9-1991

PROGRAM MANAGER FOR
ROCKY MOUNTAIN ARSENAL

U.S. ARMY
MATERIEL COMMAND

— COMMITTED TO PROTECTION OF THE ENVIRONMENT —

FINAL DECISION DOCUMENT FOR CHEMICAL PROCESS-RELATED ACTIVITIES INTERIM RESPONSE ACTION AT ROCKY MOUNTAIN ARSENAL

SEPTEMBER1991

PREPARED FOR:
U.S. ARMY PROGRAM MANAGER ROCKY MOUNTAIN ARSENAL

REQUESTS FOR COPIES OF THIS DOCUMENT
SHOULD BE REFERRED TO THE PROGRAM MANAGER
FOR THE ROCKY MOUNTAIN ARSENAL
CONTAMINATION CLEANUP, AMXRM-PM
COMMERCE CITY, COLORADO 80022

ROCKY MOUNTAIN ARSENAL

FINAL DECISION DOCUMENT FOR CHEMICAL PROCESS-RELATED ACTIVITIES INTERIM RESPONSE ACTION AT ROCKY MOUNTAIN ARSENAL

SEPTEMBER 1991

Prepared for:

U.S. Army Program Manager's Office
For Rocky Mountain Arsenal Cleanup

Prepared by:

Tennessee Valley Authority
National Fertilizer & Environmental Research Center
Muscle Shoals, Alabama

EPA Superfund
Record of Decision:

ROCKY MOUNTAIN ARSENAL (USARMY)
EPA ID: CO5210020769
OU 26
ADAMS COUNTY, CO
09/05/1991

ABBREVIATIONS

AMC	Army Material Command
AMCCOM	Armament, Munitions and Chemical Command
ARAR	Applicable or Relevant and Appropriate Requirements
ATSDR	Agencies for Toxic Substances and Disease Registry
CDC	Center for Disease Control
CERCLA	Comprehensive Environmental Response Compensation and Liability Act
CG	Agent Phosgene
DC	Methylphosphonic Dichloride
DDESB	Department of Defense Explosive Safety Board
DOD	Department of Defense
DOI	Department of Interior
EMT	Emergency Medical Technician
EPA	Environmental Protection Agency
FAMC	Fitzsimmons Army Medical Center
FFA	Federal Facility Agreement
GB	Agent GB (Sarin)
HD	Agent Mustard
HHS	U.S. Department of Health and Human Services
IRA	Interim Response Action
L	Agent Lewisite
MINICAMS	Miniature Automatic Continuous Air Monitoring System
NCP	National Contingency Plan
RCRA	Resource Conservation Recovery Act
RMA	Rocky Mountain Arsenal
ROD	Record of Decision
TWA	Time Weighted Average
VX	Agent VX

Table of Contents

Table of Contents
(Continued)

Page

Table of Contents
(Continued)

Page

I. INTRODUCTION

1.0 General

The Interim Response Action (IRA) for Chemical-Related Process Activities is being conducted as part of the continuing remedial activities proceeding pursuant to the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) and the Record of Decision (ROD) process at Rocky Mountain Arsenal (RMA) in accordance with the Federal Facility Agreement (FFA).

The Army conducted a survey of the RMA chemical process equipment/piping and ancillary materials in 1987 to assess their status regarding future plans to dismantle and remove them. This survey led to a long-term program of documentation review of existing plants/equipment regarding the levels of decontamination completed, monitoring for chemical agents, and decontaminating as required in order to facilitate final removal. Other buildings used by lessees are also part of this project.

This action has progressed from the initial documentation studies, field surveys, sampling, monitoring, and decontamination for some of the RMA chemical process piping/equipment to monitoring, decontaminating and dismantling. These activities need to be continued with

respect to the remaining chemical process piping/equipment and materials at RMA in order to facilitate final cleanup.

1.1 Completed Operations

1.1.1 Sampling Operations

During 1989, the U.S. Army analyzed 203 samples of air inside piping and equipment for agent-vapor concentrations in some of the buildings located in the North and South Plants. Forty-nine of those samples indicated concentration levels slightly above the decontamination limit as established by Federal regulations. There were no lost-time accidents.

1.1.2 Decontamination Operations

During 1990, the U.S. Army decontaminated 34 piping/equipment segments that had been previously sampled in the North Plants. Procedures and work sites were approved by the AMCCOM-Safety and AMC-field safety. There were no lost-time accidents. Standard U.S. Army procedures were utilized. Safety, operational, and environmental work plans were approved by the Armament, Munitions and Chemical Command (AMCCOM-Safety) and AMC-Field Safety. The buildings were monitored with real-time agent monitors (MINICAMS) to ensure that no agent vapors existed before, during, or following sampling

operations.

1.1.3 One-Ton Container Monitoring Operations

The U.S. Army sampled 2,354 one-ton containers for chemical-agent vapors. Standard DOD procedures were utilized. Five hundred forty-seven containers exhibited either GB, HD, L, or VX agent-vapor concentrations inside the containers above the decontamination limits established by Federal regulations.

II. CHEMICAL AGENT PROGRAM HISTORY

2.0 General

Rocky Mountain Arsenal (RMA) was established in 1942 with the mission of manufacturing and assembling mustard (blistering agent) and incendiary munitions. During World War II, the Arsenal manufactured chemical and incendiary munitions until 1945 when it was placed in standby status. Portions of the Arsenal were then leased to private industry for the production of commercial pesticides and herbicides. The principal lessee was Shell Chemical Company which produced various commercial pesticides and herbicides until 1982.

RMA was reactivated in 1950 during the Korean emergency to produce chemical and incendiary munitions. Also during this period between 1951 and 1953, the Nerve Agent Plant was constructed. GB (nerve agent) was manufactured from 1953 to 1957. Munitions were filled with GB agent from 1953 to 1969.

In May 1969, the Department of the Army decided to dispose of certain chemical munitions which were obsolete and excess to the National Deterrent Stockpile. RMA initiated the destruction of mustard in October 1969 and completed the project in July 1974. The destruction of GB agent and munitions occurred between 1973 and 1976.

Various chemical agents were destroyed at RMA from 1972 to 1985. After 1985, the Program Manager for Clean Up of RMA was established with environmental clean up as the only mission.

III. OBJECTIVES

3.0 General

The objectives of this action are to:

- Sample chemical process equipment/piping and ancillary materials to determine decontamination status.

- Decontaminate if chemical-agent vapors are found inside the piping/equipment above decontamination limits as established by Federal regulations.

- Dismantle equipment/piping and ancillary materials in preparation for removal/disposal.

IV. ACTION ALTERNATIVES

4.0 General

Activities under this action will be performed in accordance with applicable regulations and requirements. Specific methods and procedures for these activities will be in accordance with AMC 385-131, Army regulations. The only alternative to these methods is no action.

The no-action alternative consists of taking no action to sample, decontaminate, and dismantle chemical process equipment/piping and ancillary materials. The no-action alternative is not acceptable because it would make implementation of the final remedy more difficult and delay the possible reuse of the equipment/materials.

V. CHRONOLOGY OF EVENTS

5.0 General

The significant events leading to the proposed decision to sample, decontaminate, and dismantle chemical process piping/equipment and ancillary materials at RMA are listed below.

Date	Event
1987	U.S. Army initiated the survey of former chemical process equipment/piping in North and South Plants at RMA.
1988	U.S. Army completed the survey of chemical process piping/equipment sampling plan.
1989	U.S. Army initiated sampling of piping/equipment in some buildings in the North and South Plants.
1990	U.S. Army decontaminated piping/equipment in some buildings in the North Plants.
1990	U.S. Army sampled 2,354 one-ton containers.

VI. SUMMARY OF THE IRA

6.0 General

Activities under this IRA will be performed in accordance with applicable regulations and requirements. Specific methods and procedures for these activities will be in accordance with U.S. Army regulations, AMCR-385-131.

Implementation of the action to sample, decontaminate, and dismantle chemical process equipment/piping and other ancillary material is the preferred alternative for the following reasons:

- Facilitate the final remedy for clean up of chemical process buildings and structures.

- Verify decontamination status of chemical process piping/equipment and other ancillary materials.

- Removal for reuse or disposal of chemical process equipment/piping and other ancillary materials.

6.1 Sampling, Decontamination, and Dismantling of Chemical Process Piping and Equipment in the North and South Plants

The scope for this operation will include:

- Sampling to determine the level of decontamination inside piping/equipment as identified in the sampling operations.

- Decontamination of piping/equipment.

- Dismantling of piping/equipment.

Buildings covered are the following:

South Plants

- Buildings 537, 538, 413, 422, 512, 514, and 742A which were used for mustard-agent operations during World War II and demilitarization during the 1970s.

- Buildings 523 and 413 which were used for white phosphorus operations between 1943 through 1946.

- Other buildings not listed here will be part of this project and will be identified as specific work plans are prepared.

- Storage Yard.

North Plants

- Buildings 1501, 1503, 1506, 1601, 1601A, 1603, 1606, 1611, and 1703 which were used for GB manufacturing, storage, and munitions filling.

- Other buildings not listed here will be part of this project and will be identified as specific work plans are prepared.

- Storage Yard.

6.2 Building Descriptions

6.2.1 General

The North and South Plants in relation to other areas at RMA are shown in Figure 6.2-1.

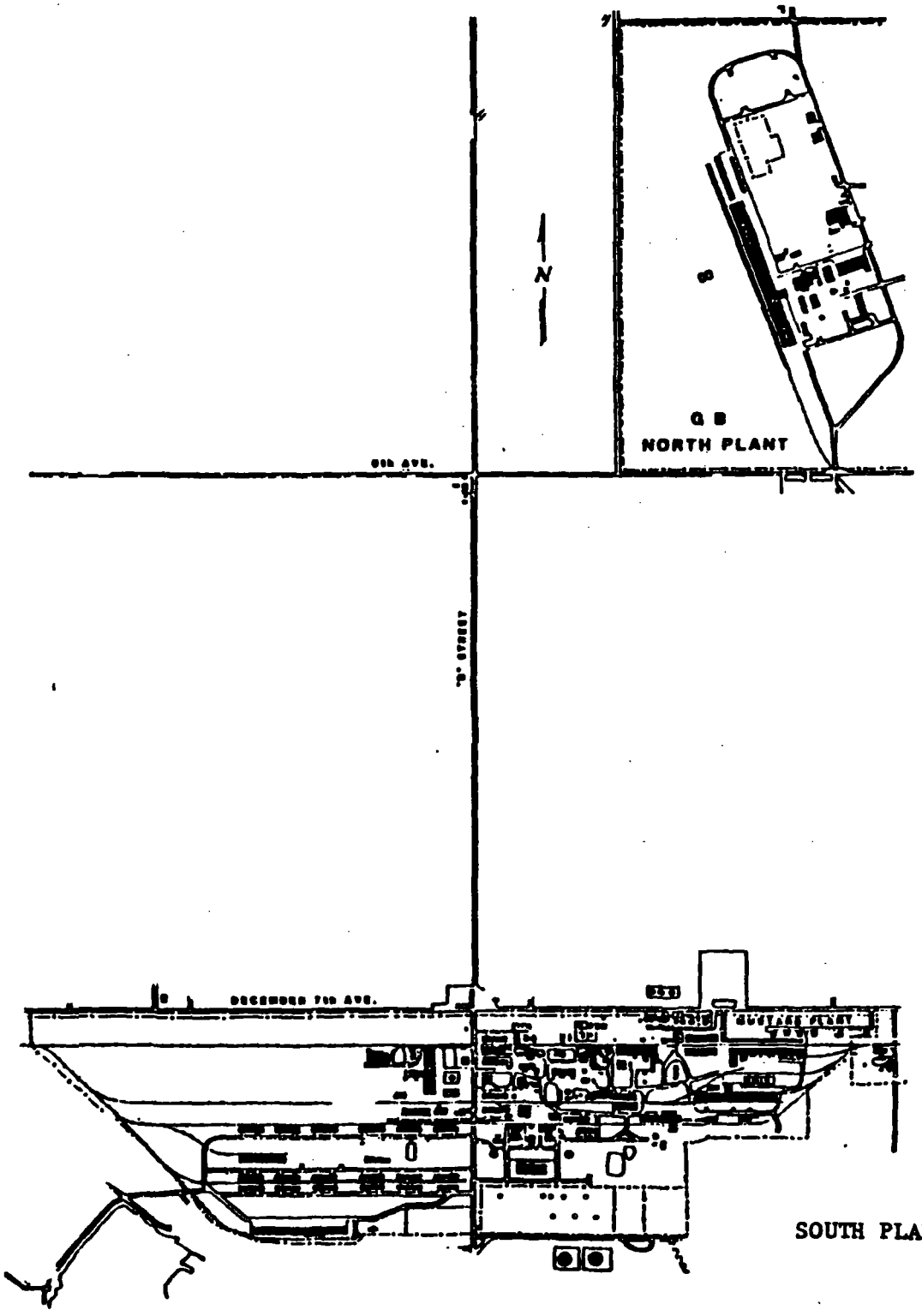
6.2.2 South Plants

Building locations in the South Plants Area are shown in Figure 6.2-2.

6.2.2.1 Building 537

Building 537 was built in 1945. This building has been used for various chemical operations throughout the years and contains some equipment and piping.

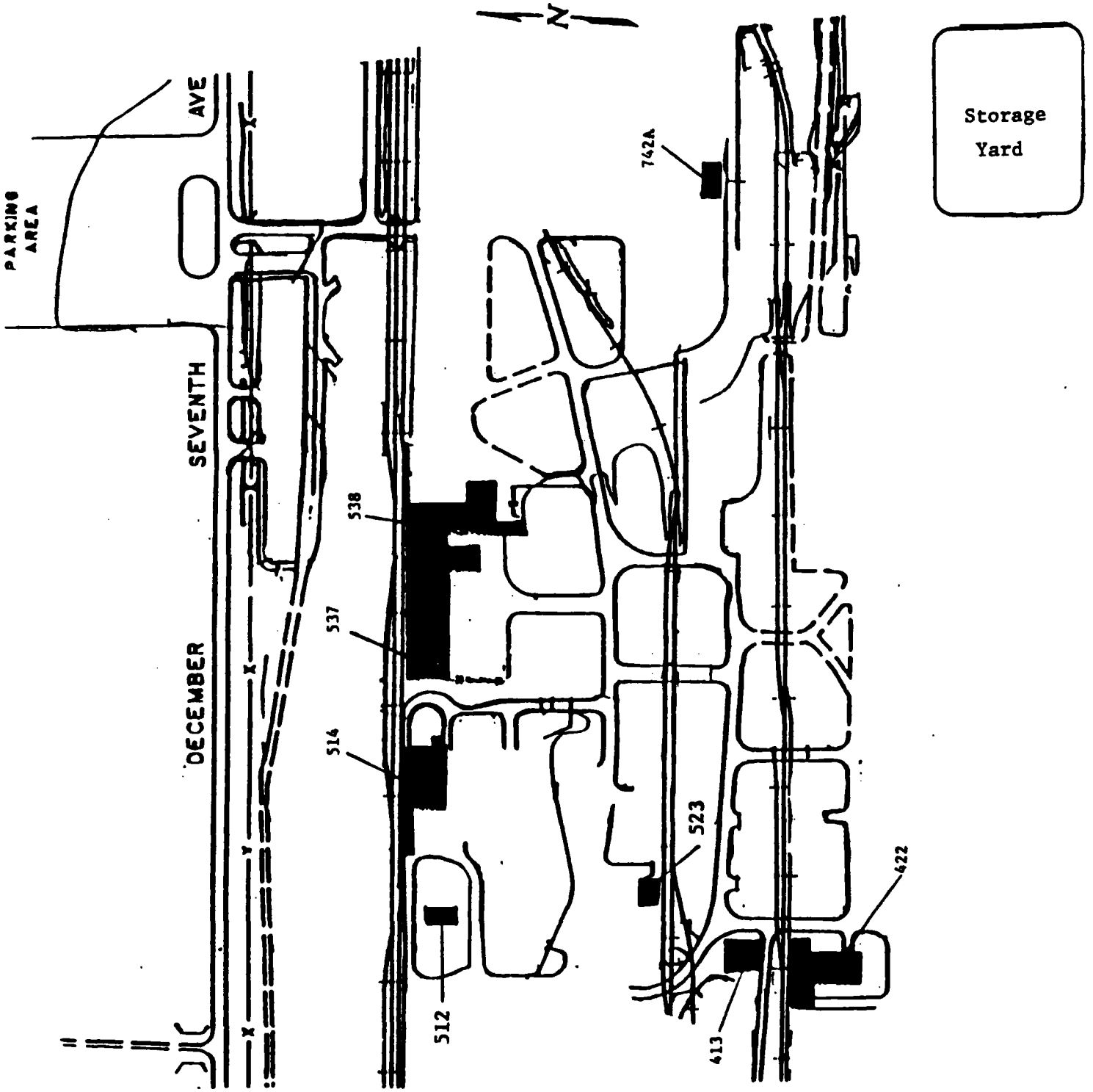
Figure 6.2-1
Location Map - RMA



Chemical Process Related Activities

Rocky Mountain Arsenal

Figure 6.2-2
Plot Plan - South Plants Area



6.2.2.2 Building 538

This building was constructed in 1945. The building was designed to contain disposal equipment (material handling, crusher, and three furnaces) for decontaminating 55-gallon drums which were drained of mustard in Building 537. In subsequent years, the building furnaces were used to decontaminate metal parts generated by the demilitarization operations in Building 537. In the 1970s, the furnaces were used to incinerate mustard. This building contains piping and equipment.

6.2.2.3 Building 523

The facility was previously used to load grenades with white phosphorus. This building contains some piping and equipment.

6.2.2.4 Building 413

This building contains storage tanks and piping and equipment used for white phosphorus operations.

6.2.2.5 Building 422

Building 422 is a two-story structure with single-story additions. The building was originally used to fill ton containers and 55-gallon drums with mustard. The building was leased by Julius Hyman & Company for manufacturing pesticides and contains some equipment and

piping.

6.2.2.6 Building 512

Building 512 was used with the Army's mustard distillation program for the filling of ton containers. Immediately following the conclusion of this program, the Army thoroughly decontaminated all piping and process equipment. In 1947, Building 512 was leased to Shell Oil Company for use in the manufacture of pesticides. There has been no use of this building since 1982. The building contains piping and equipment.

6.2.2.7 Building 514

Building 514 was used in the Army's mustard distillation program for the washing and distillation of mustard agent. Immediately following the conclusion of this program, the Army thoroughly decontaminated all piping and process equipment. In 1947, the building was leased to Julius Hyman & Company for use in the manufacture of pesticides. There has been no use of this building since 1982. This building contains piping and equipment.

6.2.2.8 Building 742A

Building 742A contains piping and tanks used in the mustard filling program at RMA.

6.2.3 North Plants

6.2.3.1 General

Building locations in the North Plants Area are shown in Figure 6.2-3.

6.2.3.2 Building 1501

Building 1501 was constructed in 1951 - 1953 to produce agent GB. Production of agent GB ceased in 1957. The building was utilized in the mid-1970s to destroy agent GB from demilitarization operations.

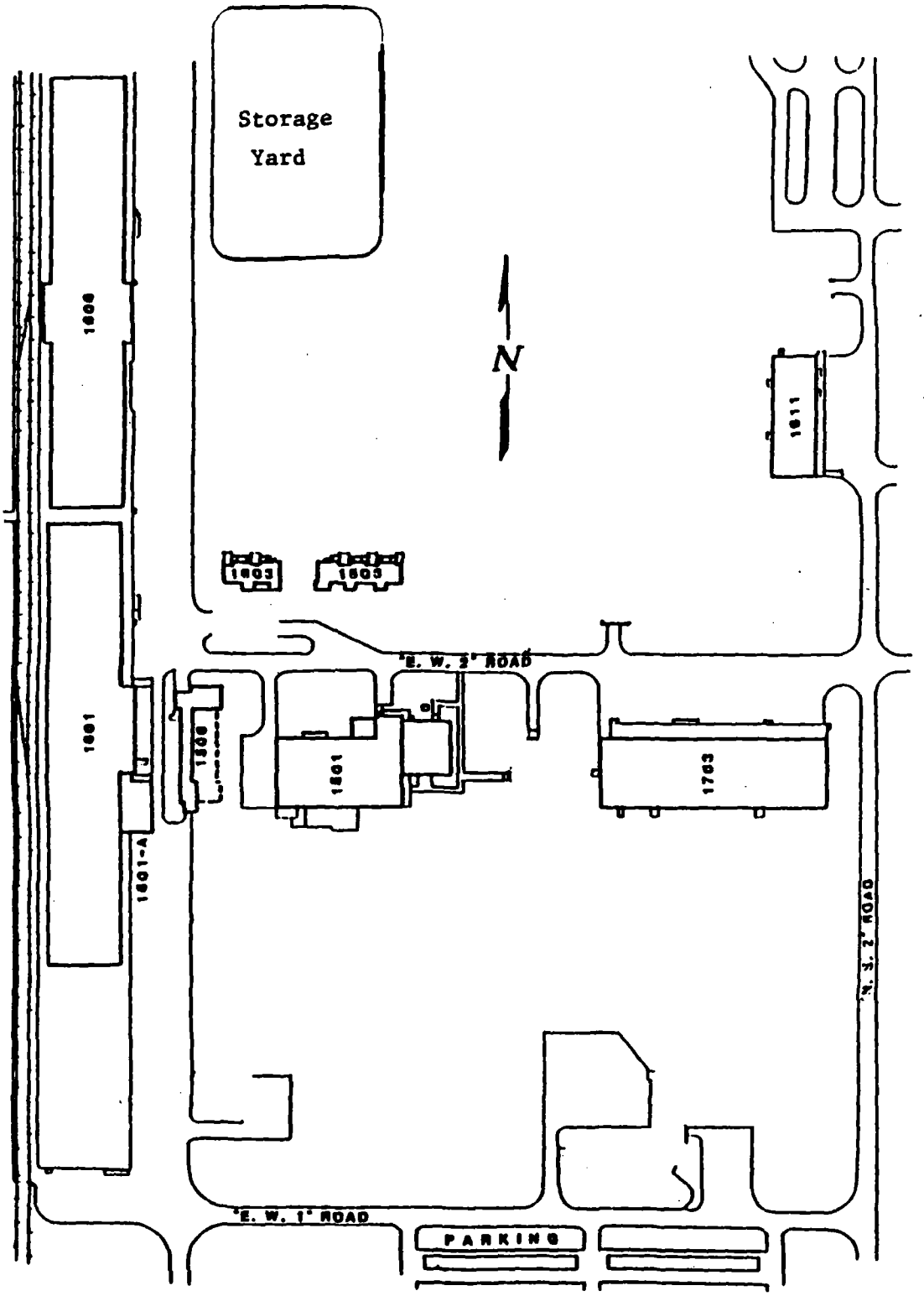
6.2.3.3 Building 1506

This building contains GB storage tanks. Building 1506 is a concrete structure, the majority of which is underground. Some transfer piping does exist in the building.

6.2.3.4 Buildings 1601 and 1601A

Buildings 1601 and 1601A were used to fill various munitions and ton containers with GB. The last filling operation in the building took place in 1969. Some equipment does exist in these buildings.

