stands (Positions A through D). Place the appropriate pumps on the stands and set up monitors (See section on General Area Monitoring with DAAMS Tubes). (All perimeter pumps and stands should be labeled A through D to avoid confusion prior to placement.)

8. Position A is at the work site. Position D is approximately 25 feet upwind from the work site. Positions B and C are approximately 25 feet downwind from the work site and are approximately 50 feet apart. See Figure A2.

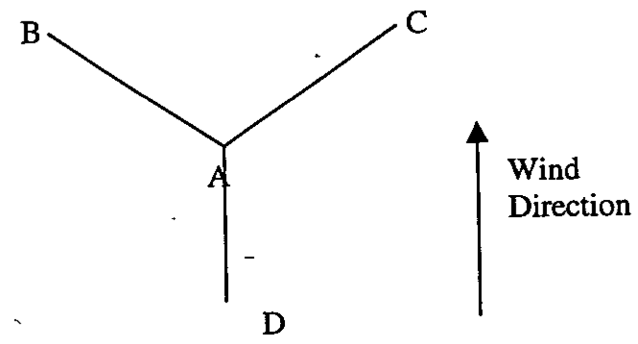

Figure A2.

9. All information must be recorded in the TAG program and on the tag itself. The information will depend on what type of monitoring is required. Enter information into the TAG program, print out tag and associated document and label sample. The program will prompt the user for appropriate information that must be included on the sample tag.

10. Fill out flow sheet with position ID. Enter the tube numbers in the space labeled tubes and record the flow rates taken.

11. When operations start, turn on the pump to start the sample and write the starting time on the field tag.

Initial Set Up: Background Monitoring with DAAMS Tubes

1. Outdoors: Assess the area and set up a minimum of three positions, (more if deemed necessary). Positions should be approximately 50 feet apart and set up approximately 25 feet down wind from the source to be monitored. See Figure A2.

2. Indoors: Assess the area and set up a minimum of two positions, (more if deemed necessary). For extremely small areas (10' x 10' or less), set up one position using dual tubes.

3. Refer to DAAMS tube set up, Steps 1-7, as applicable.

4. Fill out flow sheet with position ID. Enter the tube numbers in the space labeled tubes and record the flow rates taken.

5. Repeat steps 1-4 as appropriate throughout the day. Ensure that a set of background monitors is always ready.

Initial Set Up: General area Monitoring with DAAMS Tubes

General area air sampling will be used for both first entry and quarterly period sampling requirements

1. Refer to DAAMS tube set up, Steps 1-10, as applicable.

2. Secure the pump to the outside of the employee's clothing using a belt. Situate the pump as comfortably as possible without being entangled with the worker's clothing or nearby equipment.

3. DAAMS tubes should be located within approximately 30 centimeters of the employee's nose.

4. Observe the pump for approximately three minutes to ensure it is working correctly. Advise the wearer that under no circumstances are they to turn the pump on or off, not to smoke while wearing the pump and not to wear the pump in a port-a-pot. Wearers shall notify monitoring personnel should any situation arise that requires removal or adjustment of the pump, or if pump stops.

5. Record Air Pump Calibration Flow Rates on the flow sheet using the last four digits of the monitored individual's SSN. The last four digits are used as the ID. Enter the tube numbers in the space labeled tubes and record the flow rates taken.

6. Repeat steps 1-5 as appropriate throughout the day. Ensure that a set of general area monitors is always ready since general area monitors are exchanged every two hours.

Initial Start Up: RTAP

1. Upon entering the RTAP, verify there is (shore) power going to the instruments. If yes, go on to Step 4.

2. If no, check the circuit breakers on the wall just behind the driver's seat in the analytical portion of the truck. If there is a tripped breaker, STOP. Turn the GCs off (on the lower right side near the back). Next turn off the Hydrogen and Nitrogen generators - to prevent blowing internal fuses. Turn off all extraneous utilities, i.e. heated sample lines, overhead air vent, vacuum pump, hood, air conditioners/ heaters, computer monitors and printers. Leave the hard drive on. VERIFY that the system is drawing 10 amps or less. Flip the breaker, and proceed to turn the above mentioned back on as needed. If the gas generators do not respond immediately, adjust the Electronic Pressure Control (EPC) accordingly to prevent the GC from going into safety shutdown.

3. For running off internal generators, initiate the following:

   (a) Start the supplemental power generators, and let them warm up for about 10 minutes.

(b) Turn off extraneous utilities, i.e. heated sample lines, overhead air vent, vacuum pump, hood, air conditioners/heaters, computer monitors, printers and, in this case, GC ovens.

(c) Make sure that the system is BELOW 10 amps on the master power control panel BEFORE you unplug the vehicle from shore power. (Let the instruments run off one generator and the utilities run off of the other generator.)

(d) Unplug the shore power cord from the RTAP's external outlet and turn on the utilities necessary.

4. Conduct an initial (morning) RTAP challenge (using a DAAMS Tube/GC). Check to see if the system is ready, the flame is lit and the ChemStation is in "Ready" status.

   (a) Before running any blanks, create a directory in the ChemStation. On the main menu screen, go into "Run Control" and then to "Sample Info" to enter your name, the date, the project, etc. This should be updated every day. Record any troubleshooting or changes to the GC configuration on the GC Preventive Maintenance Log (Attachment 3). Run a blank (this can be done while the generators warm up). If the blank is normal (clear), spike the fast flow tube with 10 ul of the calibration standard as a warm up. Repeat. Next, spike the fast flow tube with 4µl of calibration standard and run the DAAMS tube. Record usage on the Usage Record (Attachment 1). Record QP results on the Monitoring Data Record (Attachment 2).

   (b) If the challenge passes, the GC system is ready to begin sampling.

   (c) If the challenge does not pass, repeat the challenge. If the second challenge fails, per the Monitoring Branch Quality Control (QC) Plan, recalibrate or troubleshoot (see system manual). Record standard usage on the agent usage record (Attachment 1). Record QP results on the Monitoring Data Record (Attachment 2).

Initial Set Up: DAAMS Monitoring of Bulk Material or Scrap.

1. Remove DAAMS tubes from the protective carriers. Inspect tubes to ensure there are no chipped ends or cracks and frits are clean. Do not use damaged tubes.

2. Write DAAMS tube numbers on upper right hand corner of the sample tag. NOTE: When using dual tubes the lowest numbered tube is listed first, with the second tube being listed below the first (See Figure A1). The lowest numbered DAAMS tube will be analyzed by the analyst/operators, first, once the sampled is received.

3. Connect the downstream end of the tygon tubing harness to an air monitoring pump.

4. Connect the GLASS WOOL side of the DAAMS tube to the Gemini Dual Port Sampler (Gemini). Two DAAMS tubes will be used concurrently during the monitoring procedure. The analysis of the DAAMS tube during desorption is a one-shot occurrence. If the desorbed sample is not analyzed as anticipated, the sample cannot be recovered. Therefore, a second tube is used as a backup or for confirmation.

5. Attach a Gemini to the sampling pump.

6. Using a calibrated flowmeter, adjust the flows through the DAAMS tubes by adjusting the set screws on the Gemini to the required rates. Take three (3) readings with the calibrator. If the third reading is within 10 percent of the first two readings record the flow rates on the sample tag as indicated in Figure A1. Flow rates for specific sampling procedures are shown in Table 1.

7. Insert frit end of DAAMS tube through all layers of wrapping material and clear of obstructions or liquid submersion. Do not insert tube into liquid or soils. if liquid is drawn onto tube, stop the sample, get new tubes and start over.

8. Turn on the pump to start the sample and write the starting time on the field tag.

Monitoring with DAAMS Tubes

1. Check tubes to ensure connections and flow rates are stable. The amount of time for Monitoring will depend on the type of monitoring conducted (See Table 1). Perform any maintenance, repair and cleaning as required. Maintain the worksite, including the interior of the RTAP, to ensure that all surfaces are clean and dirt/dust free.

2. Before disconnecting the DAAMS tubes samples from the tygon harness:

   (a) Write the time the sample finished on the field tag

   (b) Verify that the DAAMS tube numbers are written on the upper-right hand corner of the sample tag

   (c) Verify that the DAAMS tube numbers match the numbers written on the sample tag

   (d) Verify that the identification number for the sample is written on the sample tag and the actual sample (use permanent marker when marking the item being sampled).

   (e) Take three readings using a calibrated flowmeter for each DAAMS tube used during the sampling process and record the flows on the field tag. DO NOT make any adjustment to the flow rates.

3. Remove the DAAMS tube from the Gemini and place the frit end into the protective carrier first. Replace the cap.

4. Log samples into the Tag program and record flow information on the flow sheets. Technicians will annotate any sample discrepancies on the scratch log and any flow discrepancies in the flow sheet. Verify all information is correct and samples are properly identified prior to the analysis.

5. Take samples to the RTAP where the analyst/operator will verify receipt and annotate the scratchlog. Any discrepancies during the analysis will be recorded, by the analyst/operator on the data sheet. These comments shall be added to the comment section of the database program.

6. All data will be collected on the computer in the RTAP, downloaded and added to the Monitoring Branch database at the end of each month.

7. Record the following required information in the appropriate location on the scratchlog, the personnel roster or the flow log.

<u>Scratch log</u>
(a) Location
(b) Sample identification number
(c) Date of sample
(d) Agent(s) being tested for
(e) Type of sample (Background, SOP, TAPC1, etc.)
(f) Time ON and OFF for samples
(g) Point of contact and extension number
(h) Chain of custody signatures, date & time

<u>Personnel Roster</u>
(a) Sample identification number
(b) Date of sample
(c) Agent(s) being tested for
(d) SOP number(s)
(e) Point of contract and extension number
(f) Names of personnel present during operation and SSN
(g) Times (in and out) personnel were present during operations
(h) signature of technicians setting up SOP

<u>Flow Record</u>
(a) Location
(b) Sample identification number
(c) DAAMS tube number (lowest number listed first)
(d) Flow rates for all tubes prior to sample being run

---
1 Toxicological Agent Protective Clothing.

(e) Flow rates for all tubes at conclusion on sample run

(f) Comments on any discrepancies concerning tube flows (i.e. tubes contaminated with dirt/liquid, tubes broken)

8. One QP (quality process) sample per every 20 samples will be collected to ensure that no tampering or sampling anomalies occur. A QP is a sample spiked with a known concentration of analyte and analyzed with the field samples. The results are used to validate the performance of the system. Record standard usage on the agent usage record (Attachment 1). Record QP results on the Monitoring Data Record (Attachment 2).

9. Sampling tags are generated from a PC database program. The tags are attached to the carrier of the DAAMS tube and removed by the analyst during the analysis and affixed to the chromatogram. Tube numbers are written on tag for each sample prior to the analysis.

10. The analytical results, which are on the chromatogram printout in nanograms, are filled out on the data analysis sheet and entered into the tag program database by the analyst/operator.

11. Notify the site safety personnel of any result above the 8-hour time weighted average (TWA) airborne Exposure Level.

DAAMS Tubes sampling with the RTAP

1. Remain in standby mode until samples are received. Per Monitoring Branch QC Plan, for every 10 DAAMS samples, you must run a 4 µl QL challenge and challenge the instrument again at the end of the day after the last sample has been run. Record standard usage on the agent usage record (Attachment 1). Record QL results on the Monitoring Data Record (Attachment 2).

Headspace Monitoring for Soil Samples using the RTAP

1. Contractor delivers soil sample to monitoring personnel.

2. Place up to six samples in a sample box heated to 90° ± 10 degrees Fahrenheit. Open bags and remove sample jar lids. Close sample box lid and allow samples to equilibrate for 15 minutes.

3. Connect MINICAMS probe to sample port of the heated sample box. Run two complete cycles on the MINICAMS.

    a. If MINICAMS reading is below the AEL (clear), go to step 16.

    b. If MINICAMS reading is above the AEL (hot) for agent, go to step 4.

4. Don Mask and Gloves.

5. Open sample box and replace lids on sample containers.

6. Allow samples to re-equilibrate for 15 minutes.

7. Connect MINICAMS to sample port of heated sample box until a clear reading is obtained on the MINICAMS.

8. Don mask and gloves, open lid of sample box. Samples will be monitored one at a time.

9. Remove lid from sample container. Insert MINICAMS probe. Run one cycle on the MINICAMS. Close the sample jar and repeat this procedure on the next sample. All samples must be monitored to assure the hot samples are located. Segregate the samples giving a hot response. If a hot sample cannot be identified, go to step 11.

10. Collect DAAMS tubes on the hot samples. Collect tubes at 500 milliliters per minute for 30 minutes. Give tubes to the monitoring technician for analysis.

11. Place split samples in the heated sample box.

12. Allow samples to re-equilibrate for 15 minutes.

13. Connect MINICAMS to sample port of heated sample box until a clear reading is obtained on the MINICAMS.

14. Don mask and gloves, open lid of sample box. Samples will be monitored on at a time.

15. Remove lid from sample container. Insert MINICAMS probe. Run one cycle on the MINICAMS. Close the sample jar and repeat this procedure on the next sample. All samples must be monitored to assure the hot samples are located. Segregate the samples giving a hot response.

16. Give clear samples to the contractor for proper disposition.

17. If DAAMS tubes are used in place of MINICAMS, follow the same sequence of steps.

Site Shutdown:

1. Collect all perimeter and general area monitoring samples. Record the flows as required. Give all samples, tags and data sheets to the RTAP operator.

2. Ensure that there is sufficient gas in the RTAP for the next day's operation. Refuel the vehicle if necessary. Put all gas receipts in the vehicle maintenance log. Write the mileage (odometer reading) on the gas receipt. Use only low grade unleaded when refueling the RTAP.

3. Complete the final RTAP challenge of the day. Record standard usage on the agent usage record (Attachment 1). Record challenge results on the Monitoring Data Record (Attachment 2).

4. If shore power is not required, go on to the Final Checks. If shore power is required:

   (a) Turn off extraneous utilities, i.e. heated sample lines, overhead air vent, vacuum pump, hood, air conditioners/ heaters, computer monitors and in this case GC ovens. Leave appropriate utilities and instruments on.

   (b) Make sure that the system is BELOW 10 amps on the master power control panel box BEFORE the vehicle is plugged into shore power.

5. Conduct Final Checks:

   (a) Turn GC oven back on.

   (b) Adjust internal RTAP ambient temperature in relation to outside temperature (if it's hot outside, turn on AC; if it's cold, turn on heat).

   (c) Collect and store all perimeter stands and electrical cords.

   (d) Ensure that the standards are recapped and placed in the freezer.

   (e) Ensure that the agent log (Attachment 1) is completed for the day.

   (f) Ensure that the all Monitoring Data (Attachment 2) are completed and file the chromatograms for the day in the latest binder.

   (g) File scratch logs and data sheets in the appropriate binders

(h) Set up for the next day:

(1) Set up perimeter and general area pumps. Make sure pumps/calibrators are charging.

(2) Prepare DAAMS tubes sets and field tags

(3) Condition used DAAMS tubes

(i) Collect all trash and dispose of in appropriate containers

(j) Make sure that all doors on the vehicle are locked (including the cab). Lock all cabinets and drawers in the RTAP.

(k) Make sure that the cellular phone is set on charge.

(l) Fill printer trays

(m) Make sure that all windows are closed and locked.

(n) Make sure that all vacuum pumps are off.

NOTE: All calibration standards must be decontaminated before the RTAP leaves the site at the end of the operation.

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Attachment 1

CSM CUSTODIAL STOCK AND USAGE RECORD

Container No. ___________ CSM Type: _______

Document #: SCBRD-ODC-O-DG-________

Lot #: ____________________

Room No.______________ Container Vol. (mL): ____________

Date	Name of User	Balance Issued (mL)	Usage (mL)	Balance Returned (mL)	Site	Signature of Issuer

Attachment 2
RTAP QP DATA SHEET

RTAP MONITOR DATA. TURN IN WEEKLY OR UPON RETURN FROM LOCATION.
P1/P2/P3=1TWA +/- 25% GC Serial Number________________
Location________________ Monitor Number________________
Agent________STD________ug/ml Vial Number: ________________
(FC=Found Concentration) FF=Fast Flow QP/ HSL= Heated Sample Line
(CA=Corrective Action)

DATE	INJ ul	AGENT	P1/ F1 FC	P2/ F2 FC	CA OR CAL	P3 FC	OPER INITIALS	FF HSL	COMMENTS
	4ul								
	4ul								
	4ul								
	4ul								
	4ul								
	4ul								
	4ul								
	4ul								
	4ul								
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Comments:

575 444

APPENDIX B

OPERATION AND MAINTENANCE PROCEDURES

FOR

MINICAMS MOUNTED IN A MOBILE VEHICLE

Internal Operating Procedure: Operations Directorate

Monitoring Branch

Title: Operation and Maintenance Procedures for MINICAMS Mounted in a Mobile Vehicle

Division: Chemical Operations

Branch: Monitoring Branch

Building/Area:E3344 and other areas

This internal operating procedure covers operations, methods and procedures of a general nature not covered by a standing operating procedure. This procedure will be effective until rescinded or superseded.