Figure 6.2-3
Plot Plan - North Plants Area



6.2.3.5 Buildings 1503/1603

Buildings 1503/1603 are the scrubber system for the GB plant and are constructed partially underground with reinforced concrete floors and walls and a removable concrete slab roof. These facilities contain piping and equipment.

6.2.3.6 Building 1606

Building 1606 was used for bomb assembly and also the demilitarization of the bombs in 1973 - 1976. The building has been inactive since 1976. This building contains piping and equipment.

6.2.3.7 Building 1703

Building 1703 was used for spray-dryer operations which supported the GB demilitarization program. This building contains piping and equipment.

6.3 Ancillary Materials

6.3.1 Ton Container Sampling and Decontamination - General

The ton containers were filled with either mustard (HD), Sarin (GB), Agent VX, Lewisite (L), or phosgene (CG). These containers were drained, chemically decontaminated, and some were thermally decontaminated. However, due to some records not being available, the Army will determine

the decontamination status of the containers.

During the summer of 1990, 2,354 ton containers were sampled for the chemical agents GB, HD, and VX at levels established by Federal regulations and L at higher screening levels.

6.3.2 Ton Containers - Proposed Work

Ton containers will be decontaminated and sampled as necessary to ensure that they meet the decontamination limits established by Federal Regulations.

6.3.3 Ancillary Materials in Storage - Proposed Work

Ancillary materials in storage will be sampled and decontaminated as necessary to meet decontamination limits established by Federal regulations.

6.4 Health and Safety Plan

Health and safety are an integral part of this work and are required under existing Army safety regulations/procedures. This plan will address all health and safety regulations deemed necessary to implement this program with minimum risks to operations personnel as well as the general public.

As previously stated, these methods and procedures

regarding protection of the health and safety of personnel involved in these operations are proven by years of successful projects that have been completed at RMA. The Health and Safety Plan will be developed and included in the Implementation Plans for this program.

6.5 Medical Examination

All personnel assigned to perform sampling, decontamination, and dismantling operations will have a medical examination prior to working at RMA. This examination will include blood cholinesterase tests to establish a base line level and fitness to wear respiratory equipment and other personal protective clothing.

6.6 Key Medical Personnel

Key medical personnel necessary to support any emergencies will be the emergency medical technicians (EMTs) provided by the RMA Fire Department. The Fitzsimmons Army Medical Center (FAMC) will provide medical care for serious injuries or exposure to chemical agents. All assisting personnel at FAMC have been trained to attend to these emergencies. AMI Presbyterian Hospital in Aurora will be used for minor medical care when necessary.

6.7 Emergency Response Equipment

The RMA Fire Department will provide the emergency medical response equipment and personnel.

VII. INTERIM RESPONSE ACTION PROCESS

7.0 General

The activities proposed in this document are being coordinated pursuant to Section XXII of the FFA which explains the Interim Response Action (IRA) process. Section XXII establishes a specific IRA process to be conducted at RMA and a procedure for coordinating such actions. The IRA proposed in this document will follow these procedures.

VIII. APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARAR) FOR THE PROPOSED CHEMICAL PROCESS-RELATED ACTIVITIES IRA

8.0 Ambient or Chemical-Specific ARARs

Ambient or chemical-specific requirements set concentration limits or ranges in various environmental media for specific hazardous substances, pollutants, or contaminants. Such ARARs either set protective cleanup levels for the chemicals of concern in the designated media or indicate an appropriate level of discharge.

The objectives of this activity are discussed elsewhere in this document. This activity will be implemented prior to the final remediation to be undertaken in the context of the On Post Operable Unit ROD. The media of concern is air and the chemical-specific requirements listed below apply to levels of the named compound which remain in the air after completion of the remedial activities related to this action.

Any liquid or other waste material generated pursuant to this activity will be appropriately managed onsite and any disposal of such material will take place under a different program, not this IRA.

Chemical-specific standards for these compounds were

developed pursuant to 50 USC § 1512 and the final standards listed below are based upon the final recommendations of the Center for Disease Control (CDC), U.S. Department of Health and Human Services (HHS), acting pursuant to the above cited statute, published at 53 Fed. Reg. 8504 (March 15, 1988). These standards are for the worker population, since that is the only realistic population which could be exposed to concentrations of these compounds inside the buildings, and are based upon an 8-hour time weighted average (TWA). The TWA is the individual's average airborne exposure in any 8-hour work shift of a 40-hour work week, which shall not be exceeded. It is calculated to provide protection over an entire working lifetime. By reducing the levels of these compounds to those indicated below, ample protection will be provided to nonworker populations outside these buildings because such populations only exist at such a distance that no realistic potential risk of exposure will remain for such nonworker populations. The chemical-specific ARARs determined relevant and appropriate to apply in the context of this activity are:

Compound	ARAR Level	Source
GB*	0.0001 mg/m^3	53 FR 8504
VX*	0.00001 mg/m^3	53 FR 8504
HD**	0.003 mg/m^3	53 FR 8504
L***	0.003 mg/m^3	53 FR 8504

* GB (Sarin) and VX, nerve agents
** Mustard, a blister agent
*** Lewisite, a blister agent

Further requirements related to permissible exposures are contained in AMC Regulation 385-131, see Attachment A. Pursuant to this regulation, no unprotected individual will be exposed to concentrations above the following limits, regardless of the 8-hour average:

Compound	Limit
GB	0.2 mg/m^3
VX	0.4 mg/m^3
Mustard	0.003 mg/m^3

Soil

There are no action-specific ARARs that pertain to the drilling or excavation of soil during the implementation of anticipated remedial actions. Although not an ARAR, removal of soil from areas where remedial actions are anticipated will be performed in accordance with the procedures set forth in the Task No. 32 Technical Plan - Sampling Waste Handling (November 1987) and EPA's July 12, 1985, memorandum entitled "EPA Region VIII Procedure for Handling of Materials from Drilling, Trench Excavation, and Decontamination During CERCLA RI/FS Operations at the Rocky Mountain Arsenal." All soils generated by excavation during the course of anticipated response action, either at surface or subsurface, will be

returned to the location from which they originated (i.e., last out, first in).

8.1 Location-Specific ARARs

Location-specific requirements set restrictions on activities depending on the characteristics of the site or the immediate environment and function similar to action-specific requirements. Alternative remedial actions may be restricted or precluded depending on the location or characteristics of the site and the requirements that apply to it.

This activity will occur almost totally within former process buildings and has little, if any, potential to adversely affect the natural environment or wildlife in the area of the activity.

Paragraph 44.2 of the FFA provides that "wildlife habitat(s) shall be preserved and managed as necessary to protect endangered species of wildlife to the extent required by the Endangered Species Act (16 U.S.C. 1531 et seq.), migratory birds to the extent required by the Migratory Bird Treaty Act (16 U.S.C. 703 et seq.), and bald eagles to the extent required by the Bald Eagle Protection Act, 16 U.S.C. 688 et seq."

While this provision is not an ARAR, the statutes cited therein are ARARs applicable to this activity and will be complied with. Coordination will be maintained with the U.S. Fish and Wildlife Service to ensure that no such adverse impact arises from implementation of this activity.

The provisions of 40 CFR 6.302(a) and (b) regarding construction that would have an adverse impact on wetlands or be within a floodplain are considered relevant and appropriate to apply in the context of this activity. Based upon where this activity will take place, the Army believes that there will be no adverse impact on wetlands. However, individual work plans could include activities which may have impacts on wetlands. As work plans are developed, they will be reviewed to determine if a potential exists for adverse impacts on wetlands and, if such an adverse impact is considered probable, the regulatory provisions concerning activities affecting wetlands will be reviewed and activities conducted in accordance with appropriate guidance. Coordination will be maintained with the U.S. Fish and Wildlife Service to ensure that any such adverse impacts are avoided or mitigated.

The regulations at 40 CFR 230 were reviewed and determined not to be applicable within the context of this activity because no discharge of dredged or fill material into waters of the United States is contemplated. Because these regulations address only the disposal of such materials into waters of the United States, which is not contemplated, they are not considered to be relevant and appropriate to apply.

The regulations at 33 CFR 320-330 were reviewed and determined to be neither applicable nor relevant and appropriate because this activity does not involve any of the activities, or similar to the activities, intended to be controlled by these regulations as defined in 33 CFR § 320.1(b).

8.2 Action-Specific ARARs

8.2.1 Description

Performance, design, or other action-specific requirements set controls or restrictions on activities related to the management of hazardous substances, pollutants, or contaminants. These action-specific requirements may specify particular performance levels, actions, or technologies as well as specific levels (or a methodology for setting specific levels) for discharged or residual chemicals.

8.2.2 Worker Protection

The provisions of AMC Regulation 385-131 are specifically applicable to workers involved in this activity because these provisions specifically address decontamination activities for the specific compounds which are addressed by this activity. The guidance contained in U.S. Army Environmental Hygiene Agency Technical Guides Number 169 and Number 173 are also applicable to this activity. The regulations at 29 CFR 1910.120 are also applicable to this activity to the extent they are not inconsistent with the regulations cited above which specifically address activities related to decontamination activities for these specific compounds.

8.2.3 General Organizational Activities

The following performance, design, or other action-specific State ARARs have been preliminary identified by the Army as applicable to organizational activities conducted pursuant to this activity:

- Colorado Ambient Air Quality Standards, 5 CCR 1001-14, Air Quality Regulation A, Diesel-Powered Vehicle Emission Standards for Visible Pollutants.

- Colorado Noise Abatement Statute, C.R.S. Section 25-12-103.

In substantive fulfillment of Colorado's Diesel-Powered Vehicle Emission Standards, no diesel motor vehicles associated with the activity shall be operated in a manner that will produce emissions in excess of those specified in these standards.

The noise levels pertinent for construction activity provided in C.R.S. Section 25-12-103 will be attained in accordance with this applicable Colorado statute.

8.2.4 Wetlands Implications

Based upon the general area where this activity will be conducted, the Army does not believe that any wetlands could be adversely affected. However, until all related activities are fully designed and final siting decisions made, it cannot be definitively determined that no impact on wetlands will occur. If the final site selections and/or design results in an impact on wetlands, the Army will review the regulatory provisions concerning wetlands impact and other appropriate guidance and will proceed in a manner consistent with those provisions. Coordination will be maintained with the U.S. Fish and Wildlife Service concerning any potential impacts on wetlands.

IX. RISK ASSESSMENT FOR CHEMICAL PROCESS RELATED ACTIVITIES INTERIM RESPONSE ACTION

9.0 General

The Environmental Protection Agency (EPA) and the U.S. Army have agreed to conduct an Interim Response Action (IRA) for chemical process related activities at the Rocky Mountain Arsenal (RMA). This IRA is intended to help make the implementation of the Record of Decision (ROD) easier by eliminating any chemical contamination issues. This document addresses risks associated with the chemical process related activities IRA.

9.1 INTERIM RESPONSE ACTION SUMMARY

This IRA consists of surveying existing chemical process piping/equipment at RMA to determine the levels of chemical decontamination, monitoring for the presence of chemicals, and decontaminating as required in order to facilitate reuse or removal of the equipment.

Activities under this IRA are based on U.S. Army standing procedures and regulations. Requirements located in the numerous safety and technical

manuals developed by the U.S. Army Material Command and Armament, Munitions and Chemical Command (AMCCOM) are the only comprehensive regulations regarding this type of military specific activity.

The objectives of the IRA are to:

- Sample chemical process piping/equipment and ancillary materials to verify the decontamination status.
- Decontaminate if chemical vapors inside the piping/equipment are found to be above decontamination limits established by Federal regulations, and
- Dismantle piping/equipment in preparation for reuse or removal.

9.2 RISK ASSESSMENT SUMMARY

During 1989, the U.S. Army analyzed 182 sample points (piping/equipment systems) for the presence of the chemical agent GB. Extremely low levels of agent vapors were detected in forty-three (43) of these sample points. This confirms that piping and equipment had previously been decontaminated.

The worst-case scenario pertaining to this IRA would be the instantaneous release of a small quantity (6-10 oz) of decontaminating solution containing a very low concentration of agent vapor from the sample point that had the greatest analysis results during sampling operations: 1.64 x 10^{-4} mg/m^3. This is an estimated amount released before team members could respond and contain the release. The computer model, CRDC-TR-87021 (D2PC) REV. FEB 88, "Personal Computer Program for Chemical Hazard Prediction" was used to determine the distance to zero health effects based on this amount. The computer program estimates the downwind hazard from the release of chemical agent. Hazard assessment is made in terms of accumulated dosage or peak concentration resulting from instantaneous, continuous, or varying release.

Results are stated in terms of "Distance to No Effects" -A distance to where there would be no harmful effects to unprotected personnel in the immediate area if this amount of agent were to be released into the ambient environment.

The parameters used in the model were the

following:

AGENT - GB

WIND SPEED - 3 to 4 miles per hour outside building

TEMPERATURE - 70 degrees Fahrenheit

RELEASE - Instantaneous over 9 seconds

Release into ambient air of the building

AMOUNT OF RELEASE	"DISTANCE TO NO EFFECTS"
1.64×10^{-4} mg/m^3 (highest concentration detected during actual sampling operations at RMA)	less than 1 meter
1.64 mg/m^3 (10,000 times higher than highest* concentration detected during sampling operations)	2 meters
16.40 mg/m^3 (100,000 times higher than* highest concentration detected during sampling operations)	6 meters
28,300 mg (approx 1 oz neat agent)* (17,000 times higher than highest concentration detected	208 meters

during sampling operations)

* Note: this example used only for comparison.

* Note: There is NO neat agent at RMA.

Based on the actual sampling results, no health risks are expected in the performance of the chemical process related IRA for project workers, on-post employees, or the off-post population.

Engineering controls, as specified in the standing operation procedures, will be utilized to guard against the release of any agent vapor into the atmosphere.

In a typical operation involving sampling, decontamination or dismantling of equipment for chemical agent, the following health and safety guidelines would apply:

Training: One of the keys to the safe completion of this IRA will be training in the knowledge of the hazards associated with the agents; measures to control exposures; emergency procedures and first aid; and medical monitoring of sampling personnel.

Personal Protective Equipment (PPE): Personnel

involved in sampling, decontamination and dismantling operations will wear Protective Clothing and Equipment consisting of respirators, gloves, boots, hoods, protective coverall suits, aprons, and under garments.

Monitoring: Work areas will be monitored before, during, and after all sampling, decontamination, and dismantling operations using realtime continuous air monitors.

Vapor Control: Ambient air around sampling points will be exhausted through activated carbon filters to contain any release of vapors.

Job Safety Analysis (JSA): JSAs will be conducted for all sampling, decontamination, and dismantling operations to ensure that potential hazards are identified and controlled.

X. COMMENTS AND RESPONSES

10.0 General

The following are the responses to comments from the parties.

Shell Oil Company

c/o Holme Roberts & Owen
Suite 4100
1700 Lincoln
Denver, CO 80203

June 6, 1991

Mr. Kevin T. Blose
Office of the Program Manager
for Rocky Mountain Arsenal
ATTN: AMXRM-E
Rocky Mountain Arsenal, Bldg. 111
Commerce City, CO 80022-2180

Dear Kevin:

We have reviewed your proposed draft document for "Chemical Process Related Activities at RMA." We apologize for sending our comments later than your requested date; since the Townhall meeting at RMA was not scheduled in the anticipated May time frame, and actual field work timing is not estimated, our comments should be still useful to the Army.

Our key understandings are that:

(A) The activities described are a continuation of the overall decontamination work by TVA which was begun some time ago in the North Plants and the ton container yard for Army-specific compounds, and

(B) The Army, as Lead Agency, has chosen, as a matter of consistency and in the spirit of increased communications to the Organizations, to utilize mechanisms similar to those of the FFA to convey appropriate information on this Army-only action for review and comment.

Some portions of the document could, if taken out of context, result in conclusions not intended. Suggest minor rewording of sections 1.0 and 9.0 to clarify these points.

Specific comments are as follows:

1. The buildings list in section 6 of the document includes some which are listed as Shell Only in the Settlement Agreement. Recommend verifying these, and Army/Shell discussions as appropriate.

2. Recommend that pages 4-1 and 6-1 have specific references, instead of "...US Army, DDESB, and DOD regulations." A substantial portion of the material sent to the Organizations regarding the previous TVA work could also be specifically referenced.

3. The phrase "Other buildings not listed here..." is used a number of times. Suggest updating the list to include all buildings intended to be addressed with these regulations and related procedures. Buildings and equipment to be addressed with different regulations and procedures would be better handled with another document.

4. The references to Shell on pages 6-5 and 6-6 should be to Julius Hyman & Company.

Please contact me if there are any questions.

Sincerely,

George Roe
Technical Manager
Denver Site Project

GER:dls

cc: Maj. John Fomous
Gerald Barbieri
Robert Duprey
Connally Mears
Bill Clemmens
David Shelton
Jeff Edson
Victoria Peters

RESPONSES TO COMMENTS SUBMITTED BY SHELL OIL COMPANY ON THE DRAFT DECISION DOCUMENT FOR CHEMICAL PROCESS-RELATED ACTIVITIES AT ROCKY MOUNTAIN ARSENAL JUNE 1991

1. Page 1, last paragraph.

   The buildings listed in section 6 of the document includes some which are listed as Shell Only in the Settlement Agreement. Recommend verifying these, and Army/Shell discussions as appropriate.

Response: The verification of the type of former chemical process-related activities by building is part of this action. The buildings that were multi-use, specifically chemical agent and/or pesticides use required proper identification in order to proceed with the step-by-step clean up procedures related to the former use.

2. Page 2, second paragraph.

   Recommend that pages 4-1 and 6-1 have specific references, instead of "U.S. Army, DDESB, and DOD regulations." A substantial portion of the material sent to the organizations regarding the previous TVA work could also be specifically referenced.

Response: U.S. Army Regulation AMCR 385-131 is the specific regulation.

3. Page 2, third paragraph.

The phrase "Other buildings not listed here..." is used a number of times. Suggest updating the list to include all buildings intended to be addressed with these regulations and related procedures. Buildings and equipment to be addressed with different regulations and procedures would be better handled with another document.

Response: This action is to determine the buildings that were of multi-use (chemical agent/pesticide), in order to proceed with proper clean-up procedures. The Implementation Plan will address the regulations and procedures to be used in their clean up.

4. Page 2, third paragraph

The references to Shell on pages 6-5 and 6-6 should be to Julius Hyman & Company.

Response: The references on pages 6-5 and 6-6 will be corrected as necessary, regarding reference to Shell Company.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION VIII
999 18th STREET - SUITE 500
DENVER, COLORADO 80202-2405

MAY 21 1991

Ref: 8HWM-FF

Kevin Blose, Chairman
RMA Committee
ATTN: AMXMR-PM
Rocky Mountain Arsenal
Commerce City, Colorado 80022-2180

Re: Rocky Mountain Arsenal (RMA)
Proposed Chemical Agent Process-
Related Interim Response Action,
April 1991.

Dear Mr. Blose:

We have the enclosed comments on the Army's proposal for an Interim Response Action (IRA) to address chemical agent contamination, prior to the Onpost Record of Decision (ROD). Generally, EPA continues to assert that Part 22 of the Federal Facility Agreement (FFA) is the authority for the proposed action. Contrary to the Army's quotation on page 9-1 of the above referenced document, a general purpose of the FFA is to "establish a procedural framework to implement appropriate response actions at the site...". That procedural framework for pre-ROD actions is the IRA process in Part 22 of the FFA. Therefore, EPA is treating the above referenced document as an IRA proposal under Section 22.16 of the FFA, a Draft Alternatives Assessment under Section 22.6 of the FFA, and a Proposed IRA Decision Document under Section 22.8 of the FFA and is reviewing and commenting on the document accordingly.

Our comments on Decontamination of Agent Lines and Equipment at the North Plants (GB), April 1991, and One Ton Container Monitoring at RMA, April 1991, will follow. Our contacts on this matter are Mr. John Barth at (303) 294-7531 for legal issues or Ms. Linda Jacobson at (303) 294-7093 on technical issues.

Sincerely,

Connally E. Mears

Connally E. Mears
EPA Coordinator for RMA Cleanup

Enclosure

cc: Glenn Tucker, ATSDR
Gerald Barbieri, RMA
Major John Fomous
Brad Bridgewater, DOJ
David Shelton, CDH
Jeff Edson, CDH
Vicky Peters, CAGO
Janet Yanowitz, Geotrans
Bill McKinney, Shell
George Roe, Shell
Steve Killworth, Shell

COMMENTS ON THE ARMY AGENT CONTAMINATION INTERIM RESPONSE ACTION (PROPOSED CHEMICAL PROCESS-RELATED ACTIVITIES) APRIL 1991

General Comments:

1. This action is a CERCLA regulated action and meets the requirements of 22.16. These actions are being taken prior to the ROD, and accordingly Part 22 of the FFA on Interim Response Actions, is the authority for this action.

2. This process must ensure full public review, as per the FFA for all IRAs.

3. We have the following understandings: a) disposal options are not part of "this phase of the IRA." b) this phase does not deal with the outside of the equipment, which will have to be addressed in a later IRA phase before disposal can be considered. c) the buildings will not be disturbed in any equipment removal (the piping will be decontaminated and dismantled without disturbing the agent contamination (such as mustard) that may be present in the building walls).

4. Precautions need to be specified in the Implementation Document to avoid recontamination of the insides of the equipment; this is especially true for any equipment that is to be dismantled. EPA expects to be notified of a schedule for activities in an Implementation Document, as required by FFA 22.16.

5. The South Plants residuals from the decontamination process need to be managed separately, since they might have pesticide contamination, too.

6. EPA understands that there will be no dismantling of any equipment that had mixed Army/Shell use, due to potential pesticide contamination, too. This definition of mixed use should be applied by building, not by equipment piece.

7. The Army needs to establish ARARs for soil excavation and discuss the application of RCRA substantive standards to these activities.

8. EPA requests a tour of the buildings and storage yards subject to this remedial action prior to the public meeting.

Specific Comments:

1. Page 6-1, dismantling of piping/equipment, please state the planned "reuse or disposal of chemical process equipment/piping." Do you propose that these decontaminated, dismantled materials be retained within the Army or sold to outside parties (after

another phase of the IRA)? Where will the materials be stored in the interim? Due to the potential for windblown contamination to deposit within these materials if stored in the open, EPA recommends the materials be stored in such a way as to avoid such recontamination.

2. Page 6-2, please expand the text to explain the statement: "other buildings not listed here will be part of this project and will be identified as specific work plans are prepared."

3. Page 6-9, please expand the text to discuss the ancillary materials in storage that will be sampled and decontaminated as part of this program. Further, please provide a map identifying the locations of the storage yards in the North Plants and South Plants where these materials are located.

4. Page 10-1, please identify how the waste material generated from these activities will be characterized. If identified as hazardous, it must be managed in substantive compliance with RCRA requirements for the handling and storage of hazardous waste.

5. Pages 10-1 and 4-1. On page 4-1, the text states that these activities will be conducted in accordance with the U.S. Army, Department of Defense Explosive Safety Board, and Department of Defense regulations. As such, these regulations, or pertinent portions of these regulations, should be identified and included in the ARARs portion of this IRA proposal.

6. Page 10-2, please present for party and public review the downwind hazard calculation which has been conducted for the worse case scenario which served as the basis for the statements that "no realistic potential risk of exposure will remain for such nonworker populations" and that there is "little, if any, potential to adversely affect the natural environment or wildlife in the area of the activity."

7. Please provide us with a schedule of the planned dates for this activity and a list of documents and planned release dates and review periods for this IRA.

8. Page 10-1, the text needs to add reference to Section 22.14 of the FFA, which allows parties to invoke dispute resolution at any time during implementation of the IRA.

9. For non-agent contamination present in these areas, workers must be properly trained and protected, especially for work in the South Plants areas. Further, the text needs to be expanded to address the screening and management of nonagent contamination during soils excavation in these areas.

RESPONSES TO COMMENTS SUBMITTED BY THE UNITED STATES ENVIRONMENTAL PROTECTION AGENCY, REGION VII ON THE DRAFT DECISION DOCUMENT FOR CHEMICAL PROCESS-RELATED ACTIVITIES AT ROCKY MOUNTAIN ARSENAL MAY 1991

1. Page 3, first paragraph.

This action is a CERCLA regulated action and meets the requirements of 22.16. These actions are being taken prior to the ROD, and accordingly Part 22 of the FFA on Interim Response Actions, is the authority for this action.

Response: The Army agrees that this action should be an interim response action pursuant to Section XXII of the FFA.

2. Page 3, second paragraph

This process must ensure full public review, as per the FFA for all IRAs.

Response: The Army agrees that this IRA should have full public review in accordance with Section XXII of the FFA.

3. Page 3, third paragraph

We have the following understandings: a) disposal options are not part of "this phase of the IRA." b) this phase does not deal with the outside of the equipment, which will have to be addressed in a later IRA phase before disposal can be considered. c) the buildings will not be disturbed in any equipment removal (the piping will be decontaminated and

dismantled without disturbing the agent contamination (such as mustard) that may be present in the building walls).

Response: Reference (b) - This action deals with the decon of equipment/materials, both internally and externally. However, it is obvious that the majority of contamination is internal in systems that are in most cases sealed and/or shielded from the open atmosphere. Also, any equipment/materials that were contaminated externally were deconned in order to continue operations using the equipment. Based upon this rationale, the possibility of external contamination is probably less likely than residual internal contamination. In summary, this action is to be able to dismantle this equipment for subsequent removal/disposal. Your understanding as written comments a and c are correct.

4. Page 3, fourth paragraph

Precautions need to be specified in the Implementation Document to avoid recontamination of the insides of the equipment; this is especially true for any equipment that is to be dismantled. EPA expects to be notified of a schedule for activities in an Implementation Document, as required by FFA 22.13.

Response: The Implementation Document(s) shall address the problem of recontamination of the insides of the equipment that is removed. It should be noted that removal and dismantling of the process equipment procludes their use, which in essence prohibits the type of chemical contamination they experienced when intact. The schedule of activities will be in the Implementation

Document(s).

5. Page 3, fifth paragraph

The South Plants residuals from the decontamination process need to be managed separately, since they might have pesticide contamination, too.

Response: The South Plants residuals from a decontamination process will be managed separately, based upon the type of contamination present.

6. Page 3, sixth paragraph

EPA understands that there will be no dismantling of any equipment that had mixed Army/Shell use, due to potential pesticide contamination, too. This definition of mixed use should be applied by building, not by equipment piece.

Response: Dismantling of the equipment will be performed after all contamination is eliminated.

7. Page 3, seventh paragraph

The Army needs to establish ARARs for soil excavation and discuss the application of RCRA substantive standards to these activities.

Response: The Army has reviewed the IRA for any soil excavation standards which would be considered as ARARs. The text has been amended appropriately.

8. Page 3, eighth paragraph

EPA requests a tour of the buildings and storage yards subject

to this remedial action prior to the public meeting.

Response: The tour of the buildings was completed 21 May 91 for personnel from the EPA and State of Colorado.

9. Page 3, ninth paragraph

Page 6-1, dismantling of piping/equipment, please state the planned "reuse or disposal of chemical process equipment/piping." Do you propose that these decontaminated, dismantled materials be retained within the Army or sold to outside parties (after another phase of the IRA)? Where will the materials be stored in the interim? Due to the potential for windblown contamination to deposit within these materials if stored in the open, EPA recommends the materials be stored in such a way as to avoid such recontamination.

Response: Page 6-1 - Final disposal of the chemical process related equipment/piping will be determined at another phase of the IRA. Any materials stored in the open will be stored to avoid the potential of wind-blown contamination.

10. Page 4, second paragraph

Page 6-2, please expand the text to explain the statement: "other buildings not listed here will be part of this project and will be identified as specific work plant are prepared."

Response: Page 6-2 - The term "other buildings not listed here will be a part of this project and will be identified in specific work plans," etc. The method to determine the buildings to be included will be done by the document search on building use from

construction to the present time. This information will also determine the chemical(s) used.

11. Page 4, third paragraph

    Page 6-9, please expand the text to discuss the ancillary materials in storage that will be sampled and decontaminated as part of this program. Further, please provide a map identifying the locations of the storage yards in the North Plants and South Plants where these materials are located.

Response: Page 6-9 - The ancillary materials in storage will also be determined by a document search of their former use and types of chemicals/compounds involved. The map(s) will be revised to show the storage yards in the North and South Plants areas.

12. Page 4, fourth paragraph

    Page 10-1, please identify how the waste material generated from these activities will be characterized. If identified as hazardous, it must be managed in substantive compliance with RCRA requirements for the handling and storage of hazardous waste.

Response: Page 10-1 - The waste material(s) from these activities will be characterized to determine the hazard, if any, and managed as required by RCRA.

13. Page 4, fifth paragraph

    Pages 10-1 and 4-1. On page 4-1, the text states that these activities will be conducted in accordance with the U.S. Army, Department of Defense Explosive Safety Board, and

Department of Defense regulations. As such, these regulations, or pertinent portions of these regulations, should be identified and included in the ARARs portion of this IRA proposal.

Response: U.S. Army regulation AMCR-385-131 will be utilized and is included in this document as Attachment A.

14. Page 4, sixth paragraph

Page 10-2, please present for party and public review the downwind hazard calculation which has been conducted for the worse case scenario which served as the basis for the statements that "no realistic potential risk of exposure will remain for such nonworker populations" and that there is "little, if any, potential to adversely affect the natural environment or wildlife in the area of the activity."

Response: The Risk Assessment for this IRA is included in this document, see Section 9.

15. Page 4, seventh paragraph

Please provide us with a schedule of the planned dates for this activity and a list of documents and planned release dates and review periods for this IRA.

Response: The schedule of the planned dates for this activity and list of documents will be provided in the Draft Implementation Document.

16. Page 4, eighth paragraph

Page 10-1, the text needs to add reference to Section 22.14 of the FFA, which allows parties to invoke dispute resolution at

any time during implementation of the IRA.

Response: The text has been amended appropriately.

17. Page 4, ninth paragraph

For non-agent contamination present in these areas, workers must be properly trained and protected, especially for work in the South Plants areas. Further, the text needs to be expanded to address the screening and management of nonagent contamination during soils excavation in these areas.

Response: Workers will be trained and protected for the expected types of contamination. This information will be in the Implementation Document(s).

COLORADO
DEPARTMENT
OF HEALTH

May 22, 1991

ROY ROMER
Governor

JOEL KOHN
Interim Executive Director

4210 East 11th Avenue
Denver, Colorado 80220-3716
Phone (303) 320-8333

Telefax Numbers:
Main Building/Denver
(303) [illegible]

[illegible]
(303) [illegible]

[illegible]
(303) [illegible]

Grand Junction Office
(303) [illegible]

Office of the Program Manager
for the Rocky Mountain Arsenal
ATTN: AMXRM-E (Mr. Kevin Blose)
Building 111
Commerce City, Colorado 80022-0116

Re: State Comments on the Proposed Chemical Process-Related Activities at Rocky Mountain Arsenal.

Dear Mr. Blose

Attached are the State comments for the above referenced document.

Due to the paucity of information contained in the document, providing meaningful substantive comments has been somewhat difficult. Future work plans pertinent to these activities must be of sufficient detail to allow the parties to obtain a clearer understanding of the work to be conducted.

This document appears to contain no findings to support a conclusion that the proposed chemical agent decontamination activities should be conducted as a CERCLA removal action; therefore, all proposed activities must be conducted as a CERCLA remedial action, pursuant to section 121 and 40 CFR 300.430. In the alternative, all remedial activities must be conducted in full procedural as well as substantive compliance with all State and federal law.

The process being followed by these remedial activities is confusing. Please clarify the following:

1) Whether this document is to serve as an EPA decision document;

2) When will the public comment period expire?

3) When will a public meeting be held regarding these activities?

The parties must have the opportunity to submit additional comments based upon issues raised at the public meeting.

052291

RMA 91-0891 1/2

Mr. Kevin Blose
Rocky Mountain Arsenal
May 22, 1991

Page No. 2

If you have any questions regarding these comments, feel free to contact me or Russ Allen to discuss them.

Sincerely,

Russ Allen

for Jeff Edson
RMA Project Manager
Hazardous Materials and
Waste Management Division

Enclosure

cc: Vicky Peters, AAG
Bradley Bridgewater, Esq.
Bill Clemmens, Esq.
George Roe
Edward J. McGrath, Esq.
Connally Mears, EPA
John Ponous
Janet Yanowitz

052291

STATE COMMENTS ON THE PROPOSED CHEMICAL PROCESS-RELATED ACTIVITIES AT ROCKY MOUNTAIN ARSENAL, APRIL 1991

GENERAL COMMENTS

1. As explained by the State on numerous occasions, CERCLA response activities must either be removals pursuant to 40 C.F.R. 300.415 of the National Contingency Plan (NCP) or remedial actions pursuant to 40 C.F.R. 300.430. The factors to consider in deciding whether a removal is appropriate are listed in 40 C.F.R. 300.415. The "Proposed Chemical Process-Related Activities" document (the document) contains no findings supporting a conclusion that chemical agent decontamination should be conducted as a removal; therefore, the proposed activities must be conducted as a remedial action in compliance with § 121 of CERCLA and 40 C.F.R. 300.430. It is not clear that such is the case. For example, the NCP states that "[d]uring the development and analysis of alternatives, the risks associated with potential alternatives, both during implementation and following completion of remedial action, are assessed..." 55 Fed. Reg. 8666, 8712 (March 8, 1990). The document does not contain a risk assessment, nor does it discuss the nine criteria for evaluation as required by 40 C.F.R. 300.430(e)(9)(iii).

In the alternative, all remedial activities must be conducted in full procedural as well as substantive compliance with all other State and federal law.

2. These comments do not reflect our review of the TVA One Ton Container Monitoring Report and the Decontamination of Agent Lines and Equipment at North Plants Report which we received on May 21, 1991. Information gleaned from those documents may result in additional comments. These comments are also being submitted prior to the public meeting, which is scheduled for May 30, 1991, and therefore do not include issues which may be raised by the public. The State, therefore, reserves its right to submit additional comments on this document.

SPECIFIC COMMENTS

1. Page 1-1, sec. 1.1.1, Sampling Operations. It is stated that "there were no lost-time accidents." Please explain whether there were any accidents at all, and if so, describe them.

2. Page 1-2, sec. 1.1.2, Decontamination Operations. In describing decontamination operations which occurred during 1990, it is again stated "there were no lost-time accidents." This description neglects to mention the exposure of four workers to

caustic solution during decontamination procedures at the North Plants, July 2, 1990. This exposure resulted in the transportation of workers to a local hospital for examination and treatment.

3. Page 3-1, sec. 3.0, General. The location of the piping/equipment should be included in this section.

4. Page 6-1, sec. 6.0, General. A schedule should be included for the work to be conducted under this program.

5. Page 6-2, sec. 6.1, Sampling, Decontamination, and Dismantling of Chemical Process Piping and Equipment in the North and South Plants. The document refers to specific work plans which will be prepared and which will include any additional identified buildings. The document must clarify that these workplans will be submitted to the parties for review and comment. Such review and comment is essential given the paucity of information contained in this document.

6. Page 6-9, sec. 6.3.1, Ton Container Sampling and Decontamination -- General. The text states that during the summer of 1990, containers were sampled for certain chemical agents at levels established by federal regulations, and Lewisite at higher screening levels. It is not clear from the text why Lewisite was sampled at higher screening levels. Are there levels for Lewisite established by federal regulations?

7. Page 6-9, sec. 6.3.2, Ton Containers Proposed Work. The decontamination limits for each agent should be included and the applicable federal regulations cited. It is not clear whether these are the same limits that are listed in the chemical-specific ARARs section. If not, they should be added to that section.

8. Page 6-9, sec. 6.3.3, Ancillary Materials in Storage-Proposed Work. The applicable federal regulations should be cited here and in section 10.0.

9. Page 7-1, sec. 7.0, General. The Health and Safety Plan must also address emergency evacuation procedure for workers and other RMA personnel. An air monitoring program to ensure worker, RMA personnel, and public safety should also be addressed in the Health and Safety Plan. The plan should be transmitted to the parties for review and comment prior to implementation. The plan must consider potential exposures to pesticides as well as chemical agents since, according to this document, some of these buildings have been used for pesticide manufacturing.

10. Page 8-2, sec. 8.1, Key Medical Personnel. To ensure worker safety, the field crew workers should, at all times, be accompanied by a certified industrial hygienist. Also, Fitzsimons Army Medical Center (FAMC) should be contacted daily to alert them regarding RMA chemical agent decontamination operations.

11. Page 8-1, sec. 8.2, Emergency Response Equipment. An emergency response notification plan to ensure the safety of workers, RMA personnel, and the public, must also be in place. This plan would comprise a part of the emergency response capabilities of this program.

12. Page 9-1, secs. 9.0 and 9.1, Introduction and Intended Process. See General Comment 1.

13. Page 9-2, sec. 9.1, Intended Process. Draft workplans are normally subjected to a 30-day comment. No justification for the shortened comment period is given. Therefore, the text should be modified to provide for a 30-day comment period.

14. Page 10-1, sec. 10.0, Ambient or Chemical-Specific ARARs. It is stated that "any liquid or other waste material generated pursuant to this activity will be appropriately managed on-site." Section 262.11 of the state regulations promulgated pursuant to the Colorado Hazardous Waste Management Act, requires a generator of solid waste to make a hazardous waste determination; therefore, any waste generated as a result of this activity must be characterized pursuant to Section 262.11 of the state regulations, and subsequently managed in accordance with those same regulations. If the decontamination liquid has a pH greater than 12.5, it will be considered hazardous waste pursuant to 6 CCR 261.22.

15. Page 10-2, sec. 10.0, Ambient or Chemical-Specific ARARs. On page 6-5, the Army refers to white phosphorus operations which occurred in buildings to be decontaminated as part of this action. No decontamination level is given for this chemical in the ARAR section. If the Army has a decontamination level for this chemical it should be included in this section.

16. Page 10-2, sec. 10.0, Ambient or Chemical-Specific ARARs. The text states that "(b)y reducing the levels of these (chemical agent) compounds to those indicated below, ample protection will be provided to non-worker populations outside these buildings because such populations only exist at such a distance that no realistic potential risk of exposure will remain for such non-worker populations." What is the quantitative basis for this

RESPONSES TO COMMENTS SUBMITTED BY THE COLORADO DEPARTMENT OF HEALTH ON THE DRAFT DECISION DOCUMENT FOR CHEMICAL PROCESS-RELATED ACTIVITIES AT ROCKY MOUNTAIN ARSENAL MAY 1991

1. Cover letter

Response: As noted in earlier correspondence, the Army is treating this action as an interim response action. The document reviewed by the State which generated these comments was, in essence, the IRA Proposed Decision Document. The implementation plans, which were originally called work plans, will provide the necessary detail regarding the IRA. The revised schedule is included in the Draft Final Decision Document. The public meeting was held on July 16, 1991. The public comment period ended August 15, 1991.

2. Page 4, first paragraph

As explained by the State on numerous occasions, CERCLA response activities must be either be removals pursuant to 40 C.F.R. 300.415 of the National Contingency Plant (NCP) or remedial actions pursuant to 40 C.F.R. 300.430. The factors to consider in deciding whether a removal is appropriate are listed in 40 C.F.R. 300.415. The "Proposed Chemical Process-Related Activities" document (the document) contains no finding supporting a conclusion that chemical agent decontamination should be conducted as a removal; therefore,

the proposed activities must be conducted as a remedial action in compliance with § 121 of CERCLA and 40 C.F.R. 300.430. It is not clear that such is the case. For example, the NCP states that "{d}uring the development and analysis of alternatives, the risks associated with potential alternatives, both during implementation and following completion of remedial action, are assessed..." 55 Fed. Reg. 8666, 8712 (March 8, 1990). The document does not contain a risk assessment, nor does it discuss the nine criteria for evaluation as required by 40 C.F.R. 300.430 (e) (9)(iii).

In the alternative, all remedial activities must be conducted in full procedural as well as substantive compliance with all other State and federal law.

Response: See response to the cover letter. The risk assessment is included in the Final Draft Decision Document.

3. Page 4, third paragraph

These comments do not reflect our review of the TVA One Ton Container Monitoring Report and the Decontamination of Agent Lines and Equipment at North Plants Report which we received on May 21, 1991. Information gleaned from those documents may result in additional comments. These comments are also being submitted prior to the public meeting, which is scheduled for May 30, 1991, and therefore do not include issues which may be raised by the public. The State, therefore, reserves its

right to submit additional comments on this document.

Response: Comment noted.

5. Page 4, fourth paragraph

Page 1-1, sec. 1.1.1, Sampling Operations. It is stated that "there were no lost-time accidents." Please explain whether there were any accidents at all, and if so, describe them.

Response: Page 1-1, Section 1.1.1 Sampling Operations - The only accident was the 2 Jul 90 caustic incident with the four workers. This incident did not result in a lost-time accident.

6. Page 4, fifth paragraph

Page 1-2, sec. 1.1.2, Decontamination Operations. In describing decontamination operations which occurred during 1990, it is again stated "there were no lost-time accidents." This description neglects to mention the exposure of four workers to caustic solution during decontamination procedures at the North Plants, July 2, 1990. This exposure resulted in the transportation of workers to a local hospital for examination and treatment.

Response: Page 1-2, Section 1.1.2 Decon Operations - As stated in the above comment, the 2 Jul incident did not result in a lost-time accident.

7. Page 5, second paragraph

Page 3-1, sec. 3.0, General. The location of the piping/equipment should be included in this section.

Response: The location of the piping/equipment is to be included in the Specific Work Plans.

8. Page 5, third paragraph

Page 6-1, sec. 6.0, General. A schedule should be included for the work to be conducted under this program.

Response: Page 6-1, Section 6.0 General - A schedule will be provided for the work in the Implementation Documents.

9. Page 5, fourth paragraph

Page 6-2, sec. 6.1, Sampling, Decontamination, and Dismantling of Chemical Process Piping and Equipment in the North and South Plants. The document refers to specific work plans which will be prepared and which will include any additional identified buildings. The document must clarify that these workplans will be submitted to the parties for review and comment. Such review and comment is essential given the paucity of information contained in this document.

Response: Page 6-2, Section 6.1 - The Implementation Documents will be submitted to the parties for review and comment.

10. Page 5, fifth paragraph

Page 6-9, sec. 6.3.1, Ton Container Sampling and Decontamination -- General. The text states that during the summer of 1990, containers were sampled for certain chemical agents at levels established by federal regulations, and Lewisite at higher screening levels. It is not clear from the text why Lewisite was sampled at higher screening levels. Are there levels for Lewisite established by federal regulations?

Response: Page 6-9, Section 6.3.1 TC, etc. - Lewisite was sampled at the higher levels which was directed by the sensitivity of the detection kit (M-18). The ARAR level for Lewisite is .003 mg/m^3, as shown on page 10-2 of the document (ref 53FR 8504). The 1990 Ton Container Lewisite sampling was a preliminary screen, which will be followed by sampling at the ARAR level of .003 mg/m^3. The Army is currently developing monitoring equipment to meet ARAR requirements.

11. Page 5, sixth paragraph

    Page 6-9, sec. 6.3.2, Ton Containers Proposed Work. The decontamination limits for each agent should be included and the applicable federal regulations cited. It is not clear whether these are the same limits that are listed in the chemical-specific ARARs section. If not, they should be added to that section.

Response: Page 6-9, Section 6.3.2 - The decontamination limits for the Ton Containers are on page 10-2 of the document. They are the ARARs and are referenced 53 FR 8504.

12. Page 5, seventh paragraph

    Page 6-9, sec. 6.3.3, Ancillary Materials in Storage-Proposed Work. The applicable federal regulations should be cited here and in section 10.0.

Response: The ancillary materials are to be sampled for the same agent(s) as indicated in the ARARs, page 10-2, and same Federal regulations.

13. Page 5, eighth paragraph

Page 7-1, sec. 7.0, General. The Health and Safety Plan must also address emergency evacuation procedure for workers and other RMA personnel. An air monitoring program to ensure worker, RMA personnel, and public safety should also be addressed in the Health and Safety Plan. The plan should be transmitted to the parties for review and comment prior to implementation. The plan must consider potential exposures to pesticides as well as chemical agents since, according to this document, some f these buildings have been used for pesticide manufacturing.

Response: Page 7-1, Section 7.0 General - The Health and Safety Plan will encompass all your concerns as stated in this comment. As referenced in Section 7.0, second paragraph, the "Health and Safety Plan will be developed and included in the Specific Work Plans this program."

14. Page 6, first paragraph

Page 8-2, sec. 8.1, Key Medical Personnel. To ensure worker safety, the field crew workers should, at all times, be accompanied by a certified industrial hygienist. Also, Fitzsimmons Army Medical Center (FAMC) should be contacted daily to alert them regarding RMA chemical agent decontamination operations.

Response: Page 8-2, Section 8.1 - Yes, the work crews are accompanied by a certified industrial hygienist (TVA).

15. Page 6, second paragraph

Page 8-1, sec. 8.2, Emergency Response Equipment. An emergency response notification plan to ensure the safety of workers, RMA personnel, and the public, must also be in place. This plan would comprise a part of the emergency response capabilities of this program.

Response: Page 8-1, Section 8.2 - The emergency response plan will be in the Implementation Plans and Health and Safety Document.

16. Page 6, third paragraph

Page 9-1, secs. 9.0 and 9.1, Introduction and Intended Process. See General Comment 1.

Response: See response to General Comment No. 1.

17. Page 6, fourth paragraph

Page 9-2, sec. 9.1, Intended Process. Draft workplans are normally subjected to a 30-day comment. No justification for the shortened comment period is given. Therefore, the text should be modified to provide for a 30-day comment period.

Response: The schedule has been adjusted to reflect the regular IRA time schedule, providing a 30-day comment period for the implementation plans.

18. Page 6, fifth paragraph

Page 10-1, sec. 10.0, Ambient or Chemical-Specific ARARs. It is stated that "any liquid or other waste material generated pursuant to this activity will be appropriately managed on-site." Section 262.11 of the state regulations

promulgated pursuant to the Colorado Hazardous Waste Management Act, requires a generator of solid waste to make a hazardous waste determination; therefore, any waste generated as a result of this activity must be characterized pursuant to Section 262.11 of the state regulations, and subsequently managed in accordance with those same regulations. If the decontamination liquid has a pH greater than 12.5, it will be considered hazardous waste pursuant to 6 CCR 261.22.