Changes to this procedure will be accomplished by submission of revisions or amendments for approval.

Submitted by: Approved by:

Teresa Roseberry

F. G. Lattin
Chief, Monitoring Branch

Date: December 2, 1998

IOP Number: MT-16

Revision Number: 1

Prepared by: Teresa Roseberry
X8517

Approved by: F. G. Lattin
X4479

Title: Operation and Maintenance Procedures for MINICAMS Mounted in a Mobile Vehicle

Operator's Statement: I have read, or have had read to me the procedures in this IOP. I, by my signature below, indicate that I thoroughly understand and agree to abide by these instructions.

Signature	Date	Signature	Date

Supervisor's Statement: I have personally reviewed this IOP and, to the best of my knowledge, believe that the information listed herein is correct.

Supervisor: ______________________ Date: ______________________
F. G. Lattin

OPERATION AND MAINTENANCE PROCEDURES FOR MINICAMS MOUNTED IN A MOBILE VEHICLE

Real-Time Monitoring.

The MINICAMS system is currently installed in a specially designed pickup truck or RTAP and it used for real time monitoring at various sites throughout the Continental United States.

MINICAMS Monitoring Concept.

The MINICAMS provides workers involved in remediation operations with real time monitoring for the presence of airborne chemical warfare material in the workplace. Each system is calibrated and challenged at the beginning of each operational day. Continuous monitoring is achieved through the use of a heated sampling line. The sample is drawn through the line into the MINICAMS unit, which desorbs and analyzes the sample during the two-minute cycle time. The data, collected from each MINICAMS, are stored on a floppy disk and/or on a hard copy printout. This serves as a historical record of (no) agent release.

Definition of the Presence of Chemical Agent.

During mobile operations, chemical agent is defined as present if detected by the MINICAMS in a concentration greater than or equal to the Time Weighted Average* (TWA) level for three consecutive cycles.

A member of the monitoring team monitors the performance of the MINICAMS on a daily basis. The MINICAMS is challenged each workday using a certified standard for the agent(s) under test to assure that the MINICAMS is operating correctly

Control Samples.

A MINICAMS sample is defined as the volume of air that is sampled during one automatic cycle of the instrument. A 4 ul challenge of standard dilute chemical agent see (Table No 3, paragraph 4.21, of the Monitoring Branch QC Plan) is injected into the end of the heated sampling line during the sampling period of the MINICAMS cycle. MINICAMS in the VX mode will have injections made onto the fluoride conversion pad. MINICAMS in the L mode will have injections made into the sample probe.

A record of the test date, time, MINICAMS result and the operator's initials will be maintained for each sample line challenge on MBFORM-4 attached to this IOP. Flow rate checks will be recorded in the Comment section of the form. This record will be maintained with the MINICAMS in a safe and secure location that is easily accessible. The data are transported back to the Monitoring Branch for final documentation review and storage.

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* The terms Time Weighted Average and Airborne Exposure Limit (AEL) can be used interchangeably.
TWA is used in this document to be consistent with the MINICAMS's software.

Hard Copy Printout.

All challenges of chemical agent monitors will be recorded on the hard copy printout of the operating parameters after each calibration and challenge. The same information for all challenges during operations which require more than one daily agent challenge will be printed out on hard copy. The data are also stored on the hard drive of the MINI LINK computer and are archived for subsequent storage.

Operating parameters, standard concentration, and calibration data is printed out on a hard copy.

Minimum Preventive Maintenance Procedures.

When challenging an instrument:

a. Verify that the unit is in the correct agent and concentration mode.

b. Verify that the unit is in the run (not calibrate) mode.

c. Verify that the recorder power switch is on (if applicable).

d. Verify that the alarm lamp, and horn come on when the MINICAMS is challenged.

e. Verify that no error message appears on the display.

f. Verify that each compressed-gas cylinder contains at least 100 psig. If not, change the cylinder. If monitoring for XL, verify that the EDT is at 30 psi.

g. Check the amount of printer paper remaining. Replenish, if necessary.

h. Heated sample lines used for Lewisite (XL) monitoring, require rinsing with ~300mls of alcohol to eliminate XL carryover after each 1 or 2 weeks of operation, or as required to keep the instrument in control.

As Needed:

a. Replace the Pre-Concentrator Tube (PCT) weekly.

b. Check the external gas lines and fittings for leaks.

c. Measure the sample flow through the PCT before deployment and daily at the sampling site after calibration. It should be correct for the sampling application. Adjust the flow rate if necessary. Flow rates will be recorded on the Comments section of QC form (MBFORM-4 A) attached.

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CALIBRATION PROCEDURE FOR VX, GB AND GD USING THE FPD

PRIOR TO BEGINNING OF EACH WORKWEEK, GET A NEW CALIBRATION STANDARD FROM THE LABORATORY OR THE RTAP OPERATOR IF IN THE FIELD.

NOTE: RECORD AGENT USAGE ON MBFORM-28 AND TURN IN FOR DECON AT THE END OF THE WEEK.

1. Check MINICAMS operational parameters for errors. If the MINICAMS is programmed for VX operation, replace V-G pad at the end of the sample line situated away from the point of attachment to the MINICAMS.

2. Press the PARAM button until RUN is flashing in the lower left corner, then press the INCR button until CAL is flashing and press ENTER.

3. When the word INJECT appears on the display screen, perform two injections, 4 ul of the 10 minute COMBO standard and 4 ul of the 10 minute VX standard onto the V-G filter pad at the end of the heated sample line when the MINICAMS display screen reads INJECT.

4. During the Purge cycle, press F6 to label this chromatogram as a calibration and enter the operator's initials.

5. After the printer completes the print out, write the found concentrations under the CAL column on the individual QC logs. Press ENTER from the main screen. (This action will normalize the found concentrations to 1.00 on the MINICAMS screen and the printer will print as calibration.)

6. Press the PARAM button on the MINICAMS until CAL is flashing on the lower left of the screen, press INCR button until RUN is flashing and then press ENTER.

7. Perform another 4 ul injection of the COMBO standard and a 4 ul injection of VX onto the V-G pad when the screen reads INJECT.

8. During the Purge cycle, press F6 to label this chromatogram as a challenge and enter the operator's initials.

9. An audible alarm will sound if a concentration greater than 0.80 TWA is detected for any of the selected agents. Press the ENTER button on the MINICAMS to silence this alarm horn. (The alarm light will continue to flash until the concentration falls below 0.80 TWA.)

10. Press the F4 key and print out the chromatogram screen. Next, press the Print key on the MINICAMS to print out the parameters.

11. Record each found concentration on the QC log under the P1/F1 column. Each of the concentrations must be within 0.75-1.25 TWA. If not, deselect any agents, which passed the first challenge, and repeat steps 9 through 12 above and record data under the P2/F2 columns.

NOTE: To deselect an agent, press the PAGE button 4 times until you are on the agent selection screen. Press the PARAM button until the asterisk is blinking beside the agent to be deselected. Press the ENTER button and the asterisk will disappear. At this time, this agent has been deselected.

12. If the second challenge is still not within the acceptable limits, perform and document a corrective action, repeat steps 3 through 12 again and record data under Cal and the P3/F3 columns.

NOTE: If the third challenge is still out of range, this instrument must either be removed from service or a corrective action must be performed and documented on the QC log. After the corrective action has been taken, the instrument must be recalibrated and the data recorded on the next line. If the instrument is replaced, a new QC log must be started and calibrations and challenges must be performed.

13. After acceptable challenges have been performed, reselect any deselected agents by paging to the agent selection screen (See note under paragraph 11), press PARAM until the asterisk blinks beside the agent to reselect and press the ENTER button again. Press ENTER again and the asterisk will reappear and the agent has been reselected. Page back to the main screen.

14. Once all agents have been reselected, page back to the main screen and press PRINT to print out operating parameters.

15. Attach the paperhanger to the top of the printer paper.

16. Make sure the operator's initials, calibration, and challenge data are recorded properly on the QC log.

NOTE: The MINICAMS operator shall start a new QC data sheet, MBFORM-4A on the first day of each month. The data (QC data sheets) for the previous month shall be collected and turned in to the MINICAMS group for review and filing.

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CALIBRATION PROCEDURE FOR HD USING THE FPD

PRIOR TO BEGINNING OF EACH WORKWEEK, GET A NEW CALIBRATION STANDARD FROM THE LABORATORY OR THE RTAP OPERATOR IF IN THE FIELD.

NOTE: RECORD AGENT USAGE ON MBFORM-28 AND TURN IN FOR DECON AT THE END OF THE WEEK.

1. Check MINICAMS operational parameters for errors.

2. Press the PARAM button until RUN is flashing in the lower left corner, then press the INCR button until CAL is flashing and press ENTER.

3. When the word INJECT appears on the display screen, inject, 4 ul of the 10 minute COMBO standard at the end of the heated sample line not attached to the MIICAMS when the MINICAMS display screen reads INJECT.

4. During the Purge cycle, press F6 to label this chromatogram as a calibration and enter the operator's initials.

5. After the printer completes the print out, write the found concentrations under the CAL column on the individual QC logs. Press ENTER from the main screen. (This action will normalize the found concentrations to 1.00 on the MINICAMS screen and the printer will print as calibration.)

6. Press the PARAM button on the MINICAMS until CAL is flashing on the lower left of the screen, press INCR button until RUN is flashing and then press ENTER.

7. Perform another 4 ul injection of the COMBO standard when the screen reads INJECT.

8. During the Purge cycle, press F6 to label this chromatogram as a challenge and enter the operator's initials.

9. An audible alarm will sound if a concentration greater than 0.80 TWA is detected for HD. Press the ENTER button on the MINICAMS to silence this alarm horn. (The alarm light will continue to flash until the concentration falls below 0.80 TWA.)

10. Press the F4 key and print out the chromatogram screen. Next, press the Print key on the MINICAMS to print out the parameters.

11. Record the found concentration on the QC log under the P1/F1 column. The concentration must be within 0.75-1.25 TWA. If not, repeat steps 7 through 10 above and record data under the P2/F2 columns.

12. If the second challenge is still not within the acceptable limits, perform and document a corrective action, repeat steps 2 through 11 again and record data under Cal and the P3/F3 columns.

NOTE: If the third challenge is still out of range, this instrument must either be removed from service or a corrective action must be performed and documented on the QC log. After the corrective action has been taken, the instrument must be recalibrated and the data recorded on the next line. If the instrument is replaced, a new QC log must be started and calibrations and challenges must be performed.

13. Page back to the main screen and press PRINT to print out operating parameters.

14. Attach the paperhanger to the top of the printer paper.

15. Make sure the operator's initials, calibration, and challenge data are recorded properly on the QC log.

NOTE: The MINICAMS operator shall start a new QC data sheet, MBFORM-4A on the first day of each month. The data (QC data sheets) for the previous month shall be collected and turned in to the MINICAMS group for review and filing.

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CALIBRATION PROCEDURE FOR HD AND/OR L USING THE XSD DETECTOR

PRIOR TO BEGINNING OF EACH WORKWEEK, GET A NEW CALIBRATION STANDARD FROM THE LABORATORY OR THE RTAP OPERATOR IF IN THE FIELD.

NOTE: RECORD AGENT USAGE ON MBFORM-28 AND TURN IN FOR DECON AT THE END OF THE WEEK.

1. Check MINICAMS operational parameters for errors, if none, perform a wakeup challenge of 4 ul of 2.262 ng/ul XL and a 4 ul challenge of 10 min. Combo into the end of the sample line that is not attached to the MINICAMS at time 245 on the MINICAMS screen.

2. Wait for printer to print, but do not record these data.

3. From the main screen, press the PARAM button until RUN is flashing in the lower left corner, press the INCR button until Cal is flashing and then press ENTER.

4. Perform another injection of 4 ul of the 10 min. COMBO standard and 4 ul of the XL standard into the probe end when the light on the probe controller box illuminates. The illumination occurs at approximately 245 seconds.

5. Allow the printer to print again and write the found concentration(s) on the individual QC logs under the CAL column. Press ENTER from the main screen. (This action will normalize the found concentrations to 1.00 on the MINICAMS screen and the printer will print as calibration.)

6. Press the F6 key on the MINILINK computer and label the chromatogram as a calibration and enter the operator's initials.

7. Press the PARAM button until CAL is flashing on the lower left of the screen, press INCR button until RUN is flashing and then press ENTER.

8. Perform another 4ul injection of the Combo and XL standards into the probe end when the light on the probe controller box illuminates. The illumination occurs at approximately 245 seconds.

9. When the challenge concentration(s) is printed out, an audible alarm will sound if any of the concentrations are greater than 0.20 TWA. Press the ENTER button to silence this alarm horn. (The alarm light will continue to flash until all of the concentrations fall below 0.20 TWA)

10. Use the F6 key to label this chromatogram as a challenge and enter operator's initials.

11. Press the F4 key and print out the chromatograms. Next, press the Print button on the MINICAMS and print Parameters.

12. Record the found concentration(s) on the QC logs under the P1/F1 column. The concentrations must be within 0.75-1.25 TWA. If one of the agents is within this limit, deselect the passing agent by pressing the PAGE button 4 times until you are on the agent selection page. Press the PARAM button until the asterisk blinks beside the agent to be deselected and press ENTER. Repeat steps 8 through 12 above and record data under the P2/F2 columns.

13. If the second challenge is still not within the acceptable limits, perform and document corrective action, repeat steps 3 through 12 again and record data under Cal column.

NOTE: If a third challenge is still out of range, this instrument must either be removed from service or a corrective action must be performed and documented on the QC log. At that time re-calibration can be performed and the data recorded on the next line. If the instrument is replaced, a new QC log must be started and calibrations and challenges must be performed.

14. After an acceptable challenge has been performed, reselect all agents by again paging to the agent selection screen (see step 10) and press the PARAM button until the asterisk is flashing next to the agent to be reselected and press ENTER. The asterisk will be replaced with XSD. Press ENTER again and the asterisk will reappear and the agent has been reselected. Page back to the main screen.

15. Initial the printout and attach the paper hanger to the top of the printer paper.

16. Make sure the operator initials and calibration and challenge data are recorded properly on the QC logs.

17. Archive MINILINK data every Friday (or last operational day of the week) in accordance with the archive procedure.

NOTE: Heated sample line shall be rinsed with ~300mls of alcohol every 1-2 weeks, as necessary, to eliminate the XL carryover.

NOTE: The MINICAMS operator shall start a new QC data sheet, MBFORM-4A on the first day of each month. The data (QC data sheets) for the previous month shall be collected and turned in to the MINICAMS group for review and filing.

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ARCHIVE PROCEDURE FOR MINILINK SYSTEM.

NOTE: USE **FORMATTED** 3.5 in DISKETTES.

NOTE: This procedure augments the CMS Operators Manual and may be used with MINILINK system.

MINILINK IS SET ON THE VISUAL STRIP CHART SCREEN DURING NORMAL OPERATIONS.

ARCHIVE DATA WHEN ARCHIVE IS FLASHING IN THE UPPER RIGHT CORNER OF COMPUTER SCREEN.

When ARCHIVE is flashing in the upper right corner of the computer screen, the hard drive is approaching 1000 stored chromatograms. If the data is not archived, the hard drive becomes full and the MINILINK automatically starts overwriting previously stored data. Once overwritten the data is impossible to retrieve.

TO ARCHIVE DATA:

1. Go to main menu and select #7 Archive Data.

2. This screen has prompts to remind the operator to use formatted disks, date the disks with proper date (date of data to be archived, which will be either the installation date noted on the challenge sheets or the last date the archive procedure was performed. (See challenge sheets or the last date recorded on the disks which are stored at every monitoring position).

3. Label the disk with the location/position, start and end date, and disk number. E.g. BRA-1, Data from 8/15/98 to 8/19/98, Disk #1. NOTE: It usually requires 4-6 disks to complete archive procedure.

4. Press ESCAPE on upper left corner of keyboard. At C:\ MINILINK > prompt, type ARC (space) 081598 per example above, and press ENTER

5. Type y and press ENTER to archive data. The bottom line on the screen will read "Do you want to delete files at end of archive procedure?" Type y unless you want more than 1 copy of the data. The data will then be deleted from the hard drive at the end of the archive procedure to make room for additional data and the flashing ARCHIVE will be eliminated from the strip chart screen.