Response: Solution will be revised for further decontamination activities.

19. Page 6, sixth paragraph

Page 10-2, sec. 10.0, Ambient or Chemical-Specific ARARs. On page 6-5, the Army refers to white phosphorus operations which occurred in buildings to be decontaminated as part of this action. No decontamination level is given for this chemical in the ARAR section. If the Army has a decontamination level for this chemical it should be included in this section.

Response: Page 10-2, Section 10.0 - White Phosphorous is not a chemical agent but is a highly reactive nonmetallic element used in munitions for smoke generation and/or as an incendiary. The smoke is not toxic, phosphorous pentoxide (P2O5). There is no decontamination level for this element, other than total removal by washing with steam/hot water. The wash-water solution which may contain White Phosphorous is processed to remove the White

Phosphorous for reuse.

20. Page 6, seventh paragraph

Page 10-2, sec. 10.0, Ambient or Chemical-Specific ARARs. The text states that "(b)y reducing the levels of these (chemical agent) compounds to those indicated below, ample protection will be provided to non-worker populations outside these buildings because such populations only exist at such a distance that no realistic potential risk of exposure will remain for such non-worker population." What is the quantitative basis for this?

Response: The Risk Assessment for this IRA is included in section 9.

Attachment A

AMCR-385-131

ATK SE

*AMC-R 385-131

DEPARTMENT OF THE ARMY
HEADQUARTERS, UNITED STATES ARMY MATERIEL COMMAND
5001 EISENHOWER AVENUE, ALEXANDRIA, VA 22333-0001

AMC REGULATION
No. 385-131

9 October 1987

Safety

SAFETY REGULATION FOR CHEMICAL AGENTS H, HD, HT, GB, and VX

Supplementation of this regulation is prohibited without prior approval from the Director, AMC Field Safety Activity, ATTN: AMXOS-C, Charlestown, IN 47111-9669.

* This regulation supersedes DARCOM-R 385-31, 20 April 1979, and DARCOM-R 385-102, 6 May 1982.

THIS PAGE INTENTIONALLY LEFT BLANK

CHAPTER 1

General

1-1. Purpose. This regulation, together with AMC-R 385-100, establishes the minimum safety criteria for use in processing, handling, storage, transportation, disposal, and decontamination of chemical blister agents H, HD, and HT, commonly known as mustard, and GB and VX nerve agents.

1-2. Scope. This regulation applies to Headquarters, United States Army Materiel Command (HQ USAMC); AMC major subordinate commands (MSCs) (including subordinate installations and activities); and separate installations and activities reporting directly to HQ AMC. Installations under the control of AMC will follow the guidance contained in AMC regulations in those instances that vary from the guidance contained in Technical Manuals or Field Manuals. Operations which involve chemical agents diluted to or below the drinking water standards in TB MED 577 are not subject to the provisions of this regulation (i.e. 0.02 mg/l for nerve agents and 0.2 mg/l for mustard). Local restrictions should be used as necessary.

1-3. Explanation of terms. For the purpose of this regulation, the following terms will apply:

a. Mandatory requirements are those in which the terms will and must are used. Deviations from those requirements will be corrected in accordance with paragraph 1-6 of this regulation (also see para g below).

b. Advisory provisions are those in which the term should is used and from which deviation may be made with written authorization from the local commander or his designated representative. Records of such approvals, along with the hazard analysis, will be maintained and reviewed annually by the local safety office.

c. Agent activity or operation is any operation which involves chemical agents, including storage, shipping, handling, manufacturing, maintenance, test chamber activities, laboratory activities, surveillance, demilitarization, decontamination, and disposal.

d. Agent facility is any location at which chemical agent operations are carried out including storage facilities, renovation, maintenance, and demilitarization facilities, manufacturing plants, disposal sites, and laboratories. Depending on the activity, the facility may be a building, enclosure, or possibly an open area.

e. Enclosed area is any operating building, shed, magazine, railroad car, truck, or trailer that sufficiently restricts natural ventilation to allow possible accumulation of agent vapors.

f. Controlled release is a release of chemical agent which may not be intended but is anticipated. It is followed by immediate action which will

suppress the vapor or liquid release by approved decontamination procedures and/or use of other suppression techniques which have also been approved beforehand. Such a release does not constitute an accident or incident.

g. Dilute solutions are those solutions presenting significantly reduced hazards. A solution of H, HD, or HT is considered dilute if its concentration is not greater than 10 mg/ml (neat agent/solvent) and it contains no more than 100 mg of neat agent. For GB a maximum concentration of 2 mg/ml of agent in a solution containing a maximum quantity of 20 mg of neat agent is considered dilute. For agent VX a maximum concentration of 1 mg/ml of agent in a solution containing a maximum quantity of 10 mg of neat agent is considered dilute. For purposes of this regulation, requirements using the terms must and will are considered advisory, rather than mandatory, for dilute solutions. Paragraph 1-3b applies. An information copy of the local deviation will be forwarded to the AMC Field Safety Activity, ATTN: AMXOS-C, Charlestown, IN 47111-9669.

h. Laboratory is a location or facility where engineering controls include a glove box or laboratory type ventilation hood and the quantities of H, HD, HT, GB, or VX in use at one time are small, normally not exceeding one liter. Laboratory operations may include research & development (R&D), production/acceptance testing, sample analysis and evaluation, limited detoxification, animal testing, or other small-scale agent operations.

i. Immediately dangerous to life or health (IDLH) level for hazardous chemicals is defined by the Standards Completion Program (SCP) of National Institute for Occupational Safety and Health (NIOSH) for selection of respiratory protective devices. This concentration represents the maximum level from which one could escape within 30 minutes without any escape-impairing symptoms or any irreversible health aspects. See paragraph 2-5a.

j. Field operations are operations conducted outdoors or outside of man-made enclosures or structures which contain built-in alarms or engineered chemical agent controls. Short-term operations in storage structures are also considered field operations.

k. Nonrelated personnel are all personnel who are not specifically involved with chemical agent operations, medically monitored, trained (first aid, use of detectors, etc.) or fitted with a protective mask.

l. Clean areas are those areas whose environments are free of liquid agent contamination and which have been monitored to verify that concentrations above the best available detection limit of agents H, HD, and HT, 0.0001 mg/m^3 for GB and 0.00001 mg/m^3 for VX do not exist.

m. Annual basis or annually should be from the month of the current year to the same month of the following year. However, the time period will not exceed thirteen months. This does not apply to items covered under DA Pam 738-750.

1-4. Policy. The Commander, AMC, requires the use of methods, procedures, and equipment which accomplish operations in a safe manner and protect personnel involved in agent operations, the general public, and the environment.

1-5. Responsibilities.

a. The commander of each MSC, installation, or activity is responsible for effective management of the chemical safety program within the command and for assurance that all safety requirements outlined herein are implemented and strictly enforced. In order to maintain an effective chemical agent safety program, it is important that the commander take the same aggressive leadership in chemical agent safety that is taken in other phases of command responsibility.

b. In discharging the command safety responsibility and in accordance with AR 385-10, Army Safety Program, each commander will appoint a safety director who is occupationally qualified in accordance with Office of Personnel Management standards to manage the chemical safety program. The safety director will also be responsible for providing technical support, advice, and other safety services to the commander and staff and for conducting safety related inspections, surveys, and studies of chemical operations on a periodic basis.

c. The safety director will maintain a safety program for chemical agents in accordance with AR 385-10, to include inspections, inspection reports, Violation Inventory Logs, and notices of violations.

1-6. Deviation correction policy.

a. In those cases involving non-compliance with mandatory requirements of this regulation, which are also mandatory requirements of AMC-R 385-100, AR 50-6, or DOD 6055.9, no deviation is permitted without specific written authority from the Commander, AMC, ATTN: AMCSF. Requests for waiver or exemption will be submitted in accordance with paragraph 1-6, AMC-R 385-100.

b. In those cases where compliance with other mandatory requirements of this regulation cannot be effected or is delayed due to lack of funding, equipment, facilities, etc., an abatement plan will be submitted per paragraphs 5-3 and 5-4, AR 385-10, and AMC Suppl 1, thereto, or for those situations which do not lend themselves to correction via abatement procedures, a waiver request along with appropriate compensating measures will be submitted to AMC Field Safety Activity, ATTN: AMXOS-C, Charlestown, IN 47111-9669.

c. Deviation from safety requirements in TMs, FMs, or DA Pams is not considered as violation of mandatory safety requirements unless specifically mandated by regulation; however, safety provisions stated therein will be considered advisory except for conflicts with this regulation in which case this regulation takes precedence.

THIS PAGE INTENTIONALLY LEFT BLANK

CHAPTER 2

Agent Information

2-1. Classification. H, HD, and HT are persistent blister agents. GB and VX are rapidly acting nerve agents. They are classified as Class A poisons by Department of Transportation (DOT) and as Chemical Group A agents by AMC. They belong to Storage Compatibility Group K.

2-2. Type of hazard.

a. Hazards from mustard agents are through vapor contact with the eyes or respiratory tract and liquid contact with skin. The most common acute hazard is that of liquid contact with the skin. Mustard vapor may be absorbed readily through the respiratory tract and eyes and ingested through the gastrointestinal tract. The severity of the effects is dependent on the degree of liquid contamination and on the vapor concentration and associated exposure time. Mustard agents may persist on surfaces as liquid contamination for long periods because of their low volatilities. Agents on contaminated surfaces can be transferred to personnel by contact.

b. The hazard from GB is primarily that of vapor inhalation through the respiratory tract although it may be absorbed through the eyes or skin. As a liquid, it is hazardous by skin or eye contact and by ingestion. It is highly toxic and quick acting. When dispersed as large droplets, GB is moderately persistent; it is nonpersistent when disseminated as a cloud of very fine particles or as a vapor.

c. The hazard from VX is primarily that of liquid absorption through the skin although it may be readily absorbed as a vapor or aerosol through the respiratory tract and eyes and ingested through the gastrointestinal tract. VX is slow to evaporate and may persist as a liquid for several days.

2-3. Mechanism of action and physiological effects.

a. Cause of casualties. Inadvertent skin contact with these agents or inhalation of agent vapors are the most common causes of casualties. The agent absorption rate is accelerated through unprotected cuts and abrasions.

b. General.

(1) Mustard is an insidious vesicant agent and has been identified as carcinogenic, mutagenic, and teratogenic. The agent's garlic-like odor quickly becomes unnoticeable after the first detection because the agent causes the olfactory nerves to become insensitive. Another indication of the insidiousness is the possible absence of pain for a period of hours after vapor contact with the skin and for many minutes even after eye contact with the liquid. With regard to skin exposure, the presence of moisture or perspiration on the skin tends to increase the effect of exposure to agent.

(2) GB is an anticholinesterase compound. Its effects are referable to stimulation of the autonomic and central nervous systems resulting from the inhibition of the acetylcholinesterase enzymes in the tissues and the resultant accumulation of acetylcholine at its various sites of action.

(3) VX is an anticholinesterase compound similar to GB (q.v.) in mechanism of action and effects. Since VX has a low volatility, liquid droplets on the skin do not evaporate quickly thereby facilitating effective percutaneous absorption. By this route, VX is approximately ten times as toxic as GB for man. By the inhalation route, VX is estimated to be twice as toxic as GB.

c. Signs and symptoms.

(1) Mustard. The eye is the most vulnerable to mustard either by liquid or vapor contact. Conjunctivitis (red eye) can occur following an exposure to a vapor concentration barely detectable by odor. Long exposures to low concentrations or exposure to high concentrations can result in permanent eye damage. The initial effect after skin contact with either vapor or liquid is a reddening of the skin similar to sunburn; depending on the severity of exposure, the reddening may progress to blistering and tissue destruction. The initial exposure is not accompanied by a sensation but, as symptoms develop, there may be an itching or burning sensation which develops to reddening and then to blistering. Inhalation of mustard vapor or aerosol causes damage to the mucous membranes of the upper respiratory tract. Damage develops slowly and may not reach the maximum severity for several days following exposure. The symptoms are hoarseness, sore throat, and coughing. In case of severe exposure, there is a predisposition to secondary infection such as bronchial pneumonia. Recovery from the effects of exposure to mustard is very slow. Very small repeated dosages are cumulative in their effect and even more serious because of their tendency toward sensitization. Exposure to vapors from spilled mustard may, in the first instance, cause only minor symptoms such as red eye. Repeated exposures may produce severe respiratory symptoms. Mustard agent is a known mutagen, teratogen, and human carcinogen and may cause these adverse health effects in individuals exposed even in very small repeated dosages.

(2) GB and VX. The first indication of exposure to liquid GB or VX agent may be a reaction at the point of contact, i.e., localized sweating, muscular twitching, and pinpoint eye pupils (miosis). For mild exposures, symptoms may not progress beyond the local reaction; however, if absorption is sufficient to produce systemic poisoning, the following signs and symptoms can be expected, the number and severity of which will depend upon the degree of exposure:

(a) Early signs and symptoms, if exposure is from aerosol or vapor; pinpointing of eye pupils and dimness of vision (may be absent entirely in cases of skin absorption); running nose; tightness of chest.

(b) Early signs and symptoms, if exposure is by skin contact, may be sweating and muscular twitching.

(c) Later signs and symptoms (indicating severe exposure); nausea, possible vomiting; diarrhea; weakness; coma; cessation of breathing.

Death can result from both respiratory and skin exposure. These agents in vapor form are rapidly absorbed through the respiratory system and death can result within one to ten minutes. Symptoms appear much more slowly when the dose is acquired by absorption through the skin. The intact skin acts as barrier to these agents in the vapor state; however, the vapor may quickly pass through the eyes and miosis may result from very low concentrations of vapor alone. The effects of repeated exposures can be cumulative and workers may experience severe cholinesterase (ChE) depressions from repeated exposure to low concentrations of agent. The rate of regeneration of ChE within the body is slow.

2-4. Chemical and physical properties. (Additional agent information may be found in FM 3-9.)

	H, HD, HT	CS	VX
Boiling Point	217°C (423°F)	158°C (316°F)	300°C (572°F)
Freezing Point	14.5°C (58°F) HD 0°C (32°F) HT	-56°C (-69°F)	-39°C (-38°F)
Flammability	Class III B Combustible Liquid	Non Flammable	Class III B Combustible Liquid
Color	Clear through amber to dark brown	Clear through strawcolored, to amber	Clear to strawcolored, oily liquid
Odor	Garlic	None	None
Vapor Pressure	0.072 mm Hg at 20°C (68°F)	2.9 mm Hg at 25°C (77°F)	0.0007 mm Hg at 25°C (77°F)

2-5. Permissible exposure limits (PEL).

a. Personnel working without protection from the inhalation of agent vapors in areas where agent may be present will not be exposed to concentrations exceeding the following criteria. When known or suspected agent concentrations exceed these values, appropriate toxicological agent protective clothing will be worn as outlined in chapter 4.

(1) H, HD, HT— Lowest measurable limit but not more than 0.003 mg/m^3.

(2) GB— 0.0001 mg/m^3 averaged over any eight-hour workshift.

(3) VX— 0.00001 mg/m^3 averaged over any eight-hour workshift.

(4) In no case will an exposure without protection from inhalation of agent vapors be allowed which exceeds 0.003 mg/m^3 mustard, 0.2 mg/m^3 GB, or 0.4 mg/m^3 VX for any period even if the time weighted average (TWA) above is not exceeded.

(5) For the purpose of determining when air-supplied respiratory protection is required, 0.5 mg/m^3 mustard, 0.2 mg/m^3 GB, or 0.4 mg/m^3 VX will be used as if it were the Immediately Dangerous to Life or Health (IDLH) level (For emergency operations, the M9A1 protective mask with level A protective ensemble is authorized at these levels).

b. Nonrelated personnel, to include the general population, will not be exposed to a concentration of mustard greater than the detection limit for any time period or of agents GB or VX greater than 0.000003 mg/m^3 averaged over 72 hours. Ceiling values of 0.0001 mg/m^3 for GB and 0.00001 mg/m^3 for VX will also apply. In cases where, by the nature of the operation, a release of agent is expected (such as in the case of emergency destruction, training, or certain preventive maintenance operations), calculations will be made using approved methodology to assure that nonrelated personnel and general population are protected within the above limits. Paragraph 2-5c below does not apply in these situations.

c. In no case will the concentration at the point of release exceed the detection limit for mustard, 0.0003 mg/m^3 for GB, and 0.00003 mg/m^3 for VX averaged over any one-hour period.

CHAPTER 3

Agent Monitoring Requirements

3-1. Detection methods and equipment.

a. Detector paper.

(1) The VGH-ABC M8 chemical detector paper is a component of both the M256 and M18A2 detector kits and will detect liquid agent. It is also available as a separate item, NSN 6665-00-050-8529. It is an off-white paper that has been treated with a combination of dyes that produces a distinctive color change in the presence of agent. When exposed to liquid agent, the paper turns to a deep-red color for mustard, yellow for GB, and dark green for VX. The paper will not detect vapor or extremely small droplets of agent. The detector ticket may be used to confirm positive M8 paper tests for nerve agents as described later.

(2) M9 chemical agent detector paper (NSN 6665-01-049-8982) is a separate stock fund item of issue. It detects small droplets (greater than 50 microns) of liquid agent. The paper is gray/green in color and turns red in contact with agent droplets or liquid. It does not distinguish between mustard or nerve agents.

NOTE. M8/M9 papers are subject to interference and should not be used as a sole verification of the presence of an agent.

b. Blue band tube or white band tube. The blue band tube (NSN 6665-00-856-8236) is a separate stock item that will detect mustard agent vapor at concentrations as low as 0.5 mg/m^3 and GB as low as 0.2 mg/m^3. The sensitivity decreases with lowering temperature. Upon addition of reagent, the tube will turn to a purple-blue color in the presence of mustard vapor and yellow-orange or blue-green in the presence of GB vapors (depending upon the reagent used). Use of the blue band tube is preferred over the M256 detector kit sampler for mustard detection. White band tube (NSN 6665-00-702-7136) may also be used for detection of GB. (The expiration date on the white and blue band tubes can be disregarded when used with indole and GB detection).

c. M256 kit sampler. The plastic detector component (NSN 6665-01-016-8399) has all the reagents self-contained in finger crushable glass ampoules. In the presence of mustard agent, a distinctive purple-blue color change is obtained after proceeding according to instructions on use of the sampler, which are printed on the outside of the heat sealed protective envelope. In the absence of GB/VX, a distinctive blue color change is obtained. The sampler will detect agent vapors at concentrations of 1.0 to 3.0 mg/m^3 for Mustard, 0.02 to 0.5 mg/m^3 for GB, and 0.05 to 0.15 mg/m^3 for VX. The response time of the sampler increases as the temperature decreases. Gloves and protective mask are required when breaking the heater ampoules used for mustard detection.

d. Absorption air sampling. An absorption air sampling system (commonly referred to as a bubbler provides a reliable method for detecting low-level concentrations of agent vapors, however, this system has no capability for providing an alarm response when agent is present. The bubbler unit is usually a vessel packed with glass beads and filled with a scrubbing solution. The air sample is bubbled through the scrubbing solution which absorbs the chemical agent from the air sample. After sampling for a predetermined time and flow rate, the unit is removed and sent to a chemical laboratory for processing to determine the presence, type, and quantity of agent in the sample. Utilizing the proper analytical techniques, the system can detect average agent vapor concentrations of 0.003 mg/m^3 for mustard, 0.0001 mg/m^3 for GB, and 0.00001 mg/m^3 for VX. Lower average concentrations can be detected by increasing the sampling time and/or the rate of the sampled air. When bubblers are used in lieu of real-time monitoring and to provide necessary feedback concerning conditions of the area monitored, samples should be analyzed as soon as possible after the sample is drawn. Where bubbler samples are not used as a substitute for real-time monitoring and immediate analysis is not required, samples may be stored (or shipped if necessary; see paragraph 10-7 for transportation controls) provided that strict controls are present over temperatures and length of storage. Since samples are subject to agent degradation (i.e. hydrolysis) when subject to high temperatures or long periods of storage, bubbler samples should be aspirated and stored at controlled temperature conditions, 21°C (70°F) or less, right up to the time they are analyzed (within 36-48 hours). If the length of time between sampling and analysis will exceed 48 hours, temperatures should be maintained at or below 2°C (36°F) to minimize degradation. Water-based samples should not be subjected to freezing temperatures.

e. 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 (e.g. Tenax GC). As the air is passed through the solid sorbent tube, agent is collected. After sampling for the predetermined period of time and flow rate, the tube is removed from the vacuum line and sent to a chemical laboratory for analysis to determine the presence, type, and quantity of agent collected in samples. This technique will sample down to the PEL and is to provide low-level detection capability.

f. Automated gas chromatograph. The Automatic Continuous Air Monitoring System (ACAMS) is a type of automated gas chromatograph that is currently available for real-time agent detection and alarm capability at various levels. It has the capability to detect and alarm at the PELs.

g. Detector Ticket. The detector ticket is a stock item which will detect nerve agent vapor at concentrations as low as 0.02 mg/m^3 (GB) and 0.1 mg/m^3 (VX). It is included in the M18A2 kit (NSN 6665-00-903-4767) and the M30A1 refill kit (NSN 6665-00-909-3647). The sensitivity of the ticket decreases with lower temperature. Using a reagent (substrate), the square end

of the ticket will turn blue in the absence of agent and will turn light red-orange or have no color change in the presence of agent. The ticket will not distinguish between GB and VX agent vapor or any other nerve agent. The detector ticket can be used for point source sampling using the APE 2053 or aspirator bulb for confirmation of positive M8 paper tests (GB only) and for area air sampling using the procedures similar to the card in the M256 kit. The detector ticket continues to detect agent for 24 minutes without rewetting of the ticket and for up to 30 minutes provided the ticket is rewetted once during the 30-minute period. The extended sampling period is approved only for use in magazines or structures where exposure to sunlight or heat will not occur. When confirming positive M8 or M9 paper tests for VX, a negative detector ticket reading will not be considered to invalidate the positive detector paper test. A second paper test must be conducted.

h. Real-Time Monitor (RTM). RTM is a nonportable continuous air sampling device normally used in operational facilities for the detection of low levels of nerve agent. The RTM will detect agent vapor concentrations of 0.0001 mg/m^3 (GB) and 0.00001 mg/m^3 (VX) and will provide an alarm response in 8-12 minutes. The M8 Detection Alarm System is used in work areas to supplement the RTMs and provide rapid alarm response to high-level concentrations. The RTM is not currently manufactured.

i. M8 and M8A1 Detection Alarm. M8 and M8A1 alarms are portable/fixed alarms using the M43 and M43A1 detectors respectively and are capable of detecting nerve agent concentrations as low as 0.2 mg/m^3 (GB) and 0.4 mg/m^3 (VX) with an alarm response of 2-3 minutes for the M43 and 0.1 mg/m^3 (GB and VX) with an alarm response of 1-2 minutes for the M43A1. The M43A1 has a much faster response time at higher concentrations.

j. Demilitarization Chemical Agent Concentrator (DCAC). The M8 alarm system used with a DCAC unit can detect GB agent vapor concentrations of 0.001 mg/m^3 in 33 minutes and 0.2 mg/m^3 within 2 minutes (the DCAC cannot be used for VX monitoring except at the 0.4 mg/m^3 level provided by the basic M43 detector). The DCAC cannot be used for mustard.

k. Hydrogen Flame Photometric Emission Detector (HYFED). The HYFED is a real-time monitoring device that can be configured for detecting agents GB and VX at a concentration of .001 mg/m^3 and mustard agents at concentrations of 0.003 mg/m^3, both in 1-2 minutes. The equipment can be equipped with an audible alarm response and a permanent record chart. Since a HYFED is actually monitoring phosphorous and sulfur (respectively for nerve and mustards), it is highly susceptible to interference and is most useful in a laboratory.

l. Visual inspection. A thorough visual inspection of accessible agent-filled munition items and containers is a necessary and useful adjunct for detecting leaking agent. Special attention should be given to any wet or damp areas and painted surfaces since agent may cause blistering or peeling and discoloration of painted surfaces. All suspect liquids observed during the

inspection should be tested with the M8 or M9 detector paper as a confirmatory measure. Agent leakage sometimes occurs at the juncture between the fuze or closing plug and projectile and then, due to chemical reaction and evaporation, self-sealing of the leak may result. Inspecting personnel should be aware of this condition and recognize that any built-up area between the fuze or closing plug and projectile or presence of a dry residue may be an indication of agent leakage.

m. Olfactory. The fact that mustard has a recognizable odor at low concentrations is useful to augment conventional monitoring methods. Personnel who detect the characteristic garlic odor of mustard must immediately mask and/or evacuate the area. Do not remain unprotected in the area after smelling mustard even if the odor disappears. Exposure to mustard vapors can impair the continued ability to smell its odor. Absence of odor will never be relied upon alone to indicate absence of agent.

n. Air pumps. Air pumps capable of being calibrated and achieving the required air flow to operate approved sampling tubes/media may be used during sampling operations, e.g., MSA Model G air pump. These air pumps must meet all other safety criteria for place of intended use.

o. Chloroform extraction. Chloroform can be used as a solvent to remove potential surface contamination for laboratory analysis. It is not a substitute for air monitoring to establish a XXX level of decontamination.

p. Other methods. Detection methods other than those listed above may be used provided sensitivity and reliability have been demonstrated and documented. Approval of such detection methods by AMC Field Safety Activity, ATTN: AMXOS-C is required.

3-2. Detection equipment capabilities.

a. Capabilities, sensitivities, and response times for detector equipment listed in paragraph 3-1 above are shown in Table 3-1.

b. Gross-level detectors and alarms. Gross-level detectors are those detection devices that can provide a response within three minutes for agent concentrations at or below the IDLH level (see para 2-5a(5)). Examples include blue band tubes, detector tickets, M8 alarms, etc. A gross-level configured ACAMS can also provide rapid response; it would not also provide PEL sensitivity in this configuration.

c. Low-level detectors and/or alarm. Low-level detectors are those detection devices that can provide detection capability and/or alarm for concentrations of 0.003 mg/m^3 for mustard, 0.0001 mg/m^3 for GB, and 0.00001 mg/m^3 for VX. Examples include the bubbler, DAAMS, ACAMS, and RTMs.

TABLE 3-1

Detector Sensitivity and Response/Processing Time*

Equipment	Sensitivity (mg/m^3) Mustard	GB	VX	Response Time
Detector Paper, M8/M9	Positive or Negative only			Immediately
Detector Ticket	Not Capable	0.02 - 0.05	0.1	3 min
Blue Band Tube	0.5	0.2	Not Capable	3 min
White Band Tube	Not Capable	0.2	Not Capable	3 min
M256 Kit	1.0 - 3.0			12-15 min
		0.02 - 0.05	0.05 - 0.15	3-5 min
Bubbler	0.003	0.0001	0.00001	2-4 hrs
DAAMS	0.003	0.0001	0.00001	1 hr
ACAMS	0.003	0.0001	0.00001	10-20 min
RTM	Not Capable	0.0001	0.00001	8-12 min
DCAC	Not Capable	0.001		33 min
		0.2	0.4	2-3 min
M8	Not Capable	0.2	0.4	2-3 min
M8A1	Not Capable	0.1	0.1	1-2 min
M43A1	Not Capable	0.2	0.4	2 min
HYFED	0.003	0.001	0.001	1-2 min

* Processing time, if required, includes transport time from the site to the lab, set-up time, and analysis. Times are approximate and may very from installation to installation.

3-3. Monitoring support requirements. Use of the air sampling devices described in paragraph 3-1 above will require special training of personnel to operate and maintain those devices. A chemical laboratory is required for each installation which charges agent generators to provide known agent concentrations for quality control (QC) testing of monitors (para 3-4) and for performing timely processing of bubbler solutions or dry-type sampling tubes. Detailed information on the use and maintenance of specific monitoring/air sampling equipment may be obtained from Director, AMC Field Safety Activity, ATTN: AMXOS-C, Charlestown, IN 47111-9669.

3-4. Quality control of monitoring methods. Except for M9 paper and components of the M256 and M18 kits, a Quality Control Plan will be established for all monitoring systems. Methods of monitoring should have an accuracy of not less than plus or minus 25 percent to a confidence level of 95 percent for concentrations of agent for which the equipment is designed to measure. Where this accuracy cannot be met, quality control procedures approved by AMXOS-C will be established for monitoring methods and procedures to assure the system is functioning within its designed specifications and that readings reported as nonpositive do not represent unacceptable exposure levels.

3-5. Detection requirements. Monitoring of agent areas is outlined in this section:

a. General.

(1) Where personnel are allowed to work unmasked, the following detection scheme will be used to assure that unprotected personnel are not exposed to agent concentrations in excess of 0.003 mg/m^3 for mustard, 0.0001 mg/m^3 for GB and 0.00001 mg/m^3 for VX.

(a) Gross-level detector (continuous or hourly readings).

(b) Low-level detector.

(c) Low-level or gross-level alarm. If no alarm capability is available (i.e. if only (a) and (b) above are available), a protective mask must be worn as a minimum (for mustard operations, the low-level alarm is required).

(2) If only gross-level detection devices are present, appropriate compensating measures (engineering controls, personnel practices, and personnel protective clothing and equipment) must be taken.

(3) The type of agent detection devices, number, and positioning of these devices will be outlined in the safety submissions and identified on facility layout drawings when requesting safety approval for operations. Positioning of detectors and use of detecting devices equal to or better than detectors submitted may be modified by the local safety office as operational experience is gained and when changes would improve the operation.

b. First entry monitoring.

(1) Initial entry each day into areas (or facilities) containing chemical agents or agent contamination will be accomplished in level A protective clothing using gross-level monitoring and will include a thorough visual inspection of each accessible item. Prior to entry, remote monitoring using

gross-level detection will be performed to assure interior is not in excess of IDLH levels. Specific exceptions to the above procedures are as follows:

(a) For outdoor storage and outdoof operational areas, first entry monitoring may be performed while wearing level B protective clothing.

(b) For maintenance, renovation, surveillance, demilitarization and production buildings with an operating ventilation system and with negative results from the last low-level monitoring performed the previous day, first entry monitoring may be performed in level B protective clothing.

(c) If the facilities in paragraph b above are monitored continuously with a low-level monitor where negative results can be ascertained prior to entry of facility, first entry monitoring may be performed in level C protective clothing.

(d) For X decontaminated areas or facilities (as defined in para 5-1a(1)), first entry monitoring may be performed in level B protective clothing.

(e) For XXX decontaminated areas or facilities (as defined in para 5-1a(2)), first entry monitoring is not required.

(f) Confirmation testing of suspect liquid may be accomplished in level B protective clothing where first entry monitoring was performed in a level of dress other than level A protective clothing (paras (a) and (d) above). However, decontamination of confirmed liquid agent and containerization of leakers must be performed in level A protective clothing except as noted in paragraph 3-6, this regulation.

(g) First entry monitoring is not required for entry into areas of a facility which are separated from its agent areas by appropriate engineering controls, i.e., personnel may enter in level F protective clothing.

(h) First entry monitoring of enclosed areas used solely for storage of standard overpacked munitions (e.g., MK-116 bombs, TMU 28/B spray tanks, and M23 mines packed in drums) may be accomplished with personnel wearing level B protective clothing.

(i) In storage igloos containing G and H series agents which are monitored continuously with low-level monitors, and where gross-level negative results can be ascertained immediately prior to entry into the facility, first entry monitoring need only consist of cursory visual inspection and level C protective clothing may be worn. In storage igloos, equipped with continuous low-level monitors and low-level alarms which measure below the PEL, first entry monitoring is not required. First entry monitoring in level A protective clothing is required for storage igloos containing V series agents.

(2) The commander may authorize a modified first entry monitoring procedure when entry is of a short duration (approximately 15 minutes or less)

and no further entry is anticipated that day (e.g., Intrusion Detection System check or other in-out operation). Such entries will be made only by personnel wearing level A protective clothing and monitoring with a minimum of two gross-level detection devices while in the facility. Item-by-item inspection is not required, but visual observation of each aisle for any abnormal condition is required. The level A clothing used will be monitored in accordance with paragraph 4-3d(2). For this clothing, decontamination is not required; only a thorough rinsing with water. If no contamination is found from monitoring, the clothing may be rinsed and, after an aeration of 12 hours, be worn.

c. Monitoring during operations.

(1) After first entry monitoring has been performed, personnel wearing appropriate protective clothing (para 4-2) may enter the area to work.

(2) Gross-level monitoring will be accomplished at least hourly in not less than two widely separated stationary locations, one of which is to be located in or near the work place. When monitoring with point source detectors (i.e., detector tubes, enzyme tickets, or M8 alarm with tubing attached), samples are to be taken in a stationary location.

(3) Low-level monitoring may be used in conjunction with gross-level monitoring to allow workers to work unmasked. The following provisions apply to such low-level monitoring:

(a) Samples will be taken at intervals not to exceed two hours.

(b) Results of first sample must be available before workers may unmask. (Monitoring results prior to the last exit within the past 24 hours will also suffice if no disturbance of agent items has occurred.)

(c) Results of samples must be available within two hours from the start of the sample interval.

(d) When personnel are permitted to work unmasked, monitoring will be with a low-level detector and gross-level detectors supplemented with a low-level or gross-level alarms. For mustard operations, the low-level alarm is required for personnel to work unmasked.

(4) Where low-level monitoring is used for purposes other than to allow personnel to work unmasked, provisions of paragraph (3) above are not applicable.

(5) Air monitoring will be supplemented by frequent visual observations for conditions which may indicate leakage.

d. Remote monitoring. Monitoring of the interior of storage/operational facilities by remote sampling procedures should be employed in lieu of personnel entry whenever possible. Such monitoring does not negate requirements for first entry monitoring; however, it can provide valuable information regarding

interior conditions and an early warning of leakers when used on a continuous basis.

3-6. Leaking containers or munitions. When agent leakage is detected during first entry monitoring or when performing operations, personnel in level A protective clothing will containerize the leaking item in accordance with requirements outlined in SB 742-1 (if a munition) or repair the item to stop the leak (if a container or process equipment). The area will then be decontaminated and the atmosphere remonitored to verify that harmful concentrations of agent do not exist prior to permitting unprotected personnel into the facility or area. In those operations where surveillance air sampling of items are performed in level B protective clothing and vapor leaks are detected, containerization of the leakers may be performed by personnel in level B protective clothing provided the munition or container is resealed and monitoring the atmosphere with a gross-level detector yields negative results.

3-7. Maintenance of monitoring records.

a. General. Detailed records of the results of monitoring conducted in support of operations, (i.e., ACAMS record, bubbler and DAAMS analysis results, etc.,) will be collected daily for all operations.

b. Monitoring information. Records of any employee exposure above the permissible exposure limits (para 2-5) will be forwarded to MEDDAC/MEDCEN for inclusion into the individual's medical record. Monitoring records will include--

(1) The date, number, duration, location, and results of each sample taken.

(2) A description of the sampling and analytical methods used or a reference to a publication in the open literature describing these methods.

(3) Type of protective clothing and equipment (PC & E) used.

c. Daily roster. A daily roster of personnel entering the building/area will be provided along with the monitoring records to the office designated responsible for maintaining monitoring records. The daily roster will have unequivocal identifying information (e.g. social security number) for individuals entering agent areas. A summary of the rosters documenting individual agent area entrance and egress level of PC & E worn and the records of air monitoring measurements will be retained for at least 40 years.

d. Maintaining records. The office responsible for maintaining the monitoring records will be designated by the installation commander and must have personnel qualified to interpret and correlate the results.

3-8. Detector/monitor tubing. Tygon or rubber tubing will not be used on the sample inlet to a detector (e.g., bubbler). Teflon (preferred), glass, or stainless steel tubing is acceptable. Total tubing length will be kept as short as possible but in no case will the length be such that the flow rate is

reduced below that required by the detector for accurate sampling. Heat tracing of sampling lines should be considered to enhance sampling accuracy.

CHAPTER 4

Personnel Protective Clothing and Equipment

4-1. General philosophy and levels of protection.

a. The use of PC & E is the least desirable method of complying with permissible exposure limits. Efforts will be made to reduce dependence upon PC & E in agent operating environments through the increased use of engineering and administrative controls such as ventilation, isolation, remote operations, remote monitoring, and elimination of all nonessential entries into agent areas. Hazard analyses will reflect that these alternatives have been explored.

b. The following are definitions for levels of protection:

(1) Level A.

(a) M3 Toxicological agent protective ensemble. This ensemble is not a positive pressure system and thus some outside air will enter the suit through the sleeve, neck, and leg openings. Precautions to reduce the amount of outside air entering the suit are contained within this and other sections of this regulation. For environments above the IDLH, the suits described in (b) below are preferred and should be used when available.

Suit — coveralls, toxicological agent protective (TAP) (M3).
Hood — toxicological agent protective (M3).
Boots — butyl, safety toe, toxicological agent protective (M2A1).
Gloves — butyl, toxicological agent protective (M3, M4, gloveset).
GB/VX— Surgical or other equivalent nonstandard gloves will be worn underneath for protection when doffing TAP clothing.
Mustard— Surgical or other equivalent nonstandard gloves optional.
Innerwear — GB/VX— coveralls, fatigues, or similar (with drawers and undershirt) and socks. Alternative— long underwear and socks.
Mustard— impregnated gloves, impregnated socks, and impregnated long underwear or impregnated protective liner to include shirt and trousers. Coveralls, fatigues, or unimpregnated underwear may be worn in addition.
Mask — worn (M9 series)

(b) Air supplied or self-contained suits. When authorized by the Director, AMC Field Safety Activity ATTN: AMXOS-C, the demilitarization protective ensemble (DPE) or the toxicological agent protective ensemble self-contained (TAPES) may be substituted for level A protection. For operations involving mustard, only the 30 mil thick DPE (for up to two hours) is required.

(2) Level B.

Apron — toxicological agent protective (M2); extending below top of boots.

Innerwear -- GB/VX-- coveralls, fatigues, or similar (with drawers and undershirt) and socks.
Mustard-- impregnated gloves; impregnated socks; and impregnated protective liner to include shirt and trousers. Coveralls, fatigues, or unimpregnated underwear may be worn in addition.
Hood -- toxicological agent protective (M3 for M9 mask or M6A2 for M17 mask).
Boots -- butyl, safety toe, toxicological agent protective (M2A1).
Gloves -- butyl, toxicological agent protective (M3, M4, gloveset).
GB/VX-- Surgical or other equivalent nonstandard gloves will be worn underneath for protection when doffing TAP clothing.
Mustard-- Surgical or other equivalent nonstandard gloves optional.
Mask -- worn (M9 or M17 series).

(3) Level C.

Boots -- butyl, safety toe, toxicological agent protective (M2A1).
Gloves -- butyl, (M3, M4, gloveset).
Apron -- toxicological agent protective (M2), extending below top of boots. Required only if job hazards analysis (para 6-2a) determines that bodily contact with agent-filled items may occur.
Clothing -- unimpregnated-- coveralls or fatigues, socks, drawers, undershirt.
Mask -- worn (M9 or M17 series).

(4) Level D.

Boots -- butyl, safety toe, toxicological agent protective (M2A1).
Gloves -- butyl, (M3, M4, gloveset).
Apron -- toxicological agent protective (M2); extending below top of boots. Required only if job hazards analysis (para 6-2a) determines that bodily contact with agent-filled items may occur.
Clothing -- unimpregnated-- coveralls or fatigues, socks, drawers, undershirt.
Mask -- slung position (M9 or M17 series).

(5) Level E.

Clothing -- unimpregnated-- coveralls or fatigues, socks, drawers, undershirt.
Mask -- slung position (M9 or M17 series).
In laboratories, a lab coat may be substituted for coveralls or fatigues and the mask may be readily available at the work site instead of in the slung position. Gloves will be worn when required by chapter 8.

(6) Level F.

Clothing -- street clothing
Mask -- slung position (M9 or M17 series)

c. Protective boots. The butyl boots specified above will be safety-toe type boots, M2A1, NSN 8430-00-820-7295/7306. Boot covers are optional additions to all levels of protective clothing.

d. Protective gloves. M3, M4, gloveset, and glovebox (made to Mil Spec MIL-G-12223) gloves are considered to be standard and may be used with any level of protective clothing. Butyl 7 and 14 mil gloves (para 8-5c) do not require testing under an acceptable quality level (AQL) plan (para 4-2h(2)) but must be specifically approved by AMXOS for other than laboratory use.

e. Impregnated clothing. Impregnated liners and underwear can be reused after laundering but not worn more than seven times (initial issue and six launderings/wearings) without reimpregnating. Discard and reissue new clothing if impregnating facilities are not available.

f. Microclimate controls (cooling equipment). Commercially available cooling vests or suits may be used under the M3 TAP ensemble or level B clothing provided the integrity of the clothing is not degraded, the cooling equipment does not interfere with safe operations, a written SOP is prepared, training is provided, and a local hazard analysis verifying safe use is prepared. Cooling hats or skull caps will not be used without specific approval from the Field Safety Activity, ATTN: AMXOS-C, Charlestown, IN 47111-9669. Cooling equipment inside a protective suit will not be reused if it becomes agent contaminated.

g. Emergency escape devices. Commercially available emergency escape devices may only be used by visitors who cannot be properly fitted with a regular protective mask and only for emergency escape purposes. These devices must have a self-contained air supply (typically 5-15 minute duration) and a hood and neck seal system that provides positive pressure clean air to the entire hood. The device must be NIOSH-approved as an escape device. Installation must provide appropriate training in the use of the device and the evacuation plan must be consistent with the short duration of protection these devices provide.

4-2. Determination of protection required. The level of protection required will be determined for each operation and must be specified in the standing operating procedure. Conditions under which the various levels of protection are required are described below:

a. Level A.

(1) Level A will be worn in proximity to spilled agent in an area of known liquid contamination and during decontamination operations. For these situations, the cuffs of the sleeves and legs of the M3 suit will be taped to the gloves and boots to reduce the amount of outside air drawn into the suit. (Taping is not recommended for routine operations requiring level A because of the residue left on the suit.) Where a significant amount of liquid is present or the IDLH is exceeded, time in the M3 suit will be limited to the extent operationally feasible and will not exceed one hour.

(2) Air supplied or self-contained respiratory protection is required when airborne agent concentrations exceed the effective IDLH levels (para 2-5a(5)) or when in areas of potential but unknown airborne contamination, e.g., first entry monitoring of igloos. This requirement does not apply to

emergency situations unless such protection is available and its use would not significantly impede the operation.

(3) Storage operations. Level A will be worn by personnel performing first entry monitoring of enclosed areas. Level A protection must be retained until it is established by testing that the atmosphere and surface areas inside the structure are substantially free of contamination (below the PELs in para 2-5a(5)).

(4) Sampling operations. When personnel are drawing liquid samples from bulk containers or agent filled munitions, level A will be worn except when the operation is conducted within a ventilated and controlled atmosphere such as a laboratory hood or glovebox type fixture, in which case a lower level of protective clothing may be worn.

(5) Materials handling. When handling items which are known to be contaminated or leakage is suspected, level A will be worn.

(6) Maintenance operations. Level A will be worn when maintenance operations involve the opening of agent munitions/containers that could permit contact with agent by operating personnel. Replacement of plugs or valves in ton containers would be examples of this type of operation.

(7) Firefighting/chemical accident/incident control. 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 facepiece, 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. The M9 or M17 series mask may be worn in lieu of SCBA when there is no danger of oxygen deficiency. If such clothing is contaminated, it will not be reused. In cases where firefighters are responding to a chemical accident/incident for rescue/reconnaissance purposes vice firefighting, they will wear appropriate levels of protective clothing as described in paragraph 4-1b. Firefighters will be warned of the combustible characteristics of butyl rubber protective clothing. For accident/incident situations, the control officer may determine the proper level of protection required for initial entry (reconnaissance) teams and may modify existing levels of protective clothing to meet emergency requirements. Additional guidance is outlined in AMC-R 385-100, chapters 11 and 12.

b. Level B.

(1) Level B will be worn when contact with suspect item is required and when performing operations which may result in release of agent vapors within the work area (e.g., air sampling inspection of stocks or inspection/repair of equipment), but there is no contact with liquid agent anticipated and no liquid agent is present.

(2) Level B, less the butyl rubber apron, may be worn by personnel performing first entry monitoring of outdoor storage areas.

(3) Level B or equivalent commercial protective clothing, without impregnated underclothing, is required for loading and charging the M9 or M12 decontaminating apparatus with Super Tropical Bleach (STB) or High Test Hypochlorite (HTH) in an atmosphere free of chemical agent contamination.

c. Level C. Level C will be worn by personnel who must be in agent areas where handling or contact with agent-filled items is involved and if low level monitoring is not being performed.

d. Level D. Level D will be worn by personnel in clean areas where handling or contact with agent-filled items is involved and if low-level monitoring is being performed, with negative results, in accordance with 3-5c(3).

e. Level E.

(1) Level E will be worn by operating personnel who may be observing or supervising the operations and who would not likely contact an item or would only be exposed to agent in the event of an accident.

(2) Laboratory personnel will use this level of protection in conjunction with approved gloves as required (para 8-4c). A laboratory coat may be substituted for the coveralls and masks may be readily available instead of in the slung position.

f. Level F. Level F will be limited to casual or transient personnel who may be required to visit clean storage or operating areas.

g. Trained emergency personnel responding to an accident or emergency situation will wear the level of protection which is indicated by the conditions that exist. When emergency (i.e., life threatening) conditions involve exposure to liquid agent, level A protection will be worn unless modified by the supervisor or chemical accident/incident control officer (CAICO) to provide life-saving measures. However, where exposure to only agent vapor is involved, level B protection may be worn.

h. Use of nonstandard type gloves. Nonstandard gloves may be used in lieu of standard (type classified or specifically approved by AMXOS) TAP gloves for agent activities requiring special handling consideration such as laboratory operations where good hand dexterity is essential or glovebox operations subject to the following requirements:

(1) The nonstandard glove selected will be limited to use in operations where standard gloves cannot be used because of safety or operational considerations. An example is the use of lightweight tightfitting neoprene gloves in laboratory operations involving solvents incompatible with butyl rubber.