6. The operator will be prompted to insert a disk into the computer and press any key to begin the archive procedure.

7. As each disk is filled, the operator will be prompted to insert disk #2, #3 etc. and press any key to start. Repeat this procedure until all data is copied to the diskettes. The program prompts the operator for each operation.

8. When all files are copied, the program will read "All copies filed" and the C:\MINILINK> prompt will reappear. Type MLINK to return to the main menu.

9. Document that the data has been successfully archived by writing "Data arced" in the comment section of the QC Data sheet and store all disks until the disk holder is full.

10. Replace full diskette container with a new container and return the old data filled container to the data storage area.

11. Each container will be labeled with the position name and number and given to 40 year data base manager.

NOTE: For additional information on archiving data, refer to the CMS MINILINK Operators Manual.

IF PROBLEMS OCCUR, REFER TO THE FOLLOWING:

If a problem occurs during the archiving process, a message will appear with choices for the operator, e.g. "Reading on drive B—Abort, Retry, Ignore etc. Press "R" for retry. If message still appears, remove disk and add the letter "A" behind the disk number and insert a new disk and press enter. If the message appears again, Press "I" each time the message appears until the program gets past the bad sector. All data will be stored on the disk. Be sure and label the disk with "B" behind the disk number. Example: BRA-1, Data from 8/15/98 to 8/19/98, Disk 1A, Then the replacement disk will have the same data except the label will be Disk 1B.

HEADSPACE MONITORING FOR ENVIRONMENTAL SAMPLES

1. Contractor delivers soil sample to monitoring personnel.

2. Place up to six samples in a sample box heated to 90° ± 10 degrees Fahrenheit. Open bags and remove sample jar lids. Close sample box lid and allow samples to equilibrate for 15 minutes.

3. Connect MINICAMS probe to sample port of the heated sample box. Run two complete cycles on the MINICAMS.

    a. If MINICAMS reading is below the AEL (clear), go to step 16.

    b. If MINICAMS reading is above the AEL (hot) for agent, go to step 4.

4. Don Mask and Gloves. Evacuate personnel in the immediate area.

5. Open sample box and replace lids on sample containers.

6. Allow samples to re-equilibrate for 15 minutes.

7. Connect MINICAMS to sample port of heated sample box until a clear reading is obtained on the MINICAMS.

8. Don mask and gloves, open lid of sample box. Samples will be monitored one at a time.

9. Remove lid from sample container. Connect MINICAMS probe. Run one cycle on the MINICAMS. Close the sample jar and repeat this procedure on the next sample. All samples must be monitored to assure the hot samples are located. Segregate the samples giving a hot response. If a hot sample cannot be identified, go to step 11.

10. Collect DAAMS tubes on the hot samples using the sample line connection. Collect tubes at 500 milliliters per minute for 30 minutes. Log in sample information and give tubes to the RTAP operator for analysis.

11. Place split samples in the heated sample box.

12. Allow samples to re-equilibrate for 15 minutes.

13. Connect MINICAMS to sample port of heated sample box until a clear reading is obtained on the MINICAMS.

14. Don mask and gloves, open lid of sample box. Samples will be monitored on at a time.

15. Remove lid from sample container. Insert MINICAMS probe. Run one cycle on the MINICAMS. Close the sample jar and repeat this procedure on the next sample. All samples

must be monitored to assure the hot samples are located.. Segregate the samples giving a hot response.

16. Give clear samples to the contractor for proper disposition in accordance with the approved site-specific investigative-derived waste (IDW) disposal plan.

17. If DAAMS tubes are used in place of MINICAMS, follow the same sequence of steps.

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CSM CUSTODIAL STOCK AND USAGE RECORD

Container No. ___________ CSM Type: ________

Document #: SCBRD-ODC-O-DG-________

Lot #: ______________________

Room No. _______________ Container Vol. (mL): _____________

Date	Name of User	Balance Issued (mL)	Usage (mL)	Balance Returned (mL)	Lab Page	Signature of Issuer

Sample Flow Rate: 1000 mL/min
Location:______________
Target Concentration: 1 TWA
MINICAMS Serial No.:____________
Alarm Setpoint: 0.80 TWA
(FC=Found Concentration)
(CA=Corrective Action)

Reviewed By:____________________
Agent Std:____________ Vial No. _____
Agent: HD VX GB GD
PMT Voltage: _____VDC

DATE	INJ :l	CAL	P1/ F1 FC	P2/ F2 FC	CA or CAL	P3 FC	OPER INITL•S	COMMENTS
	4:l							
	4:l							
	4:l							
	4:l							
	4:l							
	4:l							
	4:l							
	4:l							
	4:l							
	4:l							
	4:l							
	4:l							
	4:l							
	4:l							

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APPENDIX C

OPERATION AND MAINTENANCE PROCEDURES

FOR

REAL TIME MONITORING SUPPORT DURING

ON-SITE OPERATIONS

Internal Operating Procedure: Operations Directorate Monitoring Branch

Title:	Operation and Maintenance Procedures for Real Time Monitoring Support During On-Site Operations.
Division:	Chemical Operations
Branch:	Monitoring Branch

Building/Area: Areas utilizing real time monitoring support.

This internal operating procedure covers operations, methods and procedures of a general nature not covered by a standing operating procedure. This procedure will be effective until rescinded or superseded.

Changes to this procedure will be accomplished by submission of revisions or amendments for approval.

Submitted by:

Kelly Maguire

Teresa Roseberry

Approved by:

F. G. Lattin
Chief, Monitoring Branch

Date:	October 27, 1998
IOP Number:	MT-17
Revision Number:	1
Prepared by:	Teresa Roseberry, X8517 Kelly Maguire, X8428
Approved by:	F. G. Lattin X4479

Title: Operation and Maintenance Procedures for Real Time Monitoring Support During On-Site Operations.

Operator's Statement: I have read, or have had read to me the procedures in this IOP. I, by my signature below, indicate that I thoroughly understand and agree to abide by these instructions.

Signature	Date	Signature	Date

Supervisor's Statement: I have personally reviewed this IOP and, to the best of my knowledge, believe that the information listed herein is correct.

Supervisor: ______________________ Date: ______________________

F. G. Lattin

Operation and Maintenance Procedures for Real Time Monitoring Support During On-Site Operations.

1.0 General Information.

1.1 Real Time Analytical Platform (RTAP).

The Real Time Analytical Platform (RTAP) is a self-contained mobile platform that can be moved from site to site. It is a mobile, low level monitor system designed to respond to Time Weighted Average (TWA) values for nerve, mustard or Lewisite agent in less than 10 minutes with alarm capability. The RTAP contains a MINICAMS or Gas Chromatograph system or both systems. These systems are continuous environmental monitoring systems.

1.2 GAS CHROMATOGRAPH

The gas chromatograph (GC) collects compounds on a solid sorbent trap, thermally desorbs them into a capillary gas chromatography column, and detects the compounds with a simultaneous phosphorous and sulfur, dual headed flame photometric detector (FPD) or an electron capture detector (ECD). The GC can detect GB, GD, VX, XL or HD at IDLH, TWA, or ASC levels. Because of the low volatility of VX, a fluorinating filter must be used for the detection of VX. The filter converts VX to a more volatile compound (the G-analog of VX), which can be quantitatively transferred through the sampling and analysis system.

1.3 MINICAMS

The MINICAMS system can be installed in a truck or RTAP and is used for real time monitoring at various sites throughout the Continental United States. The MINICAMS can detect GB, GD, VX, XL or HD at IDLH, TWA, or ASC levels. It is an automated gas chromatograph that first collects agent on a solid sorbent and then thermally desorbs the agent into a separation column for analysis. A flame-photometric detector (which respond to compounds containing either phosphorus (GB, GD and VX) or sulfur (HD)) or a halogen selective detector (which respond to compounds containing chlorine (L and HD)) detects the components eluting from the column. Because of the low volatility of VX, a fluorinating filter must be used for the detection of VX. The filter converts VX to a more volatile compound (the G-analog of VX), which can be quantitatively transferred through the sampling and analysis system. Lewisite is derivatized with EDT at the sample collection point. The derivatized compound (XL) is thermally stable and capable of transfer through the heated sample line to the MINICAMS for subsequent analysis. A direct readout, in units of the hazard level, is given on the front panel of the instrument. The MINICAMS requires environmental protection from extreme heat, cold, and dust to function properly. The MINICAMS can detect agent in ambient air. The MINICAMS does not sample continuously because sampling is stopped during the thermal-desorption step. The MINICAMS sample during 80 to 85 percent of the total cycle time for TWA and ASC monitoring and 25 percent of the 2-min cycle time for IDLH monitoring. Advanced automatic agent monitoring instrumentation, such as the MINICAMS, is provided with internal diagnostics to determine the operability of the system. The MINICAMS software checks various parameters (e.g., temperatures, flow rates, etc.) to determine whether these parameters are outside preset limits. If outside these limits, an error message appears on the front panel, a yellow light flashes, and a malfunction status signal is sent to the control center.

2.0 Operational Procedures.

2.1 Real-Time Analytical Platform (RTAP) Daily Operations.

2.1.1 For the RTAP, the following steps shall be taken during each operational day:

2.1.1.1 Check gasoline generators used to supply electrical power, for oil and fuel level.

2.1.1.2. Uncoil and place the heated sampling line (HSL) at the monitoring site. Verify the line is connected to the vacuum interface and check the vacuum interface filter to ensure there is no dirt or obstruction that could affect the proper operation of the Dynatherm unit.

2.1.1.3. To heat the HSL, insert the three pronged plug of the HSL into the portable generator or if the RTAP is still on shore power, into an outlet in the RTAP. If using the RTAP outlet, do not plug in more than one unheated sample line at a time. This will cause a circuit breaker to overload. Each sample line must be on a separate circuit. Depending on length, when a line is first plugged in, it will draw 10-15 amps to heat up, then level out around 7 amps. Each outlet can only hold a max of 15 amps. After switching to generator power, two already heated sample lines can be accommodated by one RTAP outlet.

2.1.1.4. For running off internal generators, initiate the following:

2.1.1.4.1 Start the supplemental power generators, and let them warm up for about 10 minutes.

2.1.1.4.2 Turn off extraneous utilities, i.e. heated sample lines, overhead air vent, vacuum pump, hood, air conditioners/heaters, computer monitors and, in this case, GC ovens.

2.1.1.4.3 Make sure that the system is BELOW 10 amps on the master power control panel BEFORE unplugging the vehicle from shore power.

2.1.1.4.4 Unplug the shore power cord from the RTAP's external outlet and turn on the extraneous utilities.

2.1.1.4.6 Depending on the RTAP configuration, plug the heated sample line into the appropriate outlet.

2.2 RTAP Daily Operational Procedures. FOR REAL TIME MONITORING: Before deployment to the operational site, each MINICAMS shall be calibrated and challenged with a QP through the heated sample line. Each GC unit shall be challenged through the HSL. The heated sample line /or shall also be challenged with a QP challenge.

2.2.1 Gas Chromatograph (GC) startup. Check to see if the system is ready, the flame is lit and the ChemStation is in "Ready" status. Create a directory in the ChemStation. To create a directory go into "Run Control" on the main menu screen, and then to "Sample Info" to enter your name, the ite, the project, GC serial number, etc. Record any troubleshooting or changes to the GC configuration on the GC Preventive Maintenance Log (MBFORM- 30). Record the flow rate on the appendix sheet of the SOP (Pre-Op checklist). The minimum acceptable flow rate for operation is 0.7liters per minute.

2.2.2 Run a blank through the instrument by pressing the start button on the Dynatherm (this can be done while the generators warm up). The instrument blank shows the kind of background that may be present in the column and on the tube.. If a peak does appear in the retention time widow for the agent, further blanks may be necessary at the discretion of the operator. When the blank is clear for the analytes of interest, inject a 10uL conditioning shot onto the fast flow tube. If response from the conditioning shot is within expected parameters, challenge the instrument with a 4ul aliquot of standard and record the results on the

2.2.3 Run a blank through the heated sample line by pressing the start button on the Dynatherm (this can be done while the generators warm up). The line blank shows the kind of background that may be present in the line and in the air. If a peak does appear in the retention time widow for the agent, further blanks may be necessary at the discretion of the operator.. When the blank is clear for the analytes of interest, inject a 10uL conditioning shot through the heated sample line. If response from the conditioning shot is within expected parameters, challenge the line with a 4ul aliquot of standard, and record the results.

2.2.4 To conduct an initial GC challenge, inject through the heated sample line, a 4uL aliquot of the ıpropriate standard. Record QP results on the Monitoring Data Record (MBFORM-5).

2.2.5 If the challenge does not pass, repeat the challenge. If the second challenge fails, troubleshoot by checking the fittings and the vacuum flow filters. Also check to see if the vacuum is on, the vacuum interface filter is clean, the heated sampling lines are hot and the fittings are tight and covered with insulation (if applicable) to ensure the fittings maintain the proper temperature. If a corrective action has been performed, repeat the challenge. Document the corrective action in the GC Maintenance Log. If no corrective action is requied recalibrate IAW the Monitoring Branch Quality Control (QC) Plan,.

2.2.6 If the line challenge passes, the system is ready to begin real time sampling. Record results on the Monitoring Data Record (MBFORM-5).

2.2.7 To calculate TWA in nanograms for the actual conditions:

$$\text{TWA (in ng)} = \underset{\text{factor}}{\text{*conversion}} \;\times\; \underset{\text{(in minutes)}}{\text{sample collection time}} \;\times\; \underset{\text{(in liters)}}{\text{flow}}$$

AGENT	CONVERSION FACTOR
GB	0.1

GD	0.03
VX	0.01
HD	3.0
L	3.0

To relate TWA to the sample, for this example of HD, assume a sampling time of 3 minutes and a flow of 0.9 liters:

TWA (ng) = 3 X 3 min X 0.9 liters
TWA (ng) = 8.1

If a sample result is 36 ng, then:

TWA = 36 ng/8.1 ng
TWA = 4.5

2.2 MINICAMS Daily Operations.

2.2.1 Operational check. Each operational day, the first step in the procedures is to verify that the MINICAMS is operating correctly. The generators should be running and unplugged from shore power.

2.2.2 Check the display screen to ensure that there are no errors. Page through the readouts and verify the preset readings are correct and display the expected response and that major parameters (as recorded in the MINICAMS Parameter Pamphlet) are within correct limits. Appropriate action shall be taken to correct any malfunctions found.

2.2.3 In addition to the daily check of operating parameters made by the operator, software within MINICAMS automatically checks and corrects a number of internal parameters every 0.1-sec. These parameters include the temperature of the solid sorbent during sampling and desorption and the temperatures of the detector and column during analysis.

2.2.4 After completion of the instrument observation, the instrument shall be calibrated and a QP - challenge shall be made through the heated sampling line. The results of this QP challenge shall be recorded (see MBFORM-4a, attached) as the first QP challenge of the day. Calibrate the MINICAMS for nerve agents IAW the procedures beginning in paragraph 5.1 and for mustard and Lewisite beginning in paragraph 5.2

2.2.5 The flow rates shall be checked at the beginning of each operational workday using Mass Flow Meter Model FM-360 or equivalent. The flow rate checks will be recorded in the Comments section of MBFORM-4a.

2.2.6 During a challenge or calibration operation, 4 ul aliquot of the appropriate agent(s) standard is injected into the heated sampling line. The concentration of the standard solution shall be such that the injection contains 1.0 ± 10% TWA or IDLH of the agent depending on the hazard level the MINICAMS is programmed to detect.

2.2.7 After calibration is completed, re-challenge the instrument with a QP sample to verify the calibration. If the QP response is not within ± 25% of the target concentration, verify that the instrument is operating correctly and re-challenge the instrument. If acceptable, the unit is in control, if not, it must be re-calibrated. See exception paragraph 4.8.2.3. of the Monitoring Branch QC Plan Calibration information is printed out on the "hard copy" printout from the MINICAMS.

2.2.8 When a MINICAMS is used to monitor for Lewisite, the alarm on the MINICAMS shall be set to 0.2 TWA. The Lewisite MINICAMS is used as a qualitative monitor only. A 1 TWA concentration of Lewisite is used to calibrate the MINICAMS. If the response form any challenge exceeds 0.25 TWA, the instrument is considered to be in control.

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3.0 On-site Monitoring

3.1 Real Time Sampling with the MINICAMS. Once the system is challenged and operating within standards parameters, the MINICAMS continuously collects and analyzes the samples. Data are recorded on MINILINK computers which are integral to the system. *During transit, pump/printers, and EDT tank can be turned off.

3.1.1 Upon arriving at the site, Check all "PARAMS", then again inject a 1 TWA (4ul) QP challenge through the heated sampling line to assure that the monitoring system (MINICAMS plus heated sampling line) is still performing properly.