(2) The nonstandard glove selected will have its agent penetration resistance ascertained by testing each purchased lot under an AQL plan. The plan will, as a minimum, provide for testing in accordance with MIL-STD 282 for the time period exceeding intended use with sufficient sampling to statistically demonstrate 95-percent reliability (no detectable penetration) at a 95-percent confidence level. Sampling to a four-percent AQL at general inspection level 2 in accordance with MIL-STD 105 is acceptable. Questions concerning the conduct of such tests may be referred to AMCCOM Product Assurance Directorate, ATTN: AMSMC-QAE(A), Aberdeen Proving Ground, MD 21010-5423.

(3) Nonstandard gloves will be used only in a manner which prohibits intentional contact and has low potential for unintentional contact with liquid agent. In the event of actual or suspect liquid contamination, the gloves will be decontaminated and removed as soon as feasible and disposed of in accordance with paragraph 5-2.

(4) If no liquid contamination occurs, the gloves may be decontaminated, laundered, tested and reused, except nonbutyl gloves will be destroyed in accordance with paragraph 5-2.

(5) Nonstandard gloves will not be worn (a) after liquid contamination (b) in excess of the time tested under the AQL plan, and (c) for more than one work shift.

i. **Chemical protective clothing and equipment.** Approval by Director, AMC Field Safety Activity, ATTN: AMXOS-C, is required prior to using any new nonstandard (except as in para h above) or modified chemical personal protective clothing and equipment.

4-3. Care of toxicological agent protective (TAP) clothing.

a. Each installation will establish a separate area or areas where protective clothing will be laundered, inspected, tested, and issued. TAP clothing and associated non-TAP clothing may be laundered in the same facility. Associated non-TAP clothing may also be laundered in other base laundry facilities. When the laundry is located in an area which allows access of nonrelated personnel, all TAP clothing will be monitored in accordance with paragraph d(2) below prior to delivery to the laundry.

b. Butyl rubber impermeable protective clothing will burn and does not possess self-extinguishing properties, therefore contact with open flame or objects which would ignite the clothing must be avoided during laundering, inspection and testing, issue and storage, and wearing. Smoking is prohibited in the vicinity of or while wearing butyl rubber TAP items.

c. Clothing must be in a serviceable condition and properly fit the wearer. Unserviceable, damaged, or deteriorated clothing will not be issued or used. All TAP clothing in active use must be sent to the laundry for inspection and testing quarterly. The M3 coveralls, M3/M4, gloveset gloves, and M2A1 boots will be leak tested (a) when newly removed from stock (b) after

each laundering (c) prior to use of these items if they have not been tested within the previous 3-month period, and (d) whenever there is evidence of deterioration or damage that might cause leakage. The M3 coveralls, M3/M4, gloveset, glove box gloves, and M2A1 boots will be leak tested using either the Q79A1 or the procedures in TM 10-277. Because of adhesive residue left on TAP clothing, tape should not be used for sealing cuffs or marking suits. Each wearer is to assure serviceability of their PC & E by visual inspection before and after use. Serviceable TAP clothing is not to be worn as a general utility item. Unserviceable TAP items being used as general utility items (i.e. M2A1 boots) must be clearly marked so they CANNOT be mistaken for serviceable items.

d. Requirements for decontamination and laundering of protective clothing will be as follows:

(1) Protective clothing worn during first entry monitoring of enclosed agent facilities which is not subject to agent liquid or vapor contamination will be flushed with water and aerated for at least 12 hours prior to reuse. This protective clothing will be laundered once every three months as a minimum as outlined in paragraph 4-3e below except that water temperatures may be reduced to 60°C (140°F).

(2) Protective clothing worn in known agent vapor contaminated areas (or which has minor liquid agent contamination) will be decontaminated with a 10 percent sodium carbonate or sodium hydroxide for GB and a 10 percent HTH or STB slurry for VX and mustard thoroughly flushed with water, doffed, placed in a plastic bag, and sealed to prevent escape of agent vapors. During decontamination, particular attention should be given to the double cuff area on the sleeve and folds around leg and sleeve snaps on the M3 suit and cuffs of M2 apron. After at least four hours at a location providing a minimum temperature of approximately 21°C (70°F), the atmosphere inside the plastic bag will be tested for contamination with a low-level detector to verify that agent vapor concentrations do not exceed the PEL specified in paragraphs 2-5a(1)-(3) before the clothing may be removed from the bag and sent to the laundry facility. If agent concentrations above the permissible limits are detected, the clothing will be further decontaminated and tested above.

(3) Protective clothing subjected to major liquid agent contamination (or any liquid contamination in the case of mustard) will be decontaminated and tested for thoroughness of decontamination as in paragraph 4-3 d(2) above. If no agent is detected by test, the clothing will be disposed of in accordance with paragraph 5-2.

(4) Whenever the degree or type of contamination is questionable, the clothing will be treated as if it were subjected to liquid agent contamination.

(5) Butyl rubber protective clothing contaminated with petroleum base products including solvents or lubricants will be disposed of in accordance with paragraph 5-2.

e. TAP clothing worn in contaminated areas and decontaminated and monitored to assure that any agent vapors released do not exceed permissible limits (in accordance with paras 2-5a(1)-(3)) will not be reused until laundered. The laundry facility will accomplish thorough cleaning, inspection, and repair (if required). Laundering of impermeable protective clothing (excluding masks) will be accomplished by soaking in hot soapy water with an alkalinity of pH 8 to pH 9 at a temperature of 79° to 85° C (175° to 185° F) for at least one hour without agitation. Detergents are not to be used in lieu of soaps. The clothing will then be rinsed with fresh water, air dried, and hung in a ventilated area for aeration for a 24-hour period. M3/M4 and gloveset gloves, M2A1 boots, and M3 coveralls will be leak tested as required by paragraph 4-3c above after each laundering.

f. The wearing, care, maintenance, storage, handling, and decontamination of personal protective clothing and equipment must be in compliance with appropriate TMs, FMs, SBs, etc., unless covered herein.

g. As a general rule, to prevent heat exhaustion and fatigue during warm weather periods while wearing the M3 suit, maximum wearing time should be specified below. However, the local medical authority may use discretion to vary the wearing time depending on such factors as relative humidity, use of cooling suits, and activity levels, etc. During hot weather activities, provisions to cool individuals dressed in level A protective clothing is encouraged.

Ambient Temperature	Maximum Wearing Time (hours)
Above 90°F	1/4 hour
85-90° F	1/2 hour
80-84° F	1 hour
70-79° F	1 1/2 hour
60-69° F	2 hours
50-59° F	3 hours
30-49° F	5 hours
Below 30° F	8 hours

4-4. **Respiratory protection program.** In operations where respiratory protection is required, there will be a program for selection, use, inspection, testing, and maintenance that complies with TB Med 502. The program will include the following essential elements:

a. **Selection.** The device which will give the best protection and which

can be worn with the greatest degree of comfort under conditions of employment will be selected using the following standards:

(1) In an atmosphere which is oxygen deficient (less than 19.5 percent oxygen) or for operations other than field or emergency operations in which the toxic agent vapor concentration is considered to be immediately hazardous to the life and health of personnel (para 2-5c) an air-supplied protective suit or pressure demand breathing apparatus will be used. Suit or apparatus used must be approved by AMC Field Safety Activity (AMXOS-C).

(2) Canister or filter element-type masks can be used where oxygen deficiency is not a factor and concentrations do not exceed those considered to be IDLH. This category of protection includes the M9 and M17 series masks. All M17 series masks must be equipped with M13A2 filter elements having green filter element sleeves (NSN 4240-00-165-5026). M13 and M13A1 filter elements with black or gold filter element sleeves will not be used for protection against agent as these are training filters.

(3) A sufficient number of fitted prescription optical inserts will be made available to personnel requiring them. Procedures for obtaining optical inserts are included in ARs 40-3 and 40-5.

(4) Where respiratory protection from other hazards (spray painting, sand blasting) is required simultaneously with agent protection and the airborne agent concentrations are known to be below those specified in paragraph 2-5a(1)-(3), a NIOSH-approved pressure demand respirator may be used.

b. **Wearer instructions.** The wearer will be properly fitted and trained in the use and care of the device and the means by which it gives protection. The wearer's face will be clean shaven to the extent that there is no possible interference of any facial hair growth (beard, sideburns) with the sealing surfaces of the protective mask to assure that an effective seal will be maintained between the mask and the wearer's face. Any person who needs to grow a beard to effect a cure for pseudofoliculitis as determined by their attending physician and/or dermatologist will be excused from agent activities until such time as the beard is no longer required. This restriction does not apply to the personnel provided with a self-contained emergency escape device or other approved devices not needing a mask-to-face seal.

c. **Maintenance.**

(1) A facility will be established at each installation for the issue, testing, and organizational maintenance of serviceable respiratory protective equipment in accordance with the current supply and maintenance guidance for the equipment. This unit will assure that an adequate stock of approved serviceable respiratory protective equipment is always available.

(2) Canister and filter replacements will be in accordance with the requirements of the latest technical manuals (TMs) and supply bulletins (SBs)

for the individual M9 and M17 protective masks. In addition to the replacement requirements for canisters or filter elements given in the appropriate TMs and SBs, the following replacement requirements will also apply:

(a) At least annually. Annual cycle will start when canister/filter is removed from the original sealed package.

(b) Whenever the mask becomes contaminated with liquid agent.

(c) So that the canister/filter will not be used for more than two hours when the mask has been worn in a known contaminated area.

(d) As prescribed by special directives for M13 series filter elements (M17 series masks) and the M11 canister (M9 series masks).

(3) Protective masks will be maintained as follows:

(a) Protective masks and carriers worn in known contaminated areas (or in unknown atmospheres) will be turned in along with the rest of the protective clothing for monitoring, cleaning, visual inspection, repair, and canister or filter replacement. The mask will be cleaned and sanitized at a temperature of 49° to 60° C (120° to 140° F) in accordance with NIOSH-approved procedures or procedures outlined in TM 3-4240-279-10, Operator's Manual, M17 series mask and TM 3-4240-204-12&P, Operator's and Organizational Maintenance Manual, and M9 series mask. Whenever a filter/canister is changed, M4/M14 testing of the mask is required. If applicable, the optical inserts may be removed after doffing the mask, rinsed, and returned to the user or a second set of optical inserts may be provided in another mask. The canister will be removed from the mask before returning the mask for cleaning. The threads on used canisters should be damaged to prevent reuse and the canister disposed of as contaminated waste.

(b) All protective masks will be turned into a maintenance facility at least semi-annually for cleaning and sanitizing (as above), inspection using the M4, M14, and Q204 mask testers and repair. Filter elements or canisters will be replaced annually as required in paragraph 4-4c(2).

(c) Each installation using protective masks will have a written procedure to ensure compliance with (2) and (3) above.

(4) The use of quantitative mask fit testing is beneficial in several areas such as initially determining proper mask size and type, protection factors, and as a confidence training aid. The procurement and use of quantitative mask fit equipment is encouraged. Guidance regarding information and choice of equipment may be obtained from AMC Field Safety Activity, ATTN: AMXOS-C.

d. **Storage.** The protective masks will be stored so they will not be exposed to sunlight, heat, extreme cold, moisture, or any other environment which might cause deterioration. Protective masks should be stored in the

carriers provided hung by the shoulder strap or D-ring on the carrier. Protective masks in carriers may also be stored in separate bins.

Note. Calcium hypochlorite is appropriate for sanitizing the masks. The calcium hypochlorite solution should be 50 to 70 ppm of chlorine with an immersion time of about two minutes. One of the 0.5g tubes from water purification chlorination kit (NSN 6850-00-270-6225) to one gallon of water should result in 60-70 ppm chlorine. A similar chlorine content may be produced by using a 1:400 dilution of 5 percent sodium hypochlorite solution (household bleach).

e. **Individual care and use of protective masks.**

(1) Initial fit. When a protective mask is issued or the filter element or canister is changed, it will be inspected for serviceability, fitted to the person, and tested for leaks using the method outline in appendixes B and C.

(2) A preventive maintenance program for protective masks used by individuals in their regular operational assignments must be established. The procedures prescribed in the operator's manual for the specific mask will be the minimum required except that filters or canisters are not to be removed as this invalidates the leak test. When masks are used daily, inspection and cleaning will be performed weekly to ensure serviceability. Supervisory personnel must check to assure that cleaning and inspection of masks are being performed by employees.

(3) Donning and leak checks. Personnel employed in operations where the mask is required for protection will check for fit and leakage whenever the mask is worn using the procedures in appendix C. Positive pressure air supplied masks are not subject to this provision but should be leak checked under the manufacturer's provisions.

(4) Each individual is responsible for the condition of his own mask. This includes a detailed visual inspection. Defects will be immediately reported to the supervisor.

(5) When the mask will be used only in emergency situations, the mask will be visually inspected and tested for fit and leakage (using the procedures in appendix C) at least every 6 months.

(6) Contact lenses will not be worn by personnel involved in agent operations. Excepted from this requirement are visitors and casuals who would normally don a mask only in the event evacuation is necessary.

(7) The M11 canister will not be used for respiratory protection without the pad insert installed. The pad insert must be changed every eight hours of use. Wearing of the mask for fitting and checking for leaks (isoamyl acetate test) is not to be considered use-time. A procedure must be developed to assure that the eight hours use-time is not exceeded. Mask is to be retested (M4 and M14 testers) after replacement of pad insert and M11 canister.

f. **Special fitting.** Requests for specially fitted M9/M17 series masks will be submitted to Commander, U.S. Army Armament, Munitions, and Chemical Command, ATTN: AMSMC-MAO-NC, Rock Island, IL 61299. Requests for specially fitted butyl rubber protective clothing will be submitted to Commander, U.S. Army Natick Research and Development Command, ATTN: AMDNA-VCC, Kansas Street, Natick, MA 01760, AUTOVON 955-2207, with detailed measurements.

CHAPTER 5

Decontamination and Disposal

5-1. **Decontamination.** The decontamination of personnel and items, (i.e., equipment and facilities) requires that procedures be established to ensure proper personnel training and accomplishment of desired results.

a. **Levels of decontamination** are assigned, based upon local determination, to all items which have been subject to liquid contamination or long term vapor contamination. Other methods of decontamination (in addition to those below) specifically approved by AMXOS-C are acceptable.

(1) **X** - A single X indicates that the level of decontamination is unknown or that an item is contaminated to the extent that vapor concentrations from the bagged item or within the facility exceed 0.003 mg/m^3 for mustard agents, 0.0001 mg/m^3 for GB, and 0.00001 mg/m^3 for VX.

(2) **XXX** - Three Xs (3Xs is used for brevity in this regulation; it will not be abbreviated when marking an item or facility) indicate that the item has been surface decontaminated (if required) by locally approved procedures bagged or contained, and that appropriate tests or monitoring has verified that vapor concentrations above 0.003 mg/m^3 for mustard agents, 0.0001 mg/m^3 for GB, and 0.00001 mg/m^3 for VX do not exist. Monitoring is not required for completely decontaminated and disassembled parts that are simply shaped (no crevices, threads, etc.) and are made of essentially impervious materials (simple lab glassware, steel gears, etc.).

(3) **XXXX** - Five Xs (5Xs is used for brevity in this regulation; it will not be abbreviated when marking an item or facility) indicate that the item is clean and may be released from government control without precautions or restrictions. An approved method of achieving 5X level is subjecting items for a sufficient time at a sufficient temperature to completely destroy agent. For disassembled items, heating the items to 538° C (1000° F) for 15 minutes is considered sufficient. Where items cannot be disassembled to component parts, more time may be required to assure that all agent is destroyed. 5X condition must be certified by commander's designated representative.

(4) Clean conditional - When situations such as metallurgical investigations require testing at locations outside the installation, the item will be disassembled and exposed to moderately high temperatures long enough to decompose agent to compounds of lesser toxicity. A temperature of 177° C (350° F) for 4 hours is considered sufficient to decompose agent. Bubbler samples will be taken to assure vapor concentrations do not exceed 0.003 mg/m^3 for mustard agents, 0.0001 mg/m^3 for GB, and 0.00001 mg/m^3 for VX. After test data is obtained, material will be decontaminated to 5X levels for release from government control or placed in approved storage as 3X status. Such

testing will be accomplished only at government installations and under an standing operating procedure (SOP) concurred in by the installation responsible for the item.

b. Identification of decontaminated equipment, materials, and facilities. DD Form 2271, Decontamination Tag, Nov 82 (replaces DA Form 3803 which may be used until supply exhausted) and physical marking will be used to identify decontaminated equipment, materials, and facilities.

c. Decontamination of personnel, equipment, and facilities.

(1) Equipment decontamination (metal or other nonporous materials). Appropriate tests will be conducted to assign the equipment to a level of decontamination described in paragraph a above.

(a) X items must be handled or stored as contaminated using adequate engineering control measures and/or protective clothing.

(b) 3X items may be handled or operated by agent-related personnel without restriction except that the items may only be heated or disassembled in an area having controlled ventilation. Maintenance or disassembly of such items will be accomplished by personnel knowledgeable in agent symptomatology, agent characteristics, and in facilities equipped with appropriate safeguards to control potential hazards. 3X equipment may be transported under government bill of lading if hazard analysis determines this is acceptable. The exterior of the shipping container will be marked "CONTAINS XXX MATERIAL, TO BE OPENED BY AUTHORIZED PERSONNEL ONLY." Certification of decontamination will be provided by the shipper and will accompany the shipment. Items decontaminated to 3X level may not be released from government control. The shipper will maintain an audit trail of the documents. Nonrelated personnel should not be allowed routine access to 3X items.

(c) 5X items may be handled, operated, or released from government control without restriction.

(d) Clean conditional. This material may be handled under controlled conditions when suitable precautions are taken for decomposition products. Material will not be released from government control until decontaminated to the 5X level except for shipment by regulated carrier in accordance with applicable DOT requirements for general cargo.

(2) Facilities decontamination. Prior to release of agent operating facilities or storage facilities for AMC operations of a nonrelated nature, the facilities must be certified to the 3X level of decontamination. Monitoring will be conducted with ambient temperature of 16° C (60° F) or above, with area closed, and for at least three 8-hour sample periods. Periods may be consecutive or nonconsecutive. All equipment which has been in contact with agent will be removed.

(3) Combustible waste contaminated with agents will be disposed of by burning in a controlled emission incinerator. If the waste has not been

decontaminated to 3X levels prior to incineration, this material will be incinerated in equipment which is designed to assure destruction of all toxic agent and control emission of gaseous products to ensure compliance with air pollution control standards. Latter equipment must be approved by Director, USAMC Field Safety Activity, ATTN: AMXOS-SE.

(4) Contaminated personal protective clothing will be treated as specified in paragraph 4-3d before releasing the clothing for normal use. When decontaminating the protective clothing while it is being worn, care must be taken to prevent application of the decontaminant over the protective mask air intake. Special attention should be paid to the folded areas of the sleeves and leg cuffs of the M3 TAP suit and cuffs of the M2 butyl apron. TAP clothing and mask worn in potentially contaminated areas will be considered as being 3X.

(5) Personnel decontamination. Eye and skin decontamination will be accomplished in accordance with paragraph 7-8 of this regulation.

d. Decontaminating agents.

(1) Standard decontaminating agents that are acceptable for decontaminating equipment or spills include but are not limited to--

(a) Super Tropical Bleach (STB). STB must be used as a slurry. In the dry state STB reacts violently with liquid mustard, producing toxic vapors and possibly sufficient heat to cause flame. STB should be immediately and thoroughly rinsed from surfaces after decontamination to preclude fire and limit corrosion.

(b) High test Hypochlorite (HTH). HTH must be used as a solution. In the dry state HTH reacts violently with liquid mustard, producing toxic vapors and possibly sufficient heat to cause flame.

(c) Commercial liquid bleach (nominal 5 percent solution of sodium hypochlorite).

(d) Ten percent sodium hydroxide or sodium carbonate for agent GB. Sodium hydroxide will not be utilized as a decontaminant on agent-filled aluminum munitions or containers such as the Weteye bomb or exposed M55 warhead. Sodium hydroxide reacts with aluminum generating heat, hydrogen gas, and causing deterioration of the aluminum.

(2) Selection and use of decontaminating agents.

(a) Supplies of chemical decontaminating materials which are adequate to meet the needs of each installation or activity assigned a chemical mission must be maintained at locations immediately available to each operation. Selection of the decontaminant, based on the nature and extent of contamination involved, will be made in accordance with requirements outlined herein.

(b) Because of damaging effects to butyl rubber, DS2 is not an appropriate decontaminant for use at AMC installations except as approved by the local safety office for small and controlled quantities such as might be used in laboratories (see safety precautions TM 3-220).

(c) Decontaminants must be checked at least annually in accordance with quality assurance procedures to ensure deterioration has not occurred. The minimum acceptable chlorine content for STB is 10 percent, 30 percent for HTH, and 3 percent for sodium hypochlorite solution. Sampling procedures should be in accordance with appendix G, TB 740-10. Analysis should follow procedures referenced in specifications for the decontaminant involved.

(3) Management of decontamination wastes. Waste material from the use of decontaminating agents will be managed in accordance with applicable Federal or state regulations regarding the management and disposal of hazardous wastes.

e. Decontamination equipment.

(1) Mustards and VX. Equipment provided for decontamination of major mustard or VX spills or leaks from facilities and equipment will be filled with the required amount of water prior to operations, and a predetermined amount of STB or HTH will be stored at the same location as the decontaminating equipment for mixing of the water-bleach slurry upon notification of an agent leak or spill. The slurry mix will not be held in the M9 or M12A1 apparatus for more than 4 hours to avoid plugging of equipment components and corrosion. After each use, the equipment must be drained and flushed with clear water before returning it to a standby condition. WARNING. Ethylene glycol (anti-freeze) will not be used to prevent freezing when chlorinating compounds STB or HTH are being used as the decontaminating agents. This combination (STB/anti-freeze or HTH/anti-freeze) produces an exothermic reaction liberating heat and gas which would increase pressure to the rupture point in a closed system such as a M12A1 decontaminating apparatus.

(2) GB. Equipment provided for decontamination of major GB spills or leaks will be precharged (or capable of being charged within 40 minutes) with a 10 percent sodium hydroxide (caustic soda) solution and be ready for use at all times when operations are in progress. Equipment utilized for caustic soda solutions should be constructed of steel or stainless steel (never aluminum). The M12A1 decontaminating apparatus storage tank may remain filled with caustic for extended periods of time, e.g., two to three months, provided that it is protected against freezing and the pump unit is thoroughly flushed after each use as described in the appropriate technical manuals. During periods of cold weather, ethylene glycol (without additives) may be added to the caustic soda solution to prevent freezing. For those situations involving only minor contamination, and the likelihood does not exist for hazardous release outside the immediate operating or storage area, a sodium carbonate solution heated to 70° F may be used (when temperatures are above freezing) for decontamination, e.g., laboratory equipment, personnel protective equipment, minor leaks detected during routine surveillance of storage operations, etc.

(3) Each installation will be responsible for training designated personnel to operate this equipment in event of an emergency. This equipment need not be manned with operating personnel until decontamination is required.

(4) Operating supervisors will be responsible for verifying the serviceability of decontaminating equipment by inspecting the equipment prior to starting operation and periodically thereafter.

(5) Positioning of equipment. Decontamination equipment will be positioned in accordance with the following criteria:

(a) A single piece of equipment may be used to provide coverage to multiple operations performed in the same general area providing the potential for major spillage is remote, e.g., storage leak testing, shipping, inspection, minor maintenance, etc.

(b) A single piece of equipment (or a source of decontaminating solution) will be provided for each operation where the potential for massive spillage exists, e.g., renovation, modification, demilitarization, agent transfer, etc., in sufficient amount to cope with the spill potential involved.

(6) Step-in decontamination pans containing STB slurry, HTH solution, or other suitable decontaminating solutions should be placed at exits from agent operating areas requiring the wearing of butyl boots. (Shuffle pits containing mixtures of dirt and dry STB or HTH are not allowed within AMC)

(7) Plastic sheets will be available at the operational site to cover spills until the decontamination equipment arrives at the spill location. Plastic bags will also be available as short-term drip containers for leaking agent. Spill areas will be clearly identified or controlled to prevent inadvertent access by unauthorized personnel. If a spill occurs in outdoor work-storage sites, after decontamination the surface soil layer will be removed to a depth where PEL levels in paragraph 2-5a are not exceeded and this soil will be processed through an approved incinerator. If an agent spill occurs in an area that is ventilated through charcoal filters, the use of the plastic sheets or bags is not required.

5-2. Disposal.

a. **General.** The preferred method of disposal of agent is by incineration using specially designed incinerators. Any decontaminated waste will be disposed of in accordance with appropriate provisions of Federal, state, and/or local Resource Conservation Recovery Act (RCRA) regulations. Procedures for such disposal will be approved by the Installation Environmental Coordinator.

b. **Detonation.** Routine detonation of items containing or contaminated with agents above 3X levels is prohibited. This does not limit emergency destruction of such items in accordance with AR 75-15 and Public Laws 91-121 and

91-441. For detonation operations, the applicable portions of chapter 27, AMC-R 385-100, as well as the following apply:

(1) Appropriate decontamination equipment will be available.

(2) Downwind low-level monitoring of the destruction site will be accomplished during and after destruction.

(3) Hazard Analysis will be conducted with appropriate safety zones established.

(4) Monitoring of the destruction site, soil or surface, is required to verify absence of residual contamination.

c. **Burial.** Material, equipment, and clothing that has been decontaminated to at least the 3X level may be buried (with specific approval from AMC Field Safety Activity, ATTN: AMXOS-C) only in a landfill that has been approved by the Environmental Protection Agency (EPA) or under an authorized state Resource Conservation Recovery Act (RCRA) program for hazardous waste disposal. Other existing locations where agent-filled munitions and agent contaminated items or material have been previously buried will be appropriately marked with permanent signs and measures will be taken to prohibit unauthorized personnel from entering the area. Records identifying the type and quantity of items buried will be permanently maintained and the burial site will be noted on installation master drawings. Such land cannot be excessed.

d. **Prohibitions.** Open pit burning or burying of items containing or contaminated with mustard agents, GB, or VX in any quantity is prohibited except as in paragraph 5-2c. No agent will be disposed of unless the agent has been detoxified or made harmless to humans and the environment, except where emergency disposal is necessary to safeguard human life.

e. **Chemical neutralization.**

(1) Where containment facilities are available, chemical neutralization of agent may be used. Each installation will determine the capability to neutralize agent safely and establish local limits on chemical neutralization. The neutralization process will be conducted in ventilated areas with a filtration system to remove traces of agent from the effluent air. The thoroughness of the neutralization process will be verified by laboratory analyses to assure that agent concentration above the emergency drinking water standards in TB Med 577 does not exist and the results documented. Local and state pollution control standards must also be considered. Where neutralized material is being discharged to a wastewater treatment facility, the material will be treated to a level required by the treatment facility in order to assure no adverse effect on treatment processes and no potential pass-through of toxic materials.

(2) Where containment facilities are not available, chemical neutralization will not be used except when detoxification is required under valid emergency conditions such as a result of an accident. If emergency disposal

is required without detoxification of the agent, procedures will be reported as required by Public Law 91-441.

f. **Incineration** will be accomplished using an EPA or state-approved controlled emission incinerator, appropriate engineering controls, and continuous monitoring to assure emissions are within acceptable levels. For incineration of 3X material, engineering controls and continuous monitoring may not be required if initial and periodic monitoring of effluent indicates acceptable levels consistent with applicable environmental laws and regulations.

g. **Storage of wastes** resulting from operations specified herein will be in accordance with Federal, state, and/or local RCRA regulations. All materials storage procedures will be approved by the Installation Environmental Coordinator.

h. **Former surety installations.** Termination of the chemical surety mission of an installation does not abrogate the responsibility of the installation to maintain a safety program commensurate with the remaining mission. Until such time as Agent-Free Status is issued, a chemical safety plan which describes the specific safety requirements for operations in and near the decontaminated facilities will be in effect.

THIS PAGE INTENTIONALLY LEFT BLANK

CHAPTER 6

Safety Criteria for Agent Activities

6-1. The cardinal principle. The cardinal principle to be observed in any location or operation involving explosives, ammunition, or toxic chemical agents is to limit the potential exposure to a minimum number of personnel, for a minimum period of time, and to a minimum amount of the hazardous material consistent with safe and efficient operations.

6-2. Standing operating procedures (SOPs).

a. A job hazard analysis will be conducted for all new operations involving chemical agents or whenever there is a change in production, process, or control measures which could result in an increase in vapor or liquid concentrations of chemical agents. A written record of the hazard analysis will be made and retained as a permanent record. Analysis must include date of operation, description of operation, and locations identified within the operation. Monitoring records which contain information specified in paragraphs 3-7b(1) to (3) and the list of personnel involved must be maintained with the job hazard analysis or storage location referenced within the analysis. These monitoring records will be maintained to document that exposures of personnel have not occurred as well as duplication of the records of exposure sent to MEDDAC, MEDCEN per paragraph 3-7b.

b. SOPs will be prepared in advance of operations and will be in sufficient detail to outline the necessary safety and operational requirements as directed in paragraph 16-21, AMC-R 385-100, and AMC-R 385-1. Copies of the applicable SOP will be available at the worksite for personnel information, guidance, and compliance. First aid procedures must be included.

c. Personnel limits will allow for necessary supervision and for reinforcing requirements contained in the SOP. Supervisors will be responsible for monitoring the areas and enforcing requirements outlined in the SOP.

6-3. Change house facilities/areas. Facilities must be provided for showering and changing clothes. This may be a designated area or a change-house. The following criteria applies to the location, design, and operation of change-house facilities:

a. Change-houses servicing a chemical area will be located at the maximum practicable distance from the storage or operating area; however, as a minimum the separation distance for related explosives operations will be unbarricaded intraline distance based on the maximum quantity of explosives which would be involved at the controlling location (AMC-R 385-100, ch 17).

b. Change-houses servicing chemical areas will be separated from those servicing other areas. This separation may be accomplished by the use of a separating wall if the building is sited at the appropriate inhabited building distances from each area it serves.

c. Change-houses servicing chemical areas will have, as a minimum, the following facility design requirements:

(1) Building air flow will be from the nontoxic or clean area toward the potentially contaminated areas.

(2) The building layout will provide clearly defined and separate areas (by walls, physical barriers, or other positive tangible means) for segregating clean and potentially contaminated areas.

(3) An area or room will be provided for decontamination and removal of contaminated, potentially contaminated, or soiled protective clothing. Receptacles with tight-fitting covers or plastic bags will be provided for collecting such clothing destined for thorough processing at the cleaning facility. Where practicable, external openings should be provided in the facility for removal of such clothing.

d. Change-houses/areas may be provided as an integral part of the operating building. In such cases the following provisions apply in addition to those specified in (c) above:

(1) The building design (i.e. floor slope, drainage, air flow, etc.) will preclude agent migration into the change-house/area.

(2) A means of direct egress of personnel to the exterior of the building or outside the no-effects zone for the given operation will be provided without having to pass through agent operating areas.

(3) Change-house/area must be separated from explosives hazards by a wall/barrier which provides protection equivalent to that provided by unbarricaded intraline distance (UBID) if other than personnel directly associated with the operation use the facility or the facility operates on a multiple shift basis.

e. For operations in the field and in operating buildings without an integral change-house/area, provisions will be made for decontamination and removal of contaminated or potentially contaminated protective clothing at or adjacent to the work site. Provisions for collecting such clothing for processing at the laundry facility will be provided as specified in paragraph 6-3c(3). Agent contaminated protective clothing will not normally be worn or transported to change-houses/areas.

f. Change-houses/areas should include adequate toilet and shower facilities for all personnel involved in chemical agent operations.

g. Utilization of chemical change-houses/areas will be controlled by locally approved regulations.

6-4. Operational agent facilities. The following safety features will be included in the design and construction of operating agent facilities and equipment:

a. The exhaust ventilation system will be designed so that toxic agents or other chemical compounds in amounts harmful to humans or the environment will not be discharged to the atmosphere. To achieve this, where agent contamination could reasonably be expected, it is necessary to filter or to scrub with a neutralizing solution all exhaust air from such areas before it is discharged. If agent contamination is not reasonably expected, an alternative to filtering or scrubbing is to monitor the exhaust stack effluent to prevent continued release of agent vapors. Exhaust stacks will extend at least 6 feet above the roof heights of buildings in the immediate vicinity of the operating area. Exhaust ventilation system effectiveness will be measured (air velocity, static pressure, vacuum, etc.) at least every three months or prior to initiation of operations when any changes in production, process, or control are made. New construction will meet American Conference of Government Industrial Hygienist criteria.

b. In order to reduce the number of personnel that could be exposed to agent, each facility will be designated to function with as few personnel as possible and with hazardous and safe areas isolated from each other.

c. The area where munitions are filled, closed, punched, drilled, or drained must be maintained under negative pressure during agent operations and as long as agent levels would exceed the level in paragraph 2-5 without the negative pressure or ventilation system in operation.

d. To further decrease the possibility of exposure to agent, the facility will be designed so that equipment and munitions will require only minimum handling by operational personnel.

e. There will be a method of coordinating activities in the hazardous area with those in the nonhazardous area. This may be an electronic communication system, a system of observation windows, or other equivalent methods.

f. Exits must be sufficient in size and number to permit rapid evacuation of all personnel in the event of fire, explosions, or spills (ch 5, AMC-R 385-100).

g. For manufacturing plant-type operations, laboratories that utilize large quantities of agent, and wherever agent emergency showers are located, floor drains will be installed. All drains which could possibly receive agent will be provided with liquid seals (traps) and should be connected to a sump or collection tank where liquid can be sampled for agent analysis and further neutralized if agent is present. Wastes must be retained within the facility sump until tests confirm that the agent has been completely neutralized by a process that has been verified by laboratory analysis to reduce agent levels

below drinking water standard (see also para 5-2e(1), this regulation). Vents from holding tanks and drain lines must be filtered to preclude agent leakage.

h. Wherever floor drains are provided, all floors will slant toward drains at an incline sufficient to provide surface drainage (see para 5-17, AMC-R 385-100 for guidance).

i. A supply of decontaminating agents, and equipment for applying them, must be immediately available for routine decontamination procedures and emergencies. Since most construction materials absorb agents to some extent, decontamination must be prompt and thorough.

j. Lightning protection in accordance with chapter 8, AMC-R 385-100, is required only on operating buildings, magazines, or igloos in which agent filled items with explosive components are manufactured, filled, stored, or otherwise processed.

k. The electrical system will be designed so that major pieces of equipment can be energized/de-energized either directly or remotely. In any operation where a power failure would give rise to a hazardous situation, an auxiliary electrical power source or a fail safe system will be used.

l. Construction materials such as wood or other porous materials that absorb agent are difficult to decontaminate and should not be used in the construction of buildings where agent is to be stored, handled, or processed. Nonporous steel, glassbrick, or reinforced concrete are approved materials. Stainless steel and enameled steel are good materials for doors, cabinets, and furniture in agent areas. Existing facilities constructed of porous materials may be used provided the porous materials are sealed with approved epoxy paint such as Epiloid G and use of the facility is approved by AMC Field Safety Activity, ATTN: AMXOS-C. Wood or other porous materials may be used in temporary structures, e.g., cubicles, etc., provided the porous materials are sealed with epoxy paint, use of the temporary structure is approved by the local commander, and decontamination and disposal plans are formulated.

m. When an agent facility is designed, the buildings and/or equipment will be arranged according to the sequence of operations. Such an arrangement will make it possible to keep handling of agents at a minimum and will minimize the necessity for transferring of agents through non-agent areas. Based upon the prevailing winds in the area, the manufacturing buildings, operational areas, or storage areas will be located downwind from administrative buildings, public highways, and inhabited buildings, insofar as practicable.

n. Fire protection will be provided as required in chapter 12, AMC-R 385-100.

o. Eyewash fountains and safety showers must be readily accessible to all work stations in operating buildings. Portable showers and eyewash equipment should be provided in outside or remote operating areas.

p. Air supply systems used to provide breathing and cooling air for air supplied protective suits will be tested to ensure that they conform to or exceed the requirements for grade D air as given in the commodity specification, CGA Pam G-7.1, available from the Compressed Gas Association, Inc., 1235 Jefferson Davis Highway, Arlington, VA 22202. Air can be supplied by compressed systems, motor-blower units, or compressed breathing air cylinders.

q. An audible area alarm should be installed to provide an immediate warning to all personnel in the vicinity of the operational facility and within the 1 percent lethality distance based on the Maximum Credible Event (MCE) (ch 11) in the event of a known or suspected agent release.

r. Agent work areas will be provided with an appropriate ventilation system to--

(1) Collect and exhaust agent vapors from the work area.

(2) Provide mixing of air which is essential for monitoring work areas with agent detection devices.

(3) Provide a negative pressure within the work area to eliminate escape of agent vapors.

Local exhaust ventilation is the most effective and preferred method of controlling agent vapor; however, dilution ventilation may be required for specific conditions where local exhaust ventilation is not practical. In general ventilation airflow should be from clean areas to areas of increasing potential or actual contamination. Each filter bank comprising the ventilation system will be provided with a means to measure differential pressure across each bank of filters. Airflow gauges or alarms should be used to verify proper ventilation conditions. Regardless of the type of ventilation system used, the design should be based on recommended practices published in the latest edition of Industrial Ventilation, available from the American Conference of Governmental Industrial Hygienists, Committee on Industrial Ventilation, P.O. Box 16153, Lansing, MI 48901.

s. Gloveboxes used for containment of agent vapors will provide the following:

(1) Pressure within gloveboxes will be a minimum of 1/4 inch of water gauge below that of surrounding areas.

(2) Makeup air or inert gas should be allowed into the glovebox to prevent stagnation and buildup of agent concentrations. The makeup sources will be protected by filters, backflow dampers, or other means.

(3) Temporary openings into a glovebox (such as during glove replacement) must maintain an inward flow of at least 90 linear fpm if agent is contained in the glovebox.

(4) If a glovebox has large or permanent open areas, it should be considered a ventilation hood and subject to criteria in paragraph 8-2b, this regulation.

(5) If a toxic agent operation will involve pressurized vessels within the glovebox, that glovebox will be capable of containing the maximum credible pressure release from the vessels and will be leak-tested prior to each operation.

t. In the event explosives are present, all applicable safety rules for handling such items will be followed.

6-5. Criteria for containment of operations.

a. Operations involving filling of munitions, renovation, surveillance, maintenance, and demilitarization of agent-filled munitions assembled with explosive components may be inherently more hazardous than other operations. Appropriate containment is necessary for the protection of the employees performing such work and for the protection of other employees at the installation who are not associated with the work as well as the general public. Personnel responsible for planning, designing, and accomplishing the operations must assure that adequate safety is provided by incorporating the appropriate type of hazard containment. The various circumstances and facilities that may be encountered at such operations prevent publication of specific detailed containment requirements for each agent, each ammunition, and each operation. Nevertheless the general principles of hazard containment are addressed in this section and will be normally incorporated in operations such as manufacture, disassembly, demilitarization, and disposal.

b. No containment is required for operations associated with storage activities. Examples of such operations include shipping, storing, inventory, receiving, rewarehousing, minor maintenance, surveillance inspection, repair, and encapsulation. Minor maintenance of agent munitions is any function involving preservation and packing which does not involve any internal component. Emergency transfer in the event of agent leakage is also permitted without containment. These activities normally present an acceptable degree of safety except in the event of an agent leaker, and then the increased hazard is only to those operating personnel in close proximity to the leaker. In the event of a leaker, the use of personnel protective clothing and equipment is mandatory to protect operating personnel during decontamination procedures, repair, encapsulation, or agent transfer from the leaking ammunition or container. Operations requiring no containment when accomplished by normal methods which do not require the application of undue force include--

(1) Removal of increments, primers, and ignition cartridges from mortar ammunition.

(2) Drilling of set screws and stake marks when positive stops are provided to limit the drilling depth to preclude contact with the explosives and prevent agent release.

(c) Disassembly of armed or possible armed ammunition, except for application of explosive ordnance disposal (EOD) render safe procedures by, trained EOD personnel.

(d) Disassembly of explosive components from ammunition where there is significant evidence of damage, exudation of explosives, corrosion, or deterioration, unless testing, analysis, or evaluation determines that total containment is not required.

(e) Disassembly of explosive components from ammunition where undue force is required to accomplish the disassembly, i.e., tools used for disassembly must not apply significantly greater leverage, torque, extraction, or compression force than those required for the assembly. Undue force is any force which could cause any deformation of the munition item (other than minor surface deformation) or could reasonably be expected to cause any explosive component of the explosive train to be damaged and/or initiated.

(2) Operations requiring vapor containment include--

(a) Machine tool operations, e.g., punching, drilling, or sawing only for the purpose of removing agent from ammunition providing the equipment is designed to preclude contact of its cutting tool with explosives.

(b) Burster well removal after removal of explosives components.

(c) Transfer of agent from bulk storage tanks, one-ton containers, or ammunition into holding tanks, chemical detoxification reactors, incinerators, or similar processing equipment such as may be found in a production, demilitarization, or disposal operating line.

(d) Other than normal surveillance inspections, removal of fuzes, lifting plugs, or other components which result in access to areas of munitions where agent may be present. **CAUTION.** In the event bursters or other explosives components are stuck and require abnormal methods to accomplish removal, the requirements outlined in paragraph 6-5c(1) above will be followed or the agent will be removed (drill, drain, and detoxify) and the burster, etc., destroyed by demolition methods.

(e) Cleaning and derusting burster wells by hand or with hand operated power tools.

(f) Opening containerized leaking munitions.

6-6. Leaking munitions and containers.

a. Before starting operations, all agent-filled munitions and containers will be monitored for agent or contamination and every precaution will be taken to assure that agent exposure will not occur during operations. In the event a leaker or contaminated item is discovered during the monitoring operations, or in subsequent operations, the immediate area will be evacuated. Except for leaker removal and decontamination activities, re-entry into the

area will not be permitted until appropriate corrective actions have been accomplished, the area monitored to assure completion of decontamination, and the area certified to be below the PEL specified on paragraph 2-5a.

b. Upon discovery and confirmation of a leaking item, the crew will exit the magazine and notify the central control point. Prior to reentry, cuffs of the sleeves and legs on the M3 suit will be taped. Steps will be taken to reduce the levels of agent contamination until such time as containerization as specified by SB 742-1 can be accomplished.

6-7. Required chemical safety submissions.

a. Site plans, hazard-zone calculations, and safety submissions for all proposed lethal and incapacitating chemical agents and munitions operations will be submitted through command channels to Director, AMC Field Safety Activity, ATTN: AMXOS-SE, for review and approval or forwarding to Department of Defense Explosive Safety Board (DDESB). Safety approval of site plans will be obtained prior to the initiation of final design. Approval of final safety submissions will be obtained prior to contractual obligation for construction or the initiation of Army construction work. Site plans for lethal chemical demilitarization will be forwarded to the Office of the Program Manager for Chemical Munitions (Demilitarization and Binary), ATTN: AMCPM-CM-S, Aberdeen Proving Ground, MD 21010-5401, prior to being reviewed by AMC Field Safety Activity. Routine surveillance operations conducted in accordance with SB 742-1 are excluded.

b. Hazard-zone calculations (required for site plan approval) will be based on a realistic MCE which has a reasonable probability for occurring. When explosive components are present, the MCE will be based on the maximum credible effects given the detonation of the most disruptive explosive component.

c. Site plans, hazard-zone calculations, and safety submissions will be prepared or formally endorsed by the installation safety director to assure that appropriate safety standards and necessary precautions are incorporated.

d. Submissions must contain sufficient copies of enclosures so that two copies reach AMC Field Safety Activity, ATTN: AMXOS-SE. If the submission involves an Military Construction, Army (MCA) project, three copies should be received. Allow at least 45 days for normal processing and approval after receipt at AMC Field Safety Activity, ATTN: AMXOS-SE. In order to facilitate thorough review and obtain final approval, the following minimum information is required:

(1) For site approval--

(a) A narrative giving sufficient information concerning the mission and function of the various components of the operation for reviewers to have a general understanding of the project. Narrative will include an exact definition of operations to be conducted. It should be noted that the site is only approved for those operations listed and any other operations would

require an additional submission. This is necessary, as the maximum credible event could change with changing operations, resulting in a different one-percent lethality distance.

(b) Hazard-zone calculations prepared by the submitting installation clearly stating the MCE with all supporting assumptions and rationale and containing one-percent lethality distances calculated in accordance with DDESB Technical Paper Number 10. The use of the AMC Handbook for Chemical Hazard Prediction and the several available computer programs which are consistent with DDESB Technical Paper Number 10 should be used to facilitate calculations.

(c) Appropriately scaled drawings (1" = 400') showing the one-percent lethality distance established by the hazard-zone calculations. Drawings should also show information indicating explosive classes and limits of neighboring explosive facilities and one-percent lethality distances for neighborin chemical facilities.

(d) Information required by figure 5-1, items 1 through 4, 8, 10, and 11, AMC-R 385-100.

(e) If building configurations such as the use of collective filtering systems are used in determining the MCE, a general description of the system and systems specifications will be furnished.

(f) Evacuation procedures for personnel located within the public access exclusion distance (see ch 11 also).

(2) For safety submission and final safety approval, all of the above information required by remaining items in figure 5-1, AMC-R 385-100, and the following additional information, as a minimum, should be submitted: general plan views of buildings or the site, as appropriate, showing location of first aid equipment, emergency showers, hot line, personnel decontamination line, filter systems, mask area, level A protection areas, equipment testing and approvals as appropriate (e.g., APE equipment safety approval by AMC Field Safety Activity), communications systems, ventilation systems, and specifications, wind speed indicators, command post, TV monitors, security guards, fencing, and other items as appropriate. Information previously submitted with a site plan need not be resubmitted unless changed, however, the source of the information be explicitly referenced.

6-8. Equipment and tools.

a. Portable equipment and hand tools used in the manufacture, assembly, disassembly, handling, testing, or disposal of agents/munitions must be positively identified by a permanent marking system that cannot be removed through further use in agent operations, decontamination, or maintenance. Storage of such items should be segregated from items that have not been used in agent operations. Marking is not required for laboratory tools, equipment, glassware, etc., unless contaminated with agent. Contaminated laboratory equipment will remain marked until thoroughly decontaminated.

b. Records will be maintained listing all equipment that has been involved in agent operations and is being placed in standby status, removed and saved for future operations, or being converted to use in non-agent operations. Records need not be maintained for laboratory equipment unless contaminated with agent. Such records will identify the contaminating agent, the decontamination process used, and the methods and results of analysis used to confirm the decontamination process. This equipment will continue to be controlled until decontaminated, as described in paragraphs 5-1c(1)(b) and (c), this regulation.

c. Small items of equipment such as instrumentation, which have been internally contaminated, will be disassembled and necessary work performed in a negative pressure enclosure, i.e., hood or glove box whenever maintenance is required. M8 alarm does not require negative ventilation when working on the interior components. This item incorporates features within its design to preclude interior contamination.