3.1.2 Site monitoring shall begin when all equipment is performing properly. Inject a 1 TWA (4 ul) challenge every 4 hours and at the end of daily of operations. If the QP challenge after 4 hours fails to meet the 1 TWA +/- 25%, a re-challenge is permitted. If the re-challenge fails, the MINICAMS must be re-calibrated. See paragraph 2.2.7 for the exception regarding Lewisite.

3.1.3 If the end of the day challenge fails to meet the TWA +/- 25% requirement, note this on the appropriate QP challenge log (MBFORM-4a). Perform a second challenge and document. An additional re-calibration is not required if the 2nd challenge fails, since RTM operations are complete for the day.

3.1.4 A Real Time Monitoring QP Data Sheet (MBFORM- 4a) will be completed for each agent for each MINICAMS.

3.2 Real Time sampling with the GC. Upon arriving at the site, again inject a 1 TWA (4ul) QP challenge through the heated sampling line to assure that the monitoring system (GC plus heated sampling line and/or MINICAMS plus heated sampling line) is performing properly.

3.2.1 The sampling line must be challenged every four hours, with a 4 ul challenge and again after the last sample at the end of the day. If the end of the day challenge fails to meet the TWA +/- 25% requirement, note this on the appropriate QP challenge log (MBFORM-5). Perform a second challenge and document. An additional calibration and re-challenge is not required since RTM operations are complete for the day. However, if DAAMS tubes are to be run on the GC, it must be properly calibrated prior to further use.

One copy of the new CAL Table & Curve goes on front of GC & One copy goes in data binder.

3.2.2 Record standard usage on the agent usage record (MBFORM-15). Record QP results on the Monitoring Data Record (MBFORM-5).

3.2..3 A Real Time Monitoring Checklist (MBFORM-4a or 5) will be completed for each RTAP and MINICAMS.

4.0 Calibration Procedures.

4.1 MINICAMS Calibration Procedure For VX, GB AND GD. Check MINICAMS operational parameters for errors. Replace V-G pad @ sample line end for VX.

4.1.1 Press the PARAM button until RUN is flashing in the lower left corner, then press the INCR button until CAL is flashing and press ENTER.

4.1.2 Perform two injections, 4 ul of the 10 minute COMBO standard and 4 ul of the 10 minute VX standard onto the V-G filter pad at the end of the heated sample line when the MINICAMS LCD screen reads INJECT.

NOTE: It is safe to perform the injection as late as time 180 secs on the LCD screen.

4.1.3 During the Purge cycle (0-120sec) press F6 and label this chromatogram as a calibration and operator initials.

4.1.4 Allow the printer to print again and write the found concentrations on the individual QC logs under the CAL column. Press ENTERfrom the main screen. (This action will change the found concentrations to 1.00 on the MINICAMS screen and the printer will print as calibration.)

4.1.5 Press the PARAM button on the MINICAMS until CAL is flashing on the lower left of the screen, press INCR button until RUN is flashing and then press ENTER.

4.1.6 Perform another 4 ul injection of the COMBO standard and a 4 ul injection of VX onto the V-G pad when the screen reads INJECT.

4.1.7 During the purge cycle, press F6 and label this chromatogram as a challenge and operator initials.

4.1.8 When these challenge concentrations are printed out, an audible alarm will sound if the concentrations are greater than 0.80 TWA. Press the ENTER button on the MINICAMS to silence this alarm horn. (The alarm light will continue to flash until the concentration falls below 0.80 TWA.)

4.1.9 Press the F4 key and print out the chromatogram screen. Next, press the Print key on the MINICAMS to print out the parameters.

4.1.10 Record each found concentration on the QC log under the P1/F1 column. Each of the concentrations must be within 0.75-1.25 TWA. If not, deselect any agents which did pass the first challenge, and repeat steps 4.1.6 through 4.1.9 above and record data under the CAL and P2/F2 columns.

NOTE: To deselect an agent, press the PAGE button 4 times until you are on the agent selection screen. Press the PARAM button until the asterisk is blinking beside the agent to be deselected. Press the ENTER button and the asterisk will disappear. At this time, this agent has been deselected.

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4.1.11 If the second challenge is still not within the acceptable limits, perform and document a corrective action, repeat steps 4.1.3 through 4.1.9 again and record data under Cal and P3/F3 columns.

NOTE: If the third challenge is still out of range, this instrument must either be removed from service or a corrective action must be performed and documented on the QC log. At that time recalibration can be performed and the data recorded on the next line. If the instrument is replaced, a new QC log must be started and calibrations and challenges must be performed.

4.1.12 After acceptable challenges have been performed, reselect any deselected agents by paging to the agent selection screen (See note under 4.1.11), press PARAM until the asterisk blinks beside the agent to reselect and press the ENTER button again. The FPD will be replaced with a 4. Press ENTER again and the asterisk will reappear and the agent has been reselected. Page back to the main screen.

4.1.13 Once all agents have been reselected, page back to the main screen and press PRINT to print out operating parameters.

4.1.14 Initial the printout and attach the paperhanger to the top of the printer paper.

4.1.15 Make sure the operator initials and calibration and challenge data are recorded properly on the QC log.

4.2 MINICAMS Calibration Procedure For HD/XL

4.2.1 Check MINICAMS operational parameters for errors, if none perform a wakeup challenge of 1 TWA challenge for XL and a 4 ul challenge of 10 min. Combo into the end of the sample line at time 245 on the MINICAMS screen.

4.2.2 Wait for printer to print, but do not record these data.

4.2.3 From the main screen, press the PARAM button until RUN is flashing in the lower left corner, press the INCR button until Cal is flashing and then press ENTER.

4.2.4 Perform another injection of 4 ul of the 10 min. COMBO standard and 4 ul of the XL standard into the probe end when the MINICAMS LCD screen reads INJECT.

4.2.5 Allow the printer to print again and write the found concentration (Found Concs.) on the individual QC logs under the CAL column. Press ENTER from the main screen. (This action will change the found concentrations to 1.00 on the MINICAMS screen and the printer will print as calibration.)

4.2.6 Press the F6 key on the MINILINK computer and label the chromatogram as calibration and print the operator's initials.

4.2.7 Press the PARAM button until CAL is flashing on the lower left of the screen, press INCR button until RUN is flashing and then press ENTER.

.2.8 Perform another 4 ul injection of the Combo and XL standards into the probe end when the screen reads INJECT.

4.2.9 When the challenge concentrations are printed out, an audible alarm will sound if any of the concentrations are greater than 0.80 TWA. Press the ENTER button to silence this alarm horn. (The alarm light will continue to flash until all of the concentrations fall below 0.80 TWA)

4.2.10 Use the F6 key to label this chromatogram as a challenge and initial.

4.2.11 Press the F4 key and print out the chromatograms. Next, press the Print button on the MINICAMS and print Parameters.

4.2.12 Record the found concentrations on the QC logs under the P1/F1 column. The concentrations must be within0.75-1.25 TWA. If not all agents are within this limit, deselect the passing agent by pressing the PAGE button 4 times until you are on the agent selection page. Press the PARAM button until the asterisk blinks beside the agent to be deselected and press ENTER. Repeat steps 4.2.6 through 4.2.9 above and record data under the P2/F2 columns.

4.2.13 If the second challenge is still not within the acceptable limits, perform and document corrective action, repeat steps 4.2.6 through 4.2.9 again and record data under Cal column.

.14 Perform a 3rd challenge and record in the P3/F3 column.

NOTE: If a third challenge is still out of range, this instrument must either be removed from service or a corrective action must be performed and documented on the QC log. At that time re-calibration can be performed and the data recorded on the next line. If the instrument is replaced, a new QC log must be started and calibrations and challenges must be performed.

4.2.15 After an acceptable challenge has been performed, reselect all agents by again paging to the agent selection screen (see 4.2.12) and press the PARAM button until the asterisk is flashing next to the agent to be reselected and press ENTER. The asterisk will be replaced with XSD. Press the ENTER button again and the XSD will be replaced with a 4. Press ENTER again and the asterisk will appear next to the reselected agent.

4.2.16 Initial the printout and attach the paperhanger to the top of the printer paper.

4.2.17 Make sure the operator initials and calibration and challenge data are recorded properly on the QC logs.

4.2.18 Archive MINILINK data every Friday (or last operational day of the week) in accordance with the archive procedure paragraph 5.0.

NOTE: Heated sample line shall be rinsed with alcohol every 1-2 weeks, as necessary, to eliminate XL carryover.

5.0 Archive Procedure For The MINILINK System

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NOTE: USE FORMATTED 3.5 in. DISKETTES.

NOTE: This procedure augments the CMS Operators Manual and may be used with MINILINK system.

5.1 SET MINILINK ON "VISUAL STRIP CHART"
ARCHIVE DATA WHEN "ARCHIVE" IS FLASHING IN THE UPPER RIGHT CORNER OF COMPUTER SCREEN.

5.1.1 When "ARCHIVE" is flashing in the upper right corner of the computer screen, the hard drive is approaching 1000 stored chromatograms. If the data is not archived, the hard drive becomes full; the MINILINK automatically starts dropping previously stored data, which is impossible to retrieve.

5.2 TO ARCHIVE DATA:

5.2.1 Go to main menu and select #7 "archive data".

5.2.2 This screen has prompts to remind the operator to use formatted disks, date the disks with proper date (date of data to be archived, which will be either the installation date noted on the challenge sheets or the last date the archive procedure was performed. (See challenge sheets or the last date recorded on the disks which are stored at every monitoring position).

5.2.3 Label the disk with the location/position, start and end date, and disk number. E.g. BRA-1, Data from 8/15/98 to8/19/98, Disk #1. NOTE: It usually requires 4-6 disks to complete archive procedure.

5.2.4 Press "Escape" on upper left corner of keyboard, At C:\ MINILINK > prompt, type "ARC" (space) 081598 per example above, and press "enter".

5.2.5 Type "y" and press "enter" to archive data. The bottom line on the screen will read "delete files at end of archive procedure? Type "y" unless you want more than 1 copy of the data. The data will then be deleted from the hard drive at the end of the archive procedure to make room for additional data and the flashing "ARCHIVE" will be eliminated from the strip chart screen.

5.2.6 The operator will be prompted to insert a disk into the computer and press any key to begin the archive procedure.
5.2.7 As each disk is filled, the operator will be prompted to insert disk #2, #3 etc. and press any key to start. Repeat this procedure until all data is copied to the diskettes. The program prompts the operator for each operation.

5.2.8 When all files are copied, the program will read "All copies filed" and the C:\MINILINK> prompt will reappear. Type "MLINK" to return to the main menu.

5.2.9 Document "Data Archived" in the comment section of the QC Data sheet and store all disks until the "disk holder" is full.

5.2.10 Replace full diskette container with a new container and return the "old data filled" ›ntainer to supervisor.

5.2.11 Each container will be labeled with the position name and number and given to "Government Personnel" for inclusion in the 40-year storage area.

NOTE: For additional information on archiving data, refer to the CMS MINILINK Operator Manual.

5.2.12 Record agent usage on the Usage Record (MBFORM-15).

5.2.13 Record standard usage on the agent usage record (MBFORM-15). Record QP results on the Monitoring Data Record (MBFORM-5).

5.2.14 It is essential to sample 2.7 liters of air to obtain a 1 TWA equivalent response on the Gas Chromatograph. If you are unable to obtain a 0.9-liter per minute flow rate, adjusts the sample time so that the flow rate times the sample time equal 2.7 liters. Record standard usage on the agent usage record (MBFORM-15).

IF PROBLEMS OCCUR

If a problem occurs during the archiving process, a message will appear with choices for the operator, e.g. "Reading on drive B—Abort, Retry, Ignore etc. Press "R" for retry. If message still ›pears, remove disk and add the letter "A" behind the disk number and insert a new disk and press ›nter. If the message appears again, Press "I" each time the message appears until the program gets past the bad sector. All data will be stored on the disk. Be sure and label the disk with "B" behind the disk number. Example: BRA-1, Data from 8/15/98 to 8/19/98, Disk 1A, Then the replacement disk will have the same data except the label will be Disk 1B.

6.0 Site Shutdown

6.1 Collect all DAAMS tubes IAW IOP MT-10, (perimeter and general area monitoring samples). Record the flows as required. Give all samples, tags and data sheets to the analyst.

6.1.1 Ensure that there is sufficient gas in the RTAP for the next day's operation. Refuel the vehicle if necessary; use the lowest grade of fuel. Put all gas receipts in the vehicle maintenance log. Write the mileage (odometer reading) on the gas receipt.

6.1.3 Complete the final RTAP challenge of the day. Record standard usage on the agent usage record (MBFORM-15). Record challenge results on the Monitoring Data Record (MBFORM- 4a or 5).

6.1.4 If shore power is not required, go on to the Final Checks. If shore power is required:

6.1.4.1 Turn off extraneous utilities, i.e. heated sample lines, overhead air vent, vacuum pump, hood, air conditioners/ heaters, computer monitors, printers and in this case GC ovens. Leave appropriate utilities and instruments on. (Unless still above 10 Amps)

6.1.4.2 Make sure that the system is BELOW 10 amps on the master power control panel box BEFORE the vehicle is plugged into shore power.

6.1.5 Conduct Final Checks:

6.1.5.1 Turn GC oven back on, Check MINICAMS.

6.1.5.2 Adjust internal RTAP ambient temperature in relation to outside temperature (if it's hot outside, turn on AC; if it's cold, turn on heat). Also turn hood exhaust on.

6.1.5.3 Check vacuum interface filter for dirt and/or replace dust filters on heated Sampling lines if the chromatography suggests a need to do so.

6.1.5.4 Collect and store all perimeter stands, heated sampling lines and electrical cords.

6.1.5.5 Ensure that the standards are recapped and placed in the freezer.

6.1.5.6 Ensure that the agent log (MBFORM 15) is completed for the day.

6.1.5.7 Ensure that the all Monitoring Data are completed and file the chromatograms for the day in the latest binder.

6.1.5.8 File scratch logs and data sheets in the appropriate binders

6.1.5.9 Set up for the next day:

6.1.5.9.1 Set up perimeter and general area pumps. Make sure pumps/calibrators are charging.

6.1.5.9.2 Prepare DAAMS tubes sets and field tags

6.1.5.9.3 Condition used DAAMS tubes

6.1.5.9..4 Collect all trash and dispose of in appropriate containers

6.1.5.9..5 Make sure that all doors on the vehicle are locked (including the cab). Lock all Cabinets and drawers in the RTAP.

6.1.5.9.6 Make sure that the cellular phone is set on charge.

6.1.5.9.7 Fill printer trays

6.1.5.9.8 Make sure that all windows are closed and locked.

6.1.5.9.9 Make sure that all heated sample line vacuum pumps are off.

NOTE: All calibration standards must be decontaminated before the RTAP leaves the site at the end of the operation.

6.2 Final Site Shut Down. Record all de-conned standard information on (MBFORM-MB-14) and both user and witness shall sign and date form.

NOTE: All calibration standards must be decontaminated before the RTAP leaves the site at the end of the operation.

MINICAMS QP DATA SHEET

Sample Flow Rate: 1000 mL/min
Location:_______________
Target Concentration: 1 TWA
MINICAMS Serial No.:____________
Alarm Setpoint: 0.80 TWA
(FC=Found Concentration)
(CA=Corrective Action)

Reviewed By:____________________
Agent Std:____________ Vial No. _____

Agent: HD VX GB GD
PMT Voltage:_____VDC

DATE	INJ ul	CAL	P1/ F1 FC	P2/ F2 FC	CA or CAL	P3 FC	OPER INITLS	COMMENTS
	4ul							
	4ul							
	4ul							
	4ul							
	4ul							
	4ul							
	4ul							
	4ul							
	4ul							
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	4ul							
	4ul							
	4ul							

RTAP REAL TIME MONITORING CHECK SHEET

The following check list shall be completed each operating day for each RTAP on site operation
Standard Vial Number__________ Agent Combo______ or Agent VX HD GB GD XL
Standard Vial Number__________ Agent Combo______ or Agent VX HD GB GD XL
Yes No
SOP #_________________Pre-Operational checklist filled out and signed.

1. Prior to leaving home station, determine that all monitoring equipment to be used is properly calibrated, operating properly and flow rates are correct and recorded.

2. Prior to calibration of monitoring equipment, disconnect "shore power" using proper procedures (below 10 amps), and connect to generator power.

3. Prior to leaving home station, Calibrate monitoring equipment IAW paragraph 2 above.

4. Upon arrival at monitoring site, inject a 1 TWA (4ul) QP challenge through the heated sample line to assure that the monitoring system (GC+heated sample line) or (MINICAMS+heated sample line) is performing properly.

5. Inject a 1 TWA QP challenge after each 4 hours of operation, if operation exceeds 4 hours, and/or at the end of the daily monitoring operation to determine that the monitoring equipment is still operating properly.

6. All calibration data, QP challenge data, and flow rates have been entered into the appropriate MBFORM. e.g. MBFORM 4a or 5.

7. Agent destroyed IAW paragraph 7 above and MBFORM-14 filled out.

NOTES:

If the QP challenge after 4 hours fails to meet the 1 TWA +/- 25%, a re-challenge is required. If the re-challenge fails, the Monitor must be re-calibrated.

If the end of the day challenge fails to meet the TWA +/- 25% requirement, note this on the QP challenge log (MBFORM- 4a or 5) and perform a re-challenge and document this re-challenge. An additional re-calibration is not required since RTM operations are complete for the day. However, if DAAMS tubes are to be run on the GC, it must be properly calibrated prior to use.

Operators signatures signify that Monitoring operations are performed IAW all requirements of IOP MT-17. Each operator shall sign the check sheet.

COMMENTS:____
____

Operator Signature GC
Operator__________________________________Date______________________
MINICAMS Operator____________________________ Date______________________

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MBFORM 15

CSM CUSTODIAL STOCK AND USAGE RECORD

Container No. __________ CSM Type: _______

Document #: SCBRD-ODC-O-DG-_______

Lot #: ____________________

Room No. ______________ Container Vol. (mL): ____________

Date	Name of User	Balance Issued (mL)	Usage (mL)	Balance Returned (mL)	Site	Signature of Issuer

MBFORM 14 RECORD OF DESTRUCTION

The following items have or will be deconned according to all Standing Operating Procedures. The resultant waste, following delisting procedures, is no longer dilute surety material.

Item #	Container #	CSM Type/Lot Number	Date Of DECON	Amount (mL)

CUSTODIAN ____________________ USER: ______________________________

WITNESS: ____________________

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RTAP QP DATA SHEET

RTAP MONITOR DATA. TURN IN WEEKLY OR UPON RETURN FROM LOCATION.
P1/P2/P3=1TWA +/- 25% GC Serial Number________________
Location______________ Monitor Number______________
Agent_______STD________ug/ml Vial Number: ________________
(FC=Found Concentration) FF=Fast Flow QP/ HSL= Heated Sample Line
(CA=Corrective Action)

DATE	INJ ul	AGENT	P1/ F1 FC	P2/ F2 FC	CA OR CAL	P3 FC	OPER INITIALS	FF HSL	COMMENTS
	4ul								
	4ul								
	4ul								
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Comments:

APPENDIX D

FIELD OPERATING AND MAINTENANCE PROCEDURE

FOR

OPEN PATH FOURIER TRANSFORM INFRARED SPECTROMETER (OP-FTIR)

575 484

Internal Operating Procedure: Operations Directorate

Monitoring Branch

Title: Field Operating and Maintenance Procedure for Open Path Fourier Transform Infrared Spectrometer (Op-FTIR)

Division: Chemical Operations

Branch: Monitoring Branch

Building/Area: In vicinity of E3346 and other areas nationwide

This internal operating procedure covers operations, methods and procedures of a general nature not covered by a standing operating procedure. This procedure will be effective until rescinded or superseded.

Changes to this procedure will be accomplished by submission of revisions or amendments for approval.

Submitted by:

K. Maguire
Monitoring Team

Approved by:

F. G. Lattin
Chief, Monitoring Branch

Date: April 8, 1997

IOP Number: MT-17

Revision Number: 0

Prepared by: John T. Ditillo
Don Gamiles

Approved by: F. G. Lattin
X4479

Title: Field Operating and Maintenance Procedure for Open Path Fourier Transform Infrared Spectrometer (Op-FTIR)

Operator's Statement: I have read, or have had read to me the procedures in this IOP. I, by my signature below, indicate that I thoroughly understand and agree to abide by these instructions.

Signature	Date	Signature	Date

Supervisor's Statement: I have personally reviewed this IOP and, to the best of my knowledge, believe that the information listed herein is correct.

Supervisor: ______________________ **Date:** ______________________

F. G. Lattin

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FIELD OPERATING PROCEDURE
FOR ETG INC.
FOURIER TRANSFORM INFRARED SPECTROMETER

General Information

The scope of work will include assembling and operating an ETG Inc. Open-path Fourier Transform Infrared (FTIR) based field sampling system capable of generating quantitative infrared spectral data of chemical warfare agents (CWA), pesticides, insecticides, and other related compounds. No handling or testing of chemical agents will occur.

Step 1 - System Setup

Unpacking the FTIR sensor, telescope, and retroreflector requires two people.

Step 1a – Setting up the FTIR System Unit

The largest case contains the FTIR sensor (See Figure 1). Open all four latches used to secure the cover of the case. Each person should grab one of the handles that are located on opposite ends of the case. Carefully lift the cover straight up and set aside. The FTIR sensor is now visible and remains safely seated on the bottom of the padded case. The sensor should be left in this condition until its respective tripod has been set up.

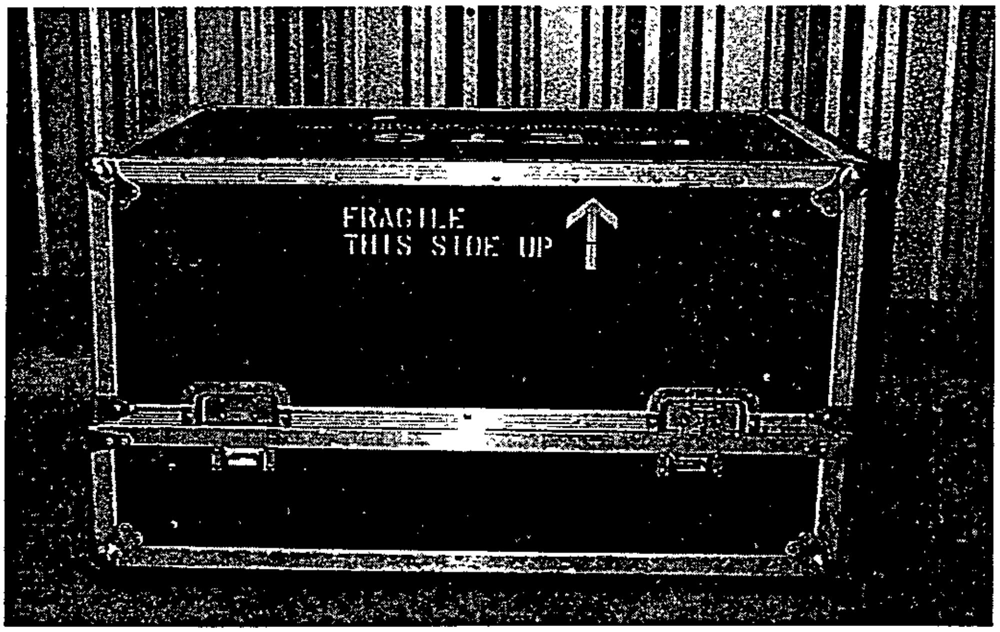

Figure 1

Extend the three legs of the large system tripod. See Figure 2.

5'75 4'87

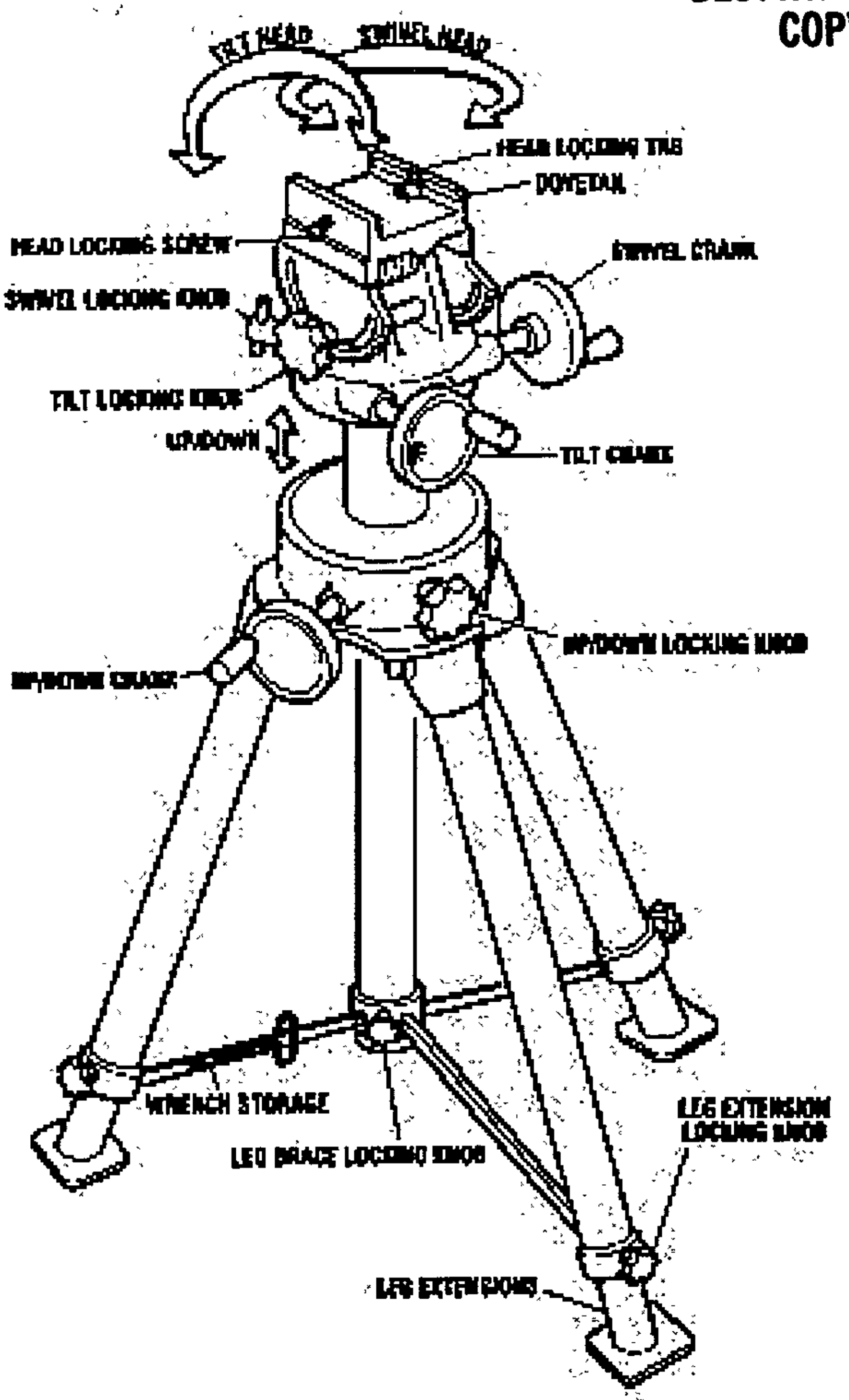

Figure 2

The leg lock on the tripod should be turned clockwise to lock all three legs into position. Each leg can be individually lengthened to attain a level setting by loosening and tightening adjustment knob on each.

ce the tripod is ready, each person should grab one of the handles that are located on opposite ends of the FTIR sensor. Carefully lift the sensor straight up off of the bottom of the case. Be certain to maintain a good grip because the sensor weighs over 200 pounds and cannot withstand the impact if dropped. Again, this step should only be done once the tripod is ready. Do not set the FTIR sensor down on the ground as the dovetail on the bottom may become damaged.

Attach the ETG FTIR by sliding the dovetail insert on the bottom of the FTIR into the dovetail mount of the tripod. Remove the white, plastic front window cover.

Lock into place by finger tightening the slide lock nut on the bottom, left side of the sensor.

When the system is successfully secured, the locking bolt will move back to its original position and the system cannot be detached.

Step 1b – Attaching the Telescope

Open both of the latches on the telescope case (See Figure 3). The telescope has no handles and can be awkward to hold when lifting from the case. One person should grasp the telescope by the dovetail on the back. The person lifting by the dovetail should be aware that most of the weight of the telescope is towards the back. The other person can grasp the other end fairly easily by reaching inside the telescope from the front.

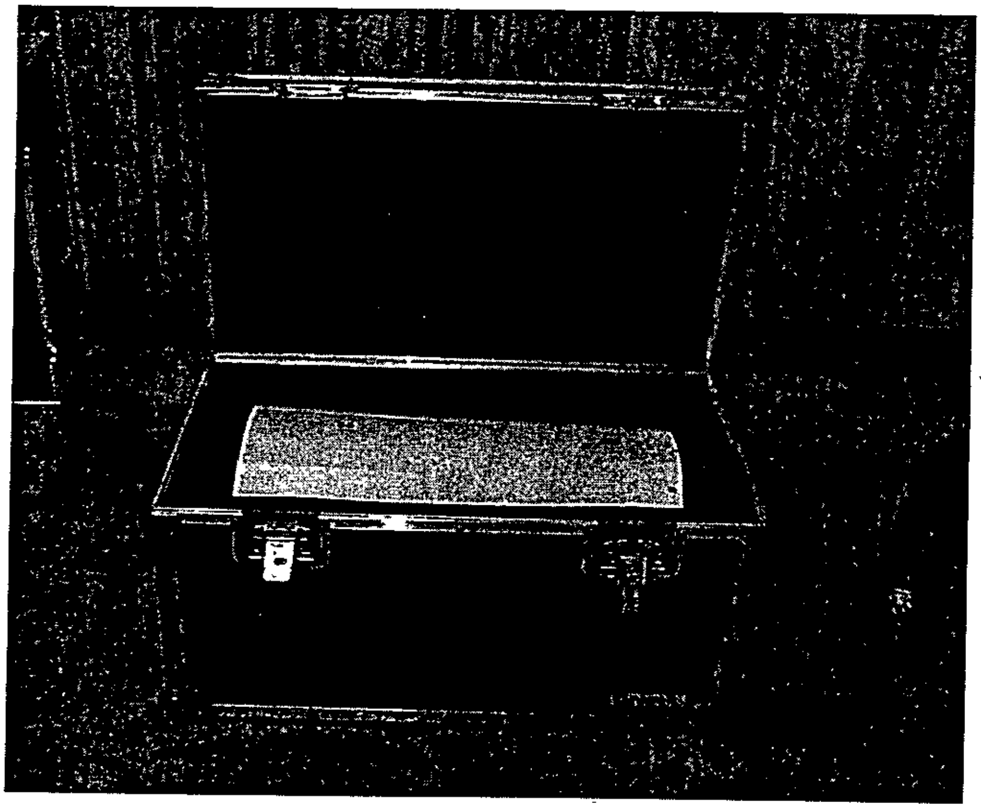

Figure 3

Once each person has a good grip, lift the telescope straight up out of the case. **Take care not to touch the optical glass at the Dovetail end of the telescope. Fingerprints on the optics can seriously degrade the performance of the system, any indication of their presence**

should be immediately reported to a supervisor. Under no circumstances should the operator attempt to clean the optical surfaces. Each person should grasp underneath the telescope with his free hand immediately when the telescope is clear of the foam padding in the case to assure a good grip. The telescope is fragile and cannot withstand the impact if dropped.

The telescope attaches to the front of the air sensor as seen in Figure 4.

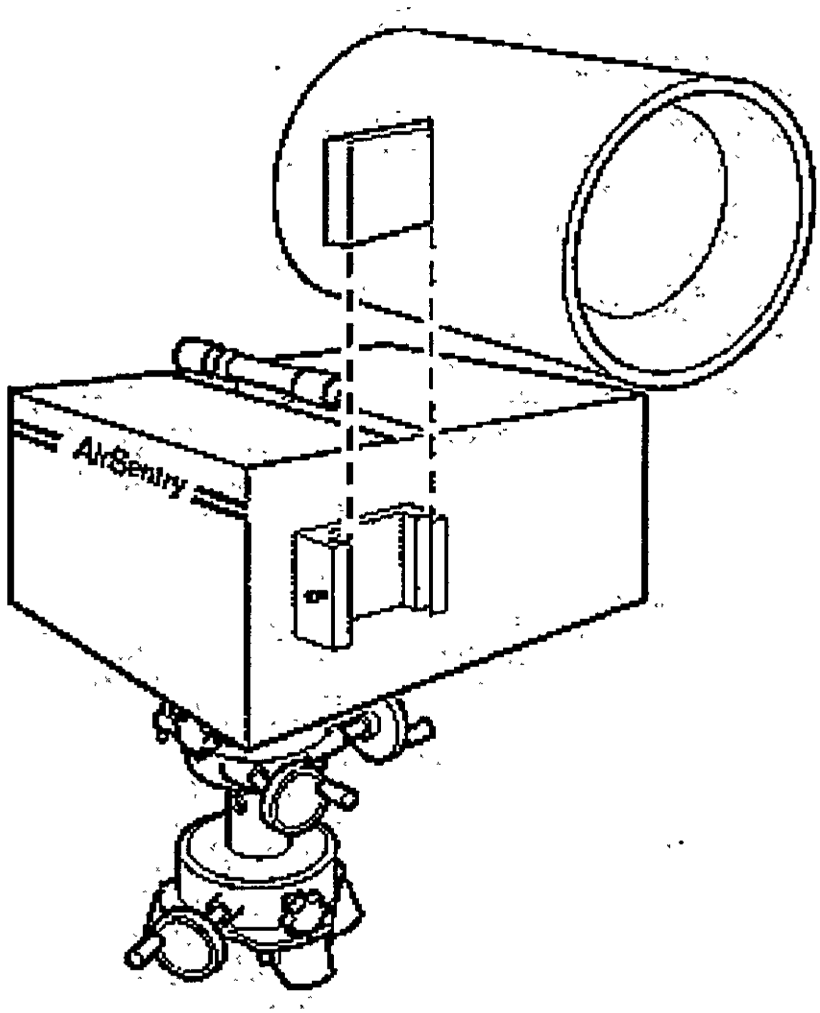

Figure 4

Tighten the set screw as seen in Figure 5.

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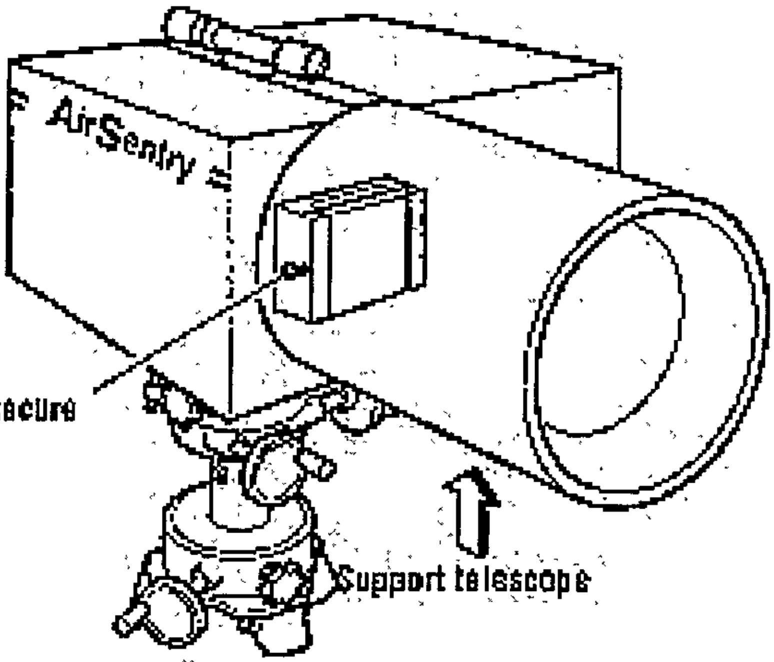

Figure 5

Step 1c – Setting up the retroreflector

Extend the three legs of the small tripod. See Figure 6.

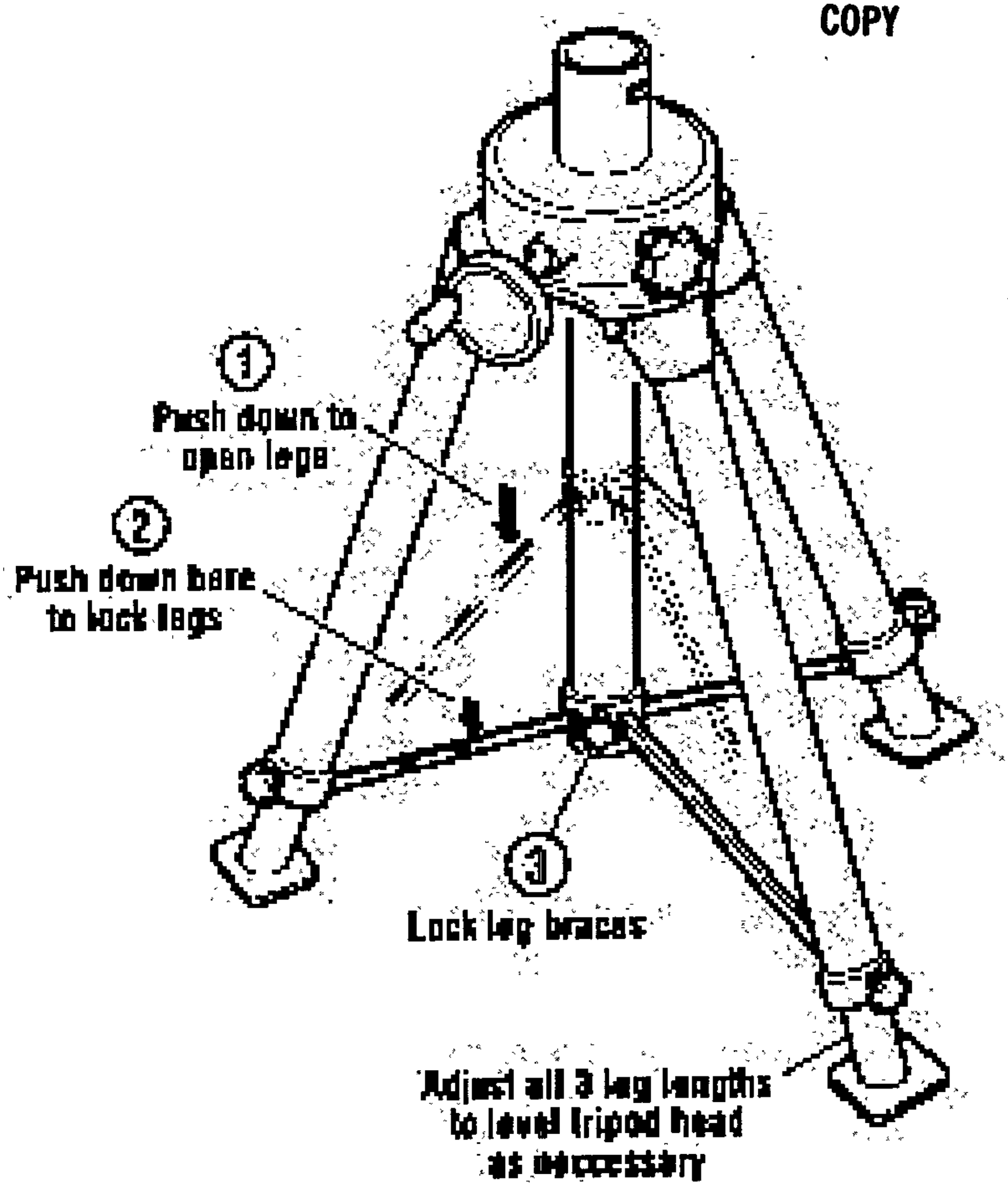

Figure 6

The leg lock on the tripod should be turned clockwise to lock all three legs into position. Each leg can be individually lengthened to attain a level setting by loosening and tightening the adjustment knob on each.

Once the retroreflector tripod is ready, open both latches of the retroreflector case (See Figure 7). The retroreflector has no handles and is relatively heavy. To lift the retroreflector from the case, each person should grasp opposite sides of the retroreflector simultaneously. To get a good grip on the retroreflector, push against it with your hands while at the same time lifting straight up. If the cover is not on the retroreflector, each person can reach inside and grab the retroreflector by its casing, however, there should be a cover on each retroreflector so this rarely be an option.

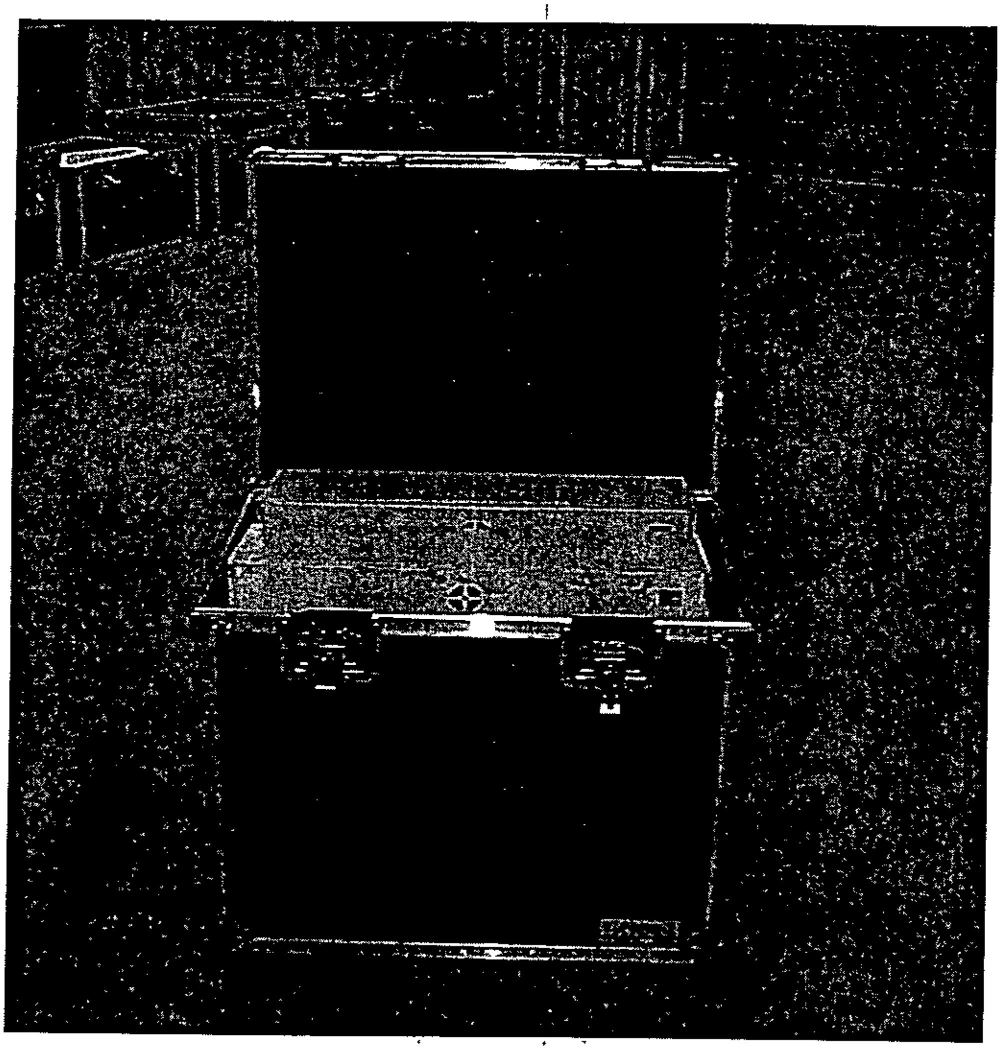

Figure 7

Each person should grasp underneath the retroreflector as soon as it clears the top of the case to insure a good grip. The retroreflector is fragile and cannot withstand the impact if dropped.

Slide the retroreflector dovetail insert onto the center of the tripod dovetail as seen in Figure 8.

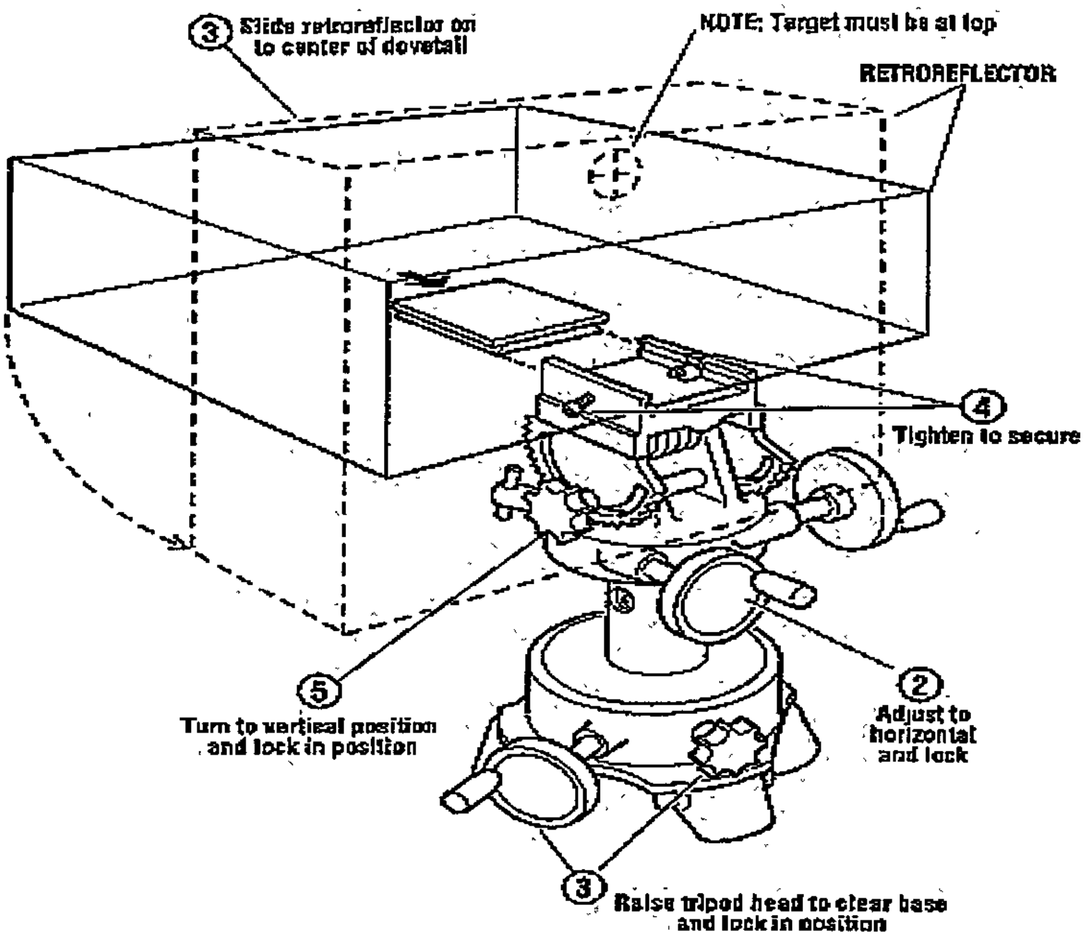

Figure 8

Tighten both locking screws (see Figure 8, element #4) with the hexagonal wrench.

The vertical position crank until the retroreflector is 90 degrees to its original position (See Figure 9).

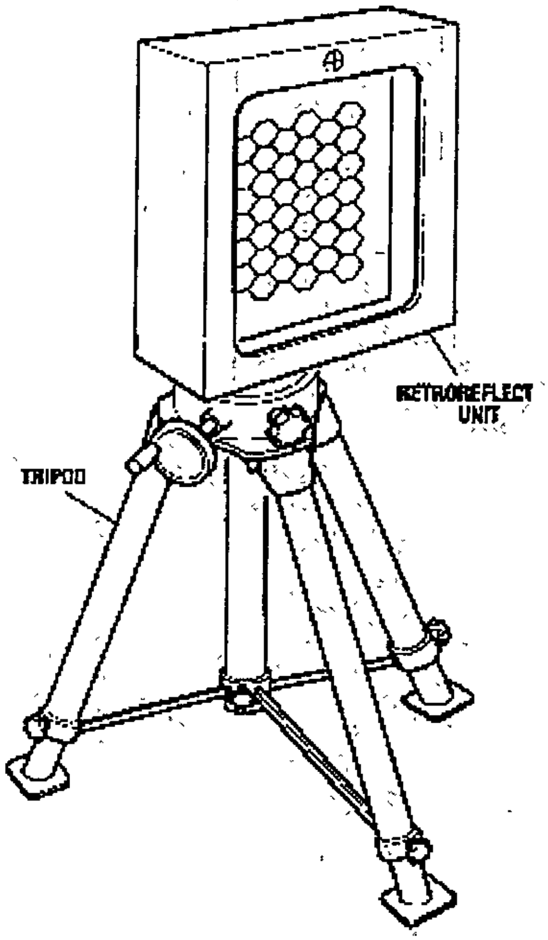

Figure 9

Remove the Plexiglas cover using the large turnkey. Be careful not to lose the hinge pins.

Step 2 – System Startup

Step 2a – Supplying Electrical Power to the System

Place the portable generator downwind of the path of analysis at a distance of 50 to 100 ft (depending on length of extension cord). Insure that the 110 VAC supply switch is in the OFF position.

Plug 50/100-foot extension cord into portable generator.

Plug 110 VAC line conditioner into multiplug connector of the extension cord. Insure that the conditioner is turned to the OFF position.

Plug one end of FTIR power cord into system connector labeled "ETG Power" and the other into the line conditioner.

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Plug the Dolch workstation power cord into the line conditioner. Insure that the workstation is ned to the OFF position.

Start the portable generator and allow it run several minutes until it runs smooth in the unchoked position. Turn on the 110 VAC supply switch.

Turn on the line conditioner.

Step 2b – Powering System Unit and Initializing System Software

Turn the Dolch workstation (PC) on.

Set the workstation date/time to local date and time.

Click on the AirSentry-FTIR CMS icon. The software needed to run the FTIR is active at this point (See Figure 10).

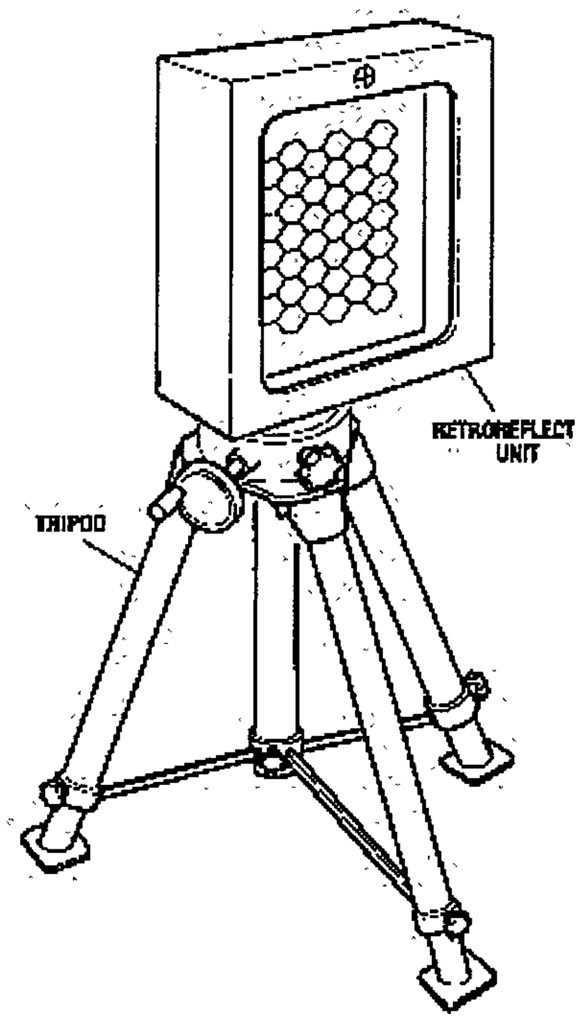

Figure 10

Click on the **COMMAND** icon, and drag the arrow down to the **MODIFY PARAMETERS** icon. The **MODIFY PARAMETERS** screen will appear (See Figure 11).

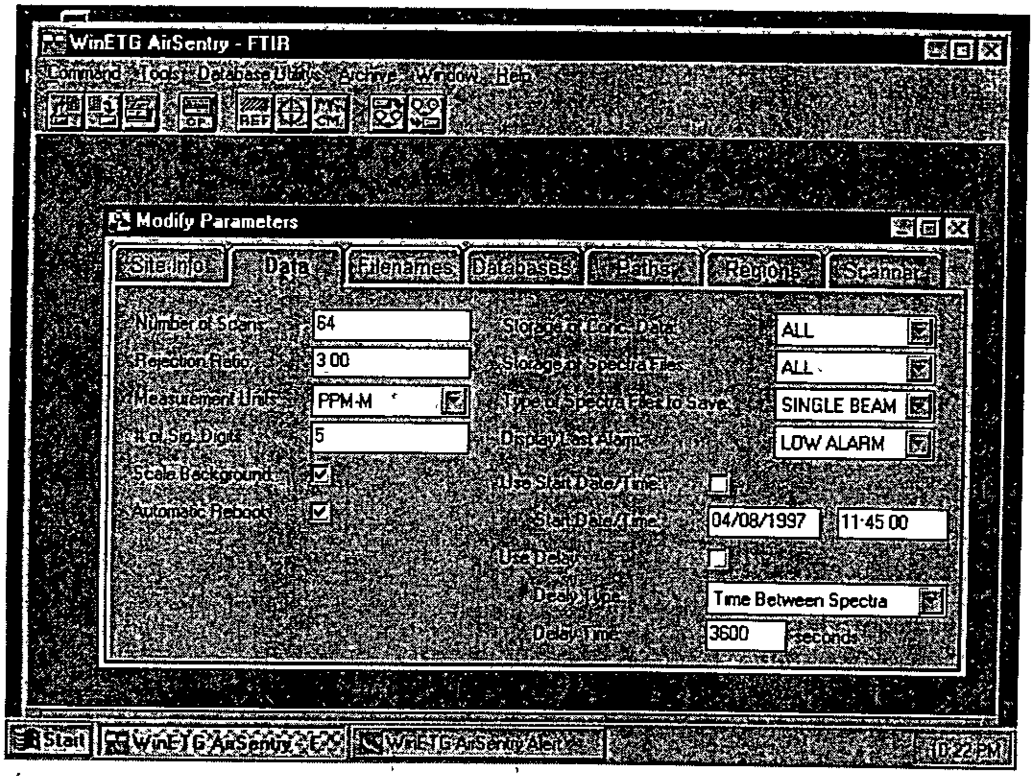

Figure 11

There are a couple of TABS to click on. These settings will be used throughout the data analysis session.

Click on **SITE INFO** and correct the information on this screen to accurately reflect information pertinent to your specific project.

Click on the **DATA** tab. Set the scans coadd parameter to 64. This result in approximately 5 minutes of coadded data per analysis/save.

Click on the **FILENAMES** tab. Rename the file in the **BACKGROUND FILE** box. Rename the file in the **SPECTRA FILE PREFIX** box. Rename the file in the **SCRIPT FILE** box to the analysis script designed specifically for the project. The following filename convention should be followed for all data collection sessions.

In order to eliminate the numerous naming conventions for the collection of Open path Fourier Transform Infrared (Op-FTIR) data the following 8.3 standard has been adopted:

ABBCCDDD.EEE

where

A	=	S	(sample) or
	=	B	(background)
	=	Z	(zero-path background)
	=	Q	(QA gas)
BB	=	AA to ZZ	(Two letter site designation of your choice)
CC	=	01 to 99	(use as a set indicator e.g. 01 first day, 02 second day or 01 first day am, 02 first day pm)
DDD	=	001 to 999	(use as scan designator e.g. 001 first scan, 002 second scan. ETG software will increment this value automatically.)
EEE	=	SPC	(spectrum) or
	=	IFG	(interferogram)

For example:

BEA01001.SPC May represent a background taken at ERDEC, Day 1, Scan 1.

SEA010012.SPC May represent a sample taken at ERDEC, Day 1, Scan 12.

or additional help on filename use, please see Appendix A – Sample Open-path FTIR Project.

There is other tabs preset. Feel free to take a look at the settings, however they should not be changed. Close out the window once site info, data, and filename information has been set.

It is now time to turn the FTIR on. The AirSentry software has a pull-down menu at the top of the main screen. Immediately under the pull-down menu is a toolbar. The fourth icon from the left in the toolbar is the CP button (See Figure 10). Click on this button with the mouse. The FTIR CONTROL window (See Figure 12) will come up on your computer screen. Click on the system power off icon to turn the FTIR on. At this point the icon should read on and you should hear the FTIR start.

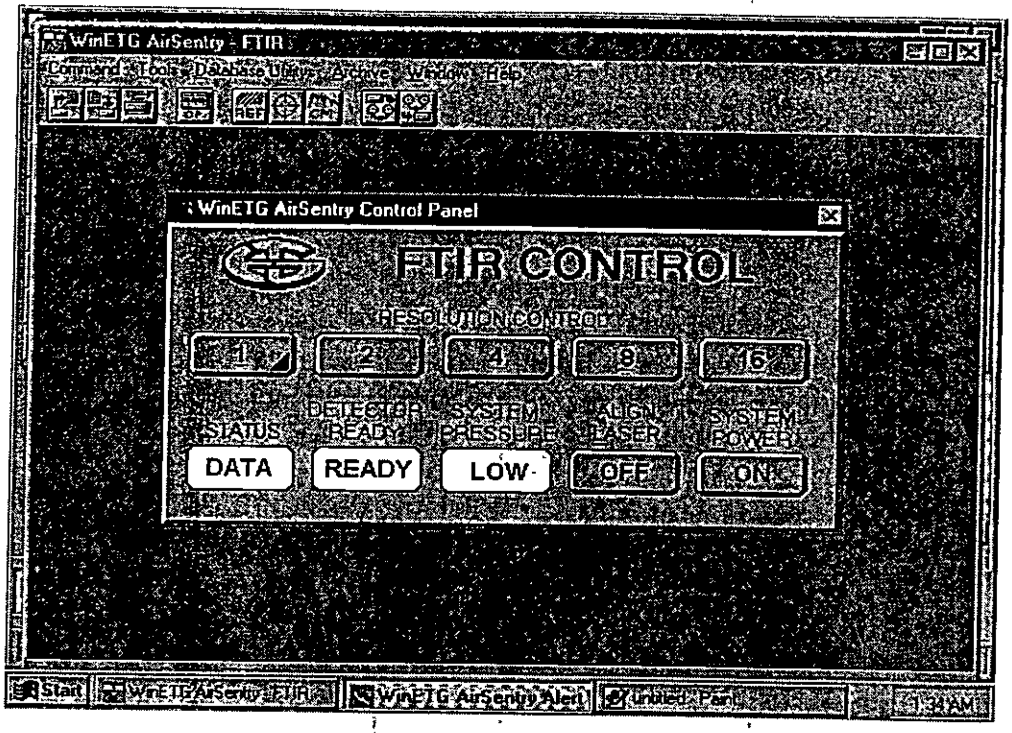

Figure 12

While in this window, assure that the number 1 is highlighted by the triangle in the corner. If it is not, click the number 1. Record start-up time on Open-path FTIR Data Log sheet. System should indicate "Detector Ready" within 10 minutes. Note the cool down time on log sheets. If cooling takes more than 15 minutes, power down the system and contact supervision. **Do not operate the system if it has not cooled down in 15 minutes.**

Step 2c – Check System Performance and Conduct Initial System Alignment

After the Detector Ready Signal is OK, the FTIR can be aligned. Position the retroreflector directly in front of the telescope. The retroreflector and telescope should be at approximately the same height. Be careful not to bump the retroreflector with the system's telescope, as the individual reflector cubes are very fragile.

To do the alignment, click on the sixth button from the left (See Figure 10). This button looks like a targeting sight. The FTIR Alignment window will appear on your computer screen (See Figure 13).

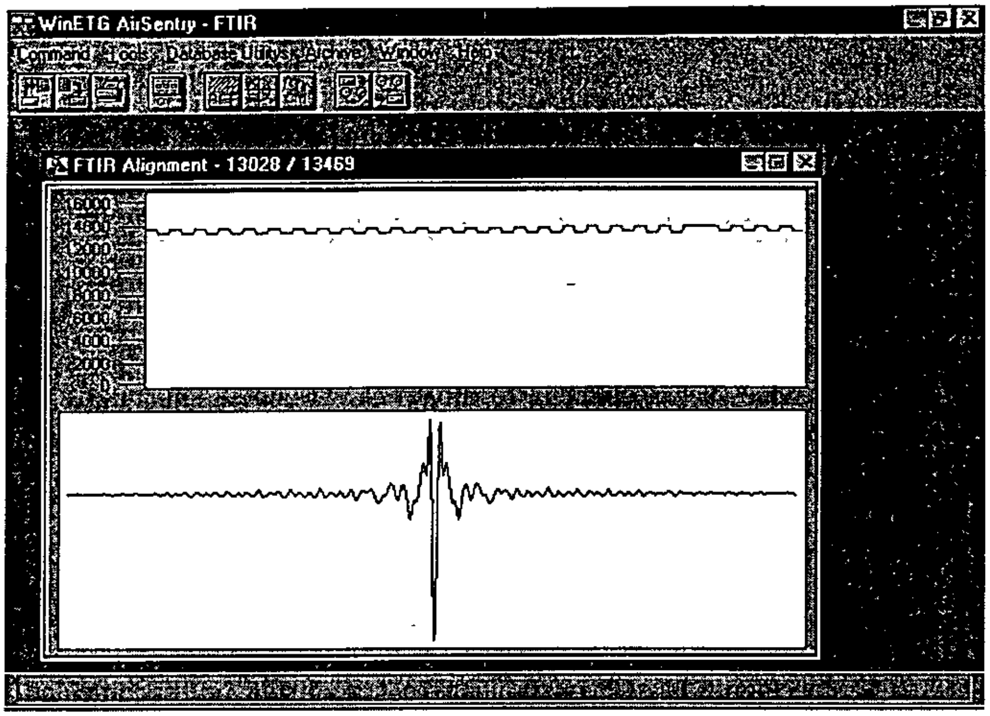

Figure 13

e number at the top of the alignment screen indicates the intensity of the infrared light incident on e detector (See Figure 13). The idea is to move and adjust positions of the FTIR and the retroreflector to maximize the number at the top of the screen. The maximum signal strength value is 16384. This number should never be realized for it indicates a condition of detector saturation. The maximum signal strength value should be around 14000 when the retroreflector is within 10 meters. This value should decrease substantially with increasing distance between the retroreflector and the telescope.

The graph in the top of the window shows a trend in the light intensity. The y-axis shows the light intensity and the x-axis is a time function. As the light intensity increases, the line across the graph will rise. This graph can be used as a tool when aligning the FTIR and to monitor the stability of the alignment.

The lower part of the alignment window shows the interferogram pattern. The operator must assure that there is symmetry in the pattern, or in other words, if you drew a vertical line down the middle of the largest peak (the center burst), the right and left half should look about the same.

Once the FTIR is aligned as indicated by maximization of the numbers at the top of the alignment window, the window can be closed. Be careful not to move either the system unit or retroreflector as this position will be used in Step 3 – Background Data Collection.

Record the maximum signal strength in the Open Path FTIR - Data Log. These log sheets *must be* *npleted* for each data collection session. This includes all requested information as well as a site etch. Use these logs to document any system failures or odd behavior. Label any broken or misbehaving hardware. An example of the log sheets can be found in Appendix A – Sample Open-path FTIR Project.

Wait 45 minutes for the system to stabilize.

Step 3 – Background Data Collection

Step 3a – Collecting a Zero Path Background

Since in many deployment scenarios it can not be assumed that a true clean path can be established to use as a background reference, it is necessary to collect a zero path background. This allows the analyst to remove spectral features due to instrument components while minimizing atmospheric pollutant concentrations in the beam path.

The system and retroreflector should still be in alignment from the previous Step 2c – Check System Performance and Conduct Initial System Alignment.

Click on the **COMMAND** pull-down icon in the FTIR software and drag the arrow down to **BACKGROUND REFERENCE** (See Figure 14). Check to insure that the displayed filename and the scans coadded are the same as the values entered during Step 2c. If not, you may click on the appropriate button and correct now. Once these values are verified/set, click on the **COLLECT** icon. When the collection begins, the screen you are now viewing will have a cancel icon in place of the collect icon, and the scan number will start increasing from 0 to 64. Once the background is complete the software will prompt the user with the question, "Do you want to use this background as a reference?". Click on <u>NO</u> and close out this screen.

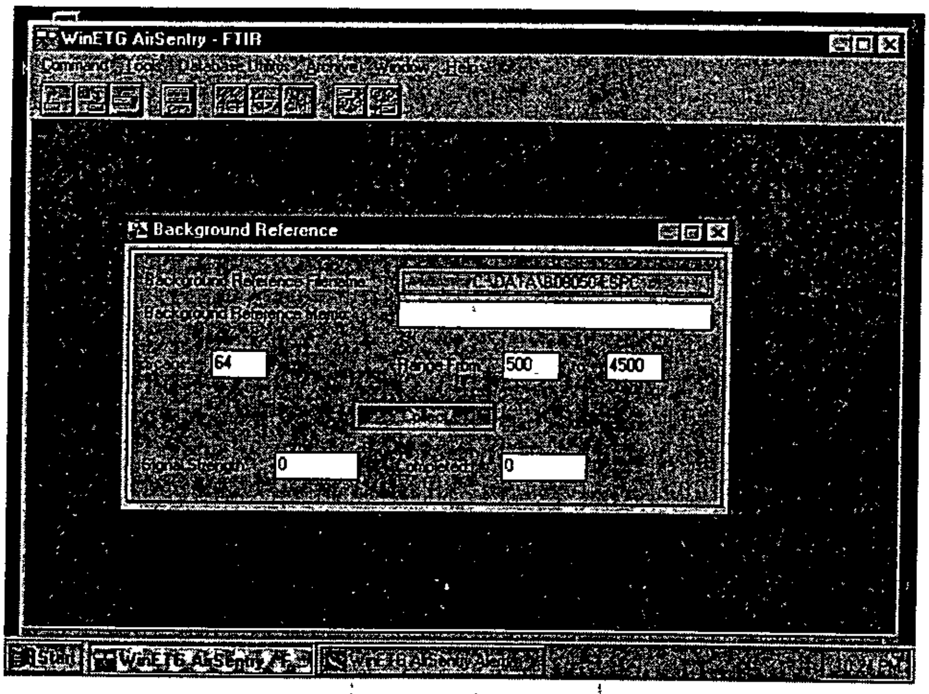

Figure 14

The next step is to take a second zero path background spectra. Click on the **COMMAND** pull-down icon and drag the arrow to **BACKGROUND REFERENCE** (See Figure 14). The background reference screen will come up. **RENAME THE FILE** and hit the **COLLECT** icon. When collection is complete, the user will once again be prompted with the question, "Do you want to use this background as a reference?". Again, click on No and close out the screen.

The final step is to take a third zero path background spectra. Click on the **COMMAND** pull-down icon and drag the arrow to **BACKGROUND REFERENCE** (See Figure 14). The background reference screen will come up. **RENAME THE FILE** and hit the **COLLECT** icon. When collection is complete, the user will once again be prompted with the question, "Do you want to use this background as a reference?". This time, click on **YES** and close out the screen.

The operator should complete the Sections 1, 2, and 3 of the standard Open Path FTIR - Data Log. The background scan information should be recorded in Section 5 of the data log. A sample copy of these log sheets is provided in Appendix A.

Step 4 – Quality Assurance Data Collection

If a known concentration of infrared active gas can be obtained in a compressed gas cylinder, then the internal QA cell can be used to determine the precision and accuracy for that particular compound. The proper use of the internal cell can act as a verification of a properly functioning Open-path FTIR, and assumptions simply made about its detection of designated target compounds. Sulfur hexafluoride will often be used for this purpose. The following procedure describes the use of the internal QA cell.

Step 4a – Quality Assurance System Setup

The system and retroreflector should still be in alignment from the previous Step 2c.

Make all necessary gas connections - regulator to SF6 cylinder, tubing to regulator, tubing to quick connect male fitting, and quick connect to the corresponding female fitting on the FTIR sensor labeled QA Cell inlet.

ALWAYS insert a male quick connect fitting into the female outlet on the FTIR sensor before the turning on the gas. The outlet is not open and gas cannot flow freely through the cell unless this is the case. Turning on the gas at a substantial flow with the outlet closed will cause the cell to become pressurized and it could be damaged.

Connecting tubing to the male quick connect fitting that fits into the outlet is not necessary for proper gas flow, however, a long length of hose will allow the gas to be directed away from the operator. Also note that the escaping gas should not flow in front of the telescope as the gas in the cylinder is at a high concentration and may absorb in the open path and cause erroneous results. Tubing can be used to avoid this problem as the escaping gas can be directed downwind of the path.

Once all connections have been made, slowly turn on the SF6 gas. A flow of only a few cubic centimeters a minute is required and larger flow rates will only cause turbulence in the cell and lead to improper mixing. A small rotameter can be placed on the outlet tubing to monitor the flow, or one can simply place his finger over the end of the tubing for a second. There should only be enough flow so that a positive pressure can be felt, but not so much that it tends to push you finger away from the end of the tubing.

Allow the gas to flow through the cell for several minutes before starting the collection. It is recommended to let the gas flow prior to data collection until a volume of at least five times that of the cell volume has passed through. This will insure homogeneous mixing in the cell.

Data collection can now begin. The system must be aligned just as in normal background data collection. The same procedures are followed with the exception of the filename that should give some indication that the spectrum contains the QA gas. Refer to the previous Step 2b and Step 3 for specific instructions on how to name and collect zero-path background spectra.

Collect three spectra with the QA gas flowing through the cell. Check the flow rate periodically to make sure that the gas is still flowing. Multiple spectra are required for precision calculations.

Once the data collection is finished, turn off the QA gas. The internal cell must now be purged with dry nitrogen before target data collection can begin. Disconnect the tubing from the SF6 regulator and attach it to the Dry Nitrogen regulator. Slowly turn on the Dry Nitrogen gas until a slow, steady flow is felt at the outlet port.

Allow the gas to flow through the cell for several minutes before starting the collection. It is recommended to let the gas flow prior to data collection until a volume of at least five times that of the cell volume has passed through. This will insure that no SF6 remains in the internal cell.

Calculate the percent accuracy by dividing concentration given by the instrument during the QA process by the known concentration of the cylinder.

Calculate precision by analyzing the multiple spectra collected during the QA process and expressing the precision as the relative standard deviation of these concentration values.

Record these values on the Open-path FTIR – Data Log.

Step 5 - Target Data Collection

Step 5a – Reposition the Retroreflector

The retroreflector used during the system alignment and zero-path background collection can now be moved. Using this retroreflector or another similarly configured retroreflector, establish a clear path downwind of the specified target location. This path should be greater than 50 meters and as long as 400 meters as determined by the project goals, site and atmospheric conditions.

With the retroreflector in its new position, repeat the alignment procedure in Step 2a. Note that the overall signal strength displayed may be significantly less than that obtained during zero-path background collection. Signal strength readings greater than 3000 should be obtained or the pathlength should be reduced.

The Open-path FTIR is now aligned and data collection can begin. To begin data collection, click the **COMMAND** pull-down menu and drag the arrow to **CONTINUOUS MONITOR** (See Figure 10). Data collection will begin immediately and the screen will update as seen in Figure 15.

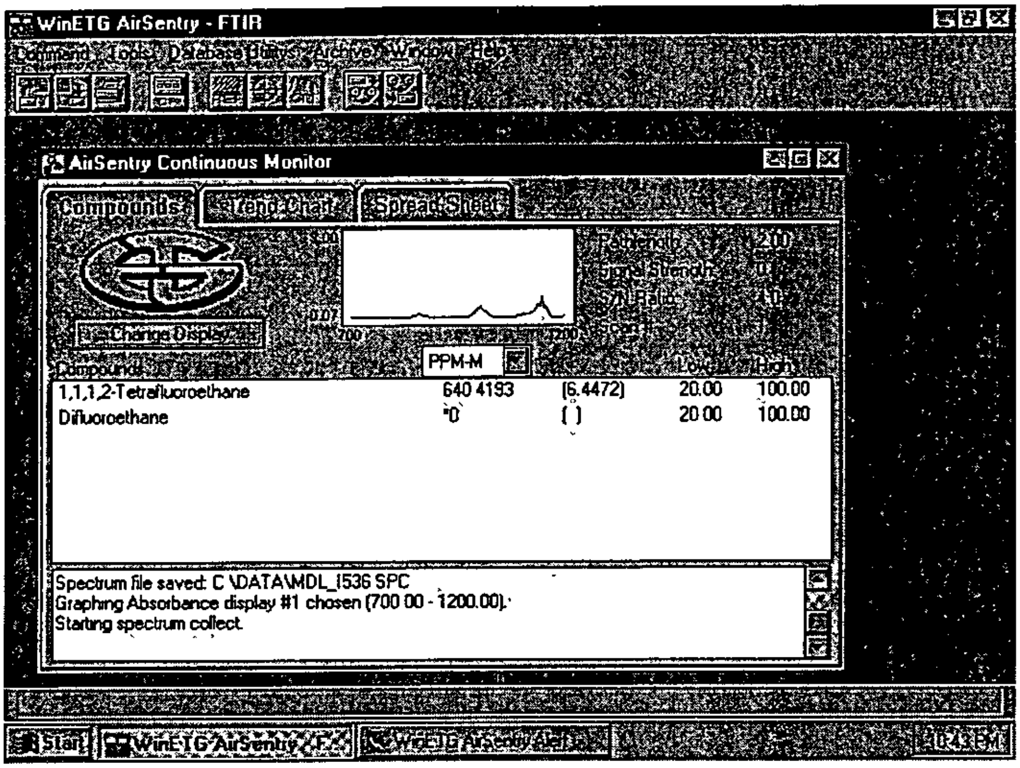

Figure 15

Step 5b – Continuous Monitor Software

The important information is the numerical value under the PPM column. Initially ***** will appear. After some data has been collected, a number will appear. The number less than 1 indicates that the concentration in the beam path is below the minimum detection limit of the instrument. A value of *0 indicates that there is something in the FTIR light path, but it is not what the software is looking for. A value greater than 1 indicates that the compound of interest is present in the light path. Specific alarm details should be included in site-safety plans.

The operator will note this window is in the form of index cards. The trends chart will continuously plot the relative concentration of compound over time.

Avoid bumping the system or obstructing the beam path during the collection process.

Operator should confirm that the system is correctly saving files. This can be accomplished by reading the activity log at the bottom of the **CONTINUOUS MONITORING** screen. A message similar to "Data saved as C:\Data\SOF01001.SPC" should be displayed at the end of each 64x add.

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Step 5c - Ending Target Data Collection

To end the target data collection simply close out the **CONTINUOUS MONITORING** window. The initial AirSentry CMS screen should be displayed.

Step 6 – Final Background Data Collection

It is desirable to repeat the zero-path, background data collection after completing target data collection. This will create background files taken more closely, in time, to the final target scans and account for any system changes that took place during the period of target data collection.

Reposition the retroreflector directly in front of the system telescope and repeat Step 2c to maximize signal strength.

Collect three additional backgrounds as described in Step 3a. Make sure to set the background filename to a unique name so that existing background files are not overwritten.

Step 7 – Turning off the System

To turn the Open-path FTIR off, click on the fourth icon in the tool bar, **CP**. The **FTIR CONTROL** dialog box will appear on the computer screen. Click on the **ON** and the power will go off. Close out this window. Close out the AirSentry-FTIR software. Exit the Windows software.

APPENDIX A
Sample Open-path FTIR Project

As an illustration of many of the steps described in this Internal Operation Procedure, a sample project has been created. The fictitious project follows:

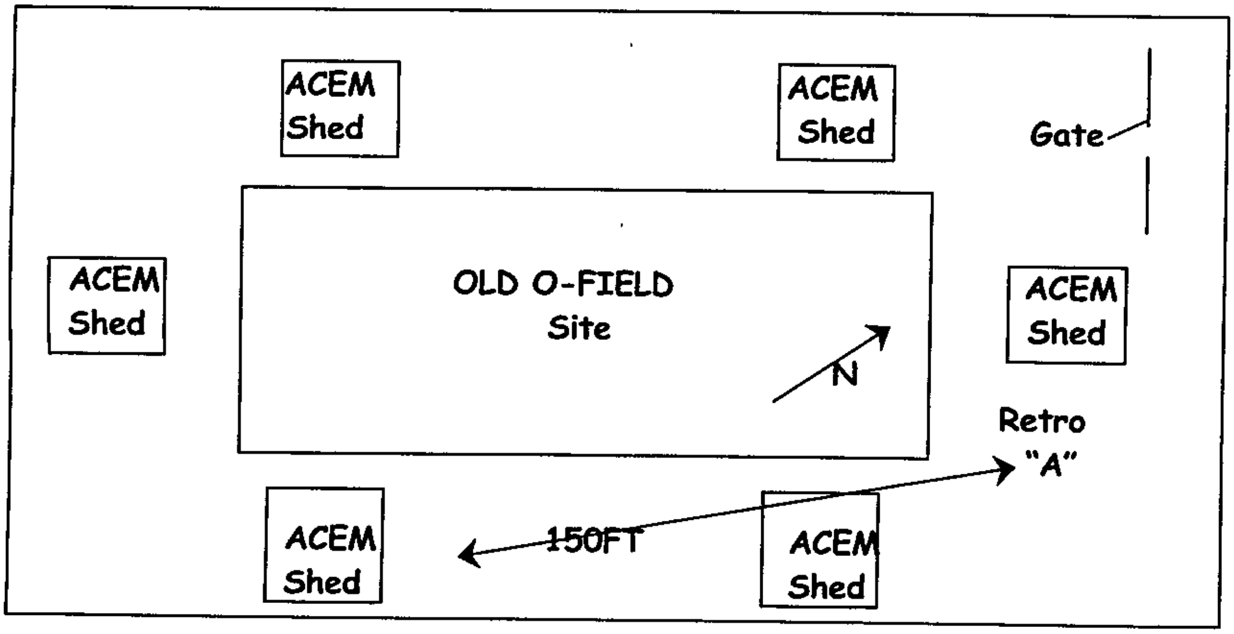
Monitoring was requested on the downwind perimeter of Edgewood Area, Aberdeen Proving Ground's Old O-Field. The monitoring took place 1-5 June 1997 with the primary compound of interest being phosgene. A real-time analysis script "ofield.spt" was created specifically for this effort and placed in the C:\data\script directory of the Dolch workstation. The team used FTIR labeled "CNBCET5" for the project.

The following data logs, filenames, and directories were used for the project.

Sample Data Log

Section 1 – General

Date: 6/01/97
Location: Old O-Field
OP-FTIR GPS Location: 39° 20' 36N 076° 17' 36W
Target Retro GPS Location: 39° 20' 37N 076° 17' 35W
Distance to Target Retro: 150 FT
Target Compound (if known) Phosgene
Analysis Script: Ofield.spt
Setup Description (sketch):



Section 2 – System Information

Name: CNBCET5 **(found on system unit label – rear, center)**
Serial Number: FTIR015 **(found on system unit label – front, left)**
Hours: 627 **(found on system unit odometer – rear, right)**
Range (cm-1): 500-4000 **(set in MODIFY PARAMETERS)**
Resolution (cm-1): 1 cm-1 **(set in CONTROL PANEL)**

Section 3 – Weather Conditions

Temperature: **(this info will be extracted for Weatherpak logs)**
Humidity: **(this info will be extracted for Weatherpak logs)**
Wind Direction/Intensity: **(this info will be extracted for Weatherpak logs)**
Precipitation/Intensity: Rain/Light

Section 4 - General Comments

Light rain begins falling @ 1050. Results in slight decrease in signal strength.

Post security parks vehicle in beam path for several minutes. Scans SEA01103, SEA01104, and SEA01105 effected.

Large explosion on northwest edge of field @ 15:25. System reports phosgene hits for next 10 minutes.

No failures or abnormal equipment behavior recorded.

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Filename	Time	Comments
System Power on	8:47	Cool Down = 8 minutes
ZEA01001	9:30	Signal Strength = 14,750
ZEA01002	9:35	
ZEA01003	9:40	
QEA01001	10:00	Signal Strength = 14,600
QEA01002	10:05	QA Gas = 25 ppm SF6
QEA01003	10:10	
SEA01001	10:30	Signal Strength = 10,400
SEA01002	10:35	Target Retro "A"
SEA01103	13:30	Vehicle parked in beam path
SEA01104	13:35	"
SEA01105	13:40	"
SEA01106	13:45	Vehicle cleared from beam path
SEA01250	15:25	Large explosion on NW perimeter
SEA01251	15:30	System reports hits on phosgene
SEA01255	13:50	System reports "All Clear"
SEA01340	15:25	Signal Strength = 10,650
ZEA01004	15:40	Signal Strength = 14,500
ZEA01005	15:45	
ZEA01006	15:50	

Sample Project Data Archiving

Data is stored on the Dolch workstation in the directory C:\data by the AirSentry software unless specifically changed by the operator. It is a good idea to make duplicate copies of the data on removable media and then move the data to a permanent directory at the end of each day. This creates duplicate copies of the data and insures that no data be lost due to system failure.

At the end of each day, *copy* the data (FTIR, Weather, Digital photos) to the Zip (Drive D:). Using our fictitious Edgewood Project establish the following directory tree on the Zip:

D:\APGEA
    ...\06_01_97
        ...\CNBCET5
        ...\MET
        ...\PHOTOS

D:\APGEA
    ...\06_02_97
        ...\CNBCET5
        ...\MET
        ...\PHOTOS

same tree on the Dolch's hard drive and *move* the data from its original storage location to this directory. This will create two copies of the data and clean AirSentry directories to dump into each day.

Please take several digital photos of the system setup and the surrounding area. These will be included in the data summary to the customer and may help if problems arise.

At the end of the mission include a subdirectory, C:\APGEA\Report and include all Word documents such as the final report, sitreps, etc.

Bring the Zip disks back when you return so that the data can be promptly analyzed and archived.

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ADMINISTRATIVE RECORD

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