6-9. Special operational provisions for emergency preparedness.

a. A central control point that is informed of all operations with agent will be established for coordination of emergencies. This control point is not required to be the center for chemical accident/incident control; however, the center may be used when it is more advantageous to the installation.

b. The work area will be clearly defined and access limited to only authorized personnel who have received appropriate safety training or are accompanied by someone who has been trained.

c. Work not necessary to the operations will not be performed in the areas of agent operations. Laboratories may have areas set aside for non-agent operations.

d. Adequate operable detection equipment and materials must be maintained at all work areas. Wind-direction indicators must be provided at all areas and located so they are readily visible to personnel in the areas.

e. Telephones, radios, or other means of communication for advising the operational control point of emergencies must be available at the work sites. Radios must be approved by local safety offices before they are used in operations involving explosives with electric firing or detonating devices.

f. Decontamination and first-aid equipment will be positioned at all agent operating sites. It is not necessary to man this type of equipment with non-operating personnel. Designated personnel will be trained to operate this equipment in the event of an emergency. A vehicle, suitable for use as an ambulance, will be readily available at the job site whenever operations are in progress.

g. For field operations, each crew will have one individual designated as the safety person to perform such duties to assure that the above equipment is

available and properly positioned, monitor communications equipment, assist personnel in donning protective clothing, and check for its proper fit, maintain records of entry/exit time, monitor stay times in TAP, assure protective clothing is properly decontaminated and doffed, etc.

h. A minimum of two trained people knowledgeable in agent exposure symptomatology, first aid, and treatment will be present during agent operations and will remain in visual contact with each other at all times or within the immediate access area when communication is provided and observation by operational control personnel is possible.

i. All personnel working with agent will be given an off-duty hour telephone number to which suspect exposures can be reported.

j. Workers will report any illness to the supervisor prior to start of daily operations or before leaving the job if the illness occurs during working hours.

k. Any agent exposure, suspected exposure, agent spill or release, or other abnormal situation that may result in personnel injury must be reported to supervisory personnel immediately after necessary emergency action is taken. Personnel with possible agent exposures will report for medical evaluation as soon as possible. All personnel involved in such a situation will have a cholinesterase level drawn that day prior to release from duty.

6-10. Pre-operational safety survey. Where site plans/safety submissions are required by paragraphs 5-1 and 5-27, AMC-R 385-100, a pre-operational safety survey of proposed or renewed chemical agent/munitions operations will be conducted by AMC Field Safety Activity, ATTN: AMXOS-C or delegated to the major subordinate command responsible for the operation. The survey will assure, as a minimum, that all provisions of the site plan/safety submission and AMC regulations are complied with and operator proficiency is demonstrated by performance of selected SOPs. Notification of proposed dates for pre-operational safety survey will reach AMXOS-C at least two weeks prior to requested date of survey.

CHAPTER 7

Personnel Protective Practices

7-1. Checking of safety equipment. The supervisor will be responsible for ensuring that safety equipment is checked and ready for use. Users will inspect the equipment before each use in accordance with appropriate regulations.

7-2. Training of personnel.

a. Supervisors are responsible for ensuring that the training outlined in this regulation is accomplished. Safety and medical personnel will provide technical assistance, approve, in writing, programs of instruction and lesson plans, and monitor selected training sessions. Additional training requirements are contained in AMC-R 350-4 "Training and Certification Program for Operating Personnel Involved in Conventional and/or Toxic Chemical Ammunition Operations."

b. Prior to being assigned to the operations, as a minimum, personnel will be trained and will demonstrate proficiency in—

(1) Operating procedures to include safety requirements.

(2) Recognizing hazards involved in the operation.

(3) Recognizing signs and symptoms of agent exposure.

(4) Administering first aid and self aid.

(5) Personnel decontaminating procedures.

(6) The execution of emergency procedures.

c. An on-going program of instruction will include—

(1) Techniques of wearing, adjusting, inspecting, and caring for personal protective masks and clothing.

(2) Use of first aid equipment.

(3) Recognition of signs and symptoms of agent exposure.

(4) Cardiopulmonary resuscitation (CPR), first aid, and self aid.

(5) Emergency procedures.

(6) Decontamination procedures.

d. Refresher instruction will be repeated at least annually. The physician in charge of the medical treatment facility will review and approve the content of first aid and CPR training and the personnel who will conduct the training.

e. The use of dry runs of operational and emergency procedures is encouraged.

f. In addition to the above training, fire protection personnel will also be made familiar with fire, explosion, and reactivity hazard data, physical/chemical data, emergency disposal procedures, etc.

7-3. **Safeguarding of personnel.** The following precautionary measures will be observed by personnel who work in contaminated, suspected contaminated areas, or where handling or contact with agent-filled items is involved (for laboratories *see* ch 8):

a. All clothing, including shoes, will be changed at the beginning and ending of the work shift upon arrival at a change house.

b. Open sores or wounds will be evaluated by the local medical authority and covered with impermeable dressing prior to admittance to the area.

c. Each worker will shower thoroughly with special attention given to hair, face, neck, and hands, using plenty of soap before leaving at the end of the work day.

d. Eating, drinking, chewing, and smoking within agent areas will be permitted only in specifically designated locations approved by AMC Field Safety Activity, ATTN: AMXOS-C. These locations will be in an area separated from the agent operating areas. Engineering controls and agent monitors will be used to assure that agent air concentrations do not exceed the permissible exposure limits specified in chapter 2. A single covered container of water or other suitable liquid replenishment and disposable cups may be located not less than 100 feet upwind from an outdoor operating site. Individual personal containers of drinking water are not authorized. Conditions under which eating, drinking, chewing, and smoking may occur will be specified in the operations SOP.

e. Supplies of decontaminating solution and emergency showers for personnel decontamination will be available at storage and operational areas when operations are in progress.

f. Each worker will be inspected for signs of agent exposure before leaving the installation. The inspection will be made by the supervisor or his designee.

g. Personnel who have been in areas of possible GB or VX exposure (normally personnel downwind of an agent release or personnel who were in areas of known agent contamination) will remain at the installation for at least 30 minutes after leaving the area. They will then be inspected for signs of

agent exposure, such as pinpoint pupils, and questioned for agent-related symptoms by the supervisor or his designated representative before departing the installation.

7-4. Medical examination. Preplacement, periodic, and termination physical examinations will be performed on all employees assigned to agent operations. The scope of examination, frequency of periodic re-exams and retention of physical examination records will follow the guidance issued by the USA Health Services Command and AMC Surgeon. Personnel who have physical conditions or diseases that would be aggravated by exposure to agent or that could be unduly hazardous to themselves or others will not be employed in agent operations.

7-5. Key medical personnel.

a. The AMC installation commander will assure appropriate Army Medical Department Activity (MEDDAC)/Medical Center (MEDCEN) Commander provides for medical support to chemical agent operations. Key medical personnel, military or civilian, who have not received specialized training in the treatment of agent casualties and in the development of appropriate occupational health support programs will be provided with such training prior to or as soon as possible after their arrival for duty. Installation commanders will coordinate the scheduling of this training with the supporting MEDDAC Commander.

b. The installation commander will advise the supporting installation medical authority of any new, unusual, or particularly hazardous activities which may require preliminary planning for support. Two to three weeks lead time should be given to assure availability of support.

c. When medical support is provided by non-MEDDAC personnel, the support will be reviewed by the AMC Surgeon for adequacy.

7-6. Emergency response equipment.

a. The following emergency response equipment and supplies will be immediately available at any site or facility where operations are conducted that involve agent items. Trained personnel will also be available to use this equipment.

(1) A government vehicle to serve as an ambulance.

(2) A communication system to summon aid.

(3) Appropriate decontaminating materials in sufficient quantities.

(4) Clean water for personnel decontaminating purposes.

(5) First aid equipment and supplies (to include dark or opaque goggles for mustard operations).

(6) Set of first aid instructions.

(7) Up to three MARK I Nerve Agent Antidote Kit injectors per person for GB or VX operations.

b. Injectors must not be stored in the proximity of organic solvents, even when sealed in polyethylene bags, as the vapors can cause the auto-injector to malfunction. Also the injectors must be protected from freezing because the injector may not function properly while frozen.

c. The physician in charge of each clinic in support of the chemical surety mission may elect to provide each individual employee with only one MARK I kit with two additional atropine injectors.

d. The following additional equipment as a minimum will be available for use in case of an emergency. Quantities will be sufficient for the operation being performed as determined by local medical personnel.

(1) Fresh water for flushing eyes.

(2) Five percent sodium hypochlorite solution (commercial bleach).

(3) Cloth, sponges, or gauze.

(4) Additional MK I kits for Nerve Agent operations.

7-7. Emergency medical identification.

a. Individuals (employed by installations assigned an agent mission) who may be exposed during the performance of operations involving agents will be furnished a medical alert card. A medical alert identification bracelet may be furnished to employees upon request by the employee or as determined to be required by the installation medical officer.

b. Personnel will be requested to wear or have the identification on their person during off-duty hours.

c. The identification bracelet, if furnished, and card will show the following information: "FOR EMERGENCY MEDICAL INFORMATION CALL (INSTALLATION MEDICAL OFFICER TELEPHONE NUMBER). U.S. GOVERNMENT SERIAL NO. (PERSONNEL IDENTIFICATION NUMBER). This person works with and may have been exposed to (type of agents by physiological action). Other special medical characteristics (list of allergies, special conditions, etc)."

d. Local procurement of emergency medical identification is authorized under provisions outlined in AR 385-32.

e. A system will be established at each installation assigned an agent mission to ensure appropriate response during nonduty hours for emergency medical information, advice, or assistance.

7-8. First aid procedures.

a. **General.** Although a prime consideration in first aid for an individual who has been exposed to vesicant (mustard) agent is immediate removal to an uncontaminated area, the risk of leaving liquid vesicant in the eye is so much greater than the risk of exposure to vesicant vapors during the short period of decontamination, that eye decontamination must be done despite the presence of vapor. Personnel exposed to nerve agents face two considerations in first aid. Exposure to GB poses primarily an immediate vapor hazard and individuals will be removed immediately to an uncontaminated area. VX is more of a percutaneous hazard and primary consideration will be given to removal of the liquid agent from the skin before removal to an uncontaminated area or atmosphere. During handling and decontamination of casualty cases, personnel will give consideration to their own safety, take necessary precautions, and wear prescribed protective clothing and equipment to avoid becoming exposed to agent.

b. **Mustard Exposure.**

(1) Eye and mucous membrane contamination. Speed in decontaminating the eyes is absolutely essential. The procedure is very effective for mustard in the first few seconds after exposure but is of very little value in preventing eye damage if the decontamination is delayed for one or two minutes after exposure. Remove person from the liquid source, flush the eyes immediately with water 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 the medical facility.

(2) Skin contamination. Remove person from agent source immediately. Flush skin and clothes with 5 percent sodium hypochlorite solution within one minute. Cut and remove contaminated clothing, flush contaminated skin area again with 5 percent sodium hypochlorite solution, then wash contaminated skin area with soap and water. If shower facilities are available, wash thoroughly and transfer to medical facility. (If thickened agent is involved, remove by scraping with something dull such as a plasterer's trowel.)

c. **Nerve Agent Exposure.** After removal from the contaminated area, the casualty will be decontaminated by washing the contaminated areas with commercial liquid household bleach (nominal 5 percent solution hypochlorite) and flushing with clean water. Mask will be left on the victim until decontamination has been completed unless it has been determined that areas of the face were contaminated and the mask must be removed to facilitate decontamination. After decontamination, the contaminated clothing will be removed and skin contamination washed away. If possible, decontamination will be completed before the casualty is taken to the aid station or medical facility. Due to rapid effects of nerve agents, it is extremely important that decontamination of personnel not be delayed by attempting to blot off excessive agent prior to decontamination with sodium hypochlorite. Care must be taken when decontaminating facial areas to avoid getting hypochlorite into the eyes or mouth. Only clear water will be used when flushing the eyes or mouth. Skin surfaces

contaminated with bleach should be thoroughly flushed with water to prevent skin irritation from the bleach.

d. An individual who has received a known agent exposure or who exhibits definite signs or symptoms of agent exposure will be given an intramuscular injection immediately with MK I kit auto-injectors.

(1) Some of the early symptoms of a vapor exposure may be rhinorrhea (runny nose) and/or tightness in the chest with shortness of breath (bronchial constriction).

(2) Some of the early symptoms of percutaneous exposure may be local muscular twitching or sweating at the area of exposure followed by nausea or vomiting.

(3) Although miosis (pinpointing of the pupils) may be an early sign of agent exposure, an injection will not be administered when miosis is the only sign present. Instead, the individual will be taken immediately to the medical treatment facility for observation.

(4) Injections using the MARK I kit injectors (or atropine only if directed by the local physician) may be repeated at 5 to 20 minute intervals if signs and symptoms are progressing until three series of injections have been administered. No more injections will be given unless directed by medical personnel. In addition, a record will maintained of all injections given.

(5) Administer, in rapid succession, all three Mark I Kit injectors (or atropine if directed by the local physician) in the case of <u>severe</u> signs of agent exposure.

e. If indicated, CPR should be started immediately. 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 exists.

CHAPTER 8

Laboratory Safety

8-1. General.

a. Agent operations and storage which are accomplished in a laboratory, as defined in paragraph 1-3h, are subject to the provisions in this chapter. Other provisions of this regulation apply only where referenced herein.

b. The requirements of chapters 1, 2, 10, and 11 apply to agent laboratories in their entirety. Requirements in paragraphs 6-1, 6-2, 6-4g, k, l, s, 6-5, 6-7, 6-9, 6-10, and all of chapter 7, except paragraph 7-3, are also applicable to agent laboratories.

c. Within a laboratory, containment of agent liquid and vapors is required at all times. When agent must be removed from the containment provided by the laboratory engineering controls, the following restrictions apply:

(1) For quantities of one milliliter or less of neat agent, one of the following is required:

(a) A double containment system.

(b) A single containment system with a protective mask worn.

(2) For quantities in excess of one milliliter of neat agent a double containment system is required.

d. A single containment system must totally contain agent liquid and vapor. Examples include glass bottles sealed with gaskets or parafilm tape, syringes with needle caps, septum bottles, sealed ampoules, and capped liquid impingers (bubblers).

e. A double containment system must provide total primary containment as above and, in the event of leakage or breakage of the primary containment, must totally contain agent liquid and substantially contain agent vapors. Examples of secondary containment include, but are not limited to, metal cans with friction fit lids containing absorbent material and sealed syringe carriers.

f. Operations requiring removal of agent from laboratory engineering controls without compliance with paragraph 8-1c are not considered laboratory operations and are subject to the remaining controls contained in this regulation.

g. Unattended overnight storage of agents will be in ventilation hoods or gloveboxes and requires double containment of agent. For operations in which the disassembly of equipment would result in increased hazards, (e.g. agent

generators and Q-testers) the double containment requirement is advisory requiring local waiver.

h. Bubbler analyses may be conducted outside of a ventilation hood provided the samples were taken from an area where significant contamination is not expected. Samples which were taken from areas with known or expected positive contamination (according to results of gross indicators such as blueband tubes or M256 detector kit) will be analyzed in a hood or glovebox and will be transported in double containment.

i. Nonrelated operations involving more than one agent should not be performed concurrently in the same room unless agents are separated by engineering controls, i.e., separate fume hoods.

j. Good housekeeping will be maintained.

k. SOPs for hazardous operations should contain a daily checklist to be used at the beginning of each day's operation to assure presence or function of first-aid supplies, decontamination materials, ventilation systems, warning signs/labels, uncluttered work area, protective clothing, etc.

8-2. Diluted Chemical Agent.

a. Operations which involve GB, VX, or mustard diluted to the drinking water standards in TB MED 577 are not subject to the provisions of this regulation. Local restrictions should be implemented as necessary.

b. For storage or operations involving dilute solutions of agent as defined in paragraph 1-3g the following may be applied:

(1) Dilute solutions may be stored in single containment within a refrigerator or freezer. The refrigerator or freezer will have a high temperature alarm to warn of malfunction and will meet appropriate electrical requirements for flammable materials if used.

(2) Engineering controls used for storage and operations with dilute solutions are not required to have back-up emergency power.

8-3. Ventilation.

a. General.

(1) Laboratories will be equipped with either laboratory-type ventilation hoods or gloveboxes to provide the engineering control necessary to contain agent during operations. Hood and glovebox materials should be agent resistant and easy to decontaminate. Hoods and gloveboxes will be provided with catch trays and basins of suitable size for agent operations.

(2) Ventilation systems will be designed so that air flow is away from the operator and toward the potential source of agent. Air pressure

within the laboratory will be maintained below that of surrounding areas and entry corridor.

(3) A record noting filter replacement dates for each air filtering system will be maintained. Ventilation requirements in paragraphs 6-4a and 6-4r apply to ventilation systems in laboratories.

(4) A scheduled preventive maintenance program should be established to provide continued assurance of adequate ventilation performance.

(5) Ventilation exhaust will not be recirculated or used as makeup air for areas occupied by unprotected personnel. Makeup air diffusers will not be located so as to cause turbulence at the laboratory hood face.

(6) Ventilation hoods or gloveboxes used for overnight storage of agent should not be used for any agent operation except transfers from storage and related dilutions unless only 100 ml or less of a single category of agent (i.e., nerve agents versus vesicant agents) is stored therein. Charged agent generators may be used in the same hood in which they are stored if no other agent is stored in that hood.

(7) Where ventilation is a sole or prime method of personnel protection, back-up emergency power (automatic start generator) or other fail-safe systems should be installed to prevent exposure in the event of an unplanned power outage.

b. Laboratory hood.

(1) A laboratory hood in which agent operations are conducted will provide an average face velocity of 100 +/- 10 linear feet per minute (lfpm) through the working opening. A traverse of one measurement per square foot (approximately) should be used to compute the average face velocity. No reading may deviate from the average face velocity by more than 20 percent. Measurements will be made every three to six months or when system has undergone major repairs. Sash stops should be used so that measurements can be taken at the full-open position. Hoods used only for the storage of double-contained agents (no operations) are not subject to upper limits on air flow when the hood sash is lowered and locked for security. Existing laboratory hoods designed and approved at 150 +/- 30 lfpm may continue to be used until they can be modified to the above criteria provided containment is verified by smoke tests.

(2) For ventilation hood exhaust systems, which contain filters that have been used for agent operations and the working area of the hood no longer contains agent or agent contaminated material, the ventilation system must maintain an inward airflow through the hood as verified by smoke tests or other visual means. The above minimum face velocities, however, are not required. If the filter system is isolated from the hood (i.e., back flow dampers, blind flanges, etc.), this paragraph does not apply.

(3) The design exhaust volume of the hood should provide excess initial capacity.

(4) New hood installations should make maximum use of proven technologies such as by-pass construction, untempered supplied air, multiple baffles, and other enhancements to provide optimal containment. Guidelines are contained in United States Army Environmental Hygiene Agency (USAEHA) Technical Guide #30, Guidelines on Design of Chemical Laboratory Hoods, November 1978.

(5) Effluent air from laboratory hood systems must not contain concentrations of agent in excess of permissible concentration as stated in paragraph 2-5b and c considering appropriate dilution factors from the discharge location to the location of personnel access. If the quantity of agent being used or the type of operation is such that this amount may be discharged into the atmosphere, the discharge of the ventilation system must be equipped with chemical-type filters or other air treatment systems to reduce the agent in the effluent to an acceptable level.

(6) Existing hood ventilation systems will be equipped with an audible alarm device which will give a warning should the ventilation system fail because of power failure, mechanical malfunction, or if the average face velocity falls below 90 linear fpm. For new construction, hoods will be provided with both visible and audible alarm devices. Visible alarms will be located so that they can be readily seen by personnel while working at the exhaust hood. For storage hoods, the visual alarm should be visible from outside the room containing the hood. Alarms should be periodically function-tested, but as a minimum not exceed six months.

(7) Each laboratory room will have a means of assessing approximate hood face velocity prior to beginning operations each day. A hanging vane velometer is considered sufficiently accurate.

(8) No agent or agent contaminated equipment located inside a ventilation hood will be allowed within 20 centimeters of the hood face. This zone should be designated by paint or tape.

c. Glovebox requirements for the laboratory will be consistent with those in paragraph 6-4s, this regulation.

8-4. Agent monitoring.

a. A detection capability with a sensitivity equal to or better than the IDLH (para 2-5a (5)) must be maintained within the laboratory or readily available outside the laboratory.

b. During the first five days of new agent operations, monitoring at the PEL will be conducted to verify the adequacy of engineering controls. Remonitoring will be conducted for one operating day quarterly following significant changes in the operation or following any significant damage or repairs to the

ventilation system. If the only change in the operation is to an agent of lower volatility, remonitoring is not required.

c. First entry.

(1) The following conditions require that first entry monitoring, protective clothing, and decontamination procedures, in accordance with chapters 3, 4, and 5 respectively, be accomplished. Unmasked personnel may not re-enter until airborne contamination is verified to be below the permissible exposure limit specified in paragraph 2-5:

(a) Agent spill outside of containment.

(b) Major (relative to controls in place) agent spill within hood.

(c) Ventilation failure of hood with uncontained agent.

(d) Ventilation failure of a hood containing any agent and lasting longer than 24 hours.

(2) For the following conditions, first entry will be conducted with a gross-level detector while wearing level E protection with mask worn. If positive results are obtained, paragraph 8-4c(1) will apply. A protective mask will be worn until ventilation has been restored for at least 30 minutes:

(a) During a loss of ventilation in a hood with single or double contained agent not exceeding 24 hours.

(b) Following loss of ventilation in a hood with single or double contained agent (less than 24 hrs) if ventilation has not been restored for at least 30 minutes.

(c) Following restoration of ventilation (for at least 30 minutes) in a hood containing single contained agent provided the ventilation loss did not exceed 24 hours.

(3) For the following conditions, entry in level E or F with visual observation for tampering, leakage, or ventilation failure is acceptable:

(a) Normal entry with no apparent problems.

(b) Following restoration of ventilation (for at least 30 minutes) in a hood containing only double contained agent provided the ventilation loss did not exceed 24 hours.

d. Prior to removal from engineering controls, agent containers will be thoroughly decontaminated externally and sampled for surface contamination with M8 paper.

e. When setting up alarms, gas chromatographs, or other agent monitoring equipment, whether for protective monitoring or process/experiment monitoring, it is necessary to ensure that the sampling device does not draw air out of a potentially contaminated location and exhaust it outside of engineering controls. Many sampling devices have sample line regulators or sample transport pumps that cause more sample volume that is required to be delivered to the monitoring device. This excess, which is then by-passed or exhausted, must remain within engineering controls. Where sample lines containing agent extend outside engineering controls, double-walled lines or equivalent redundancy will be used.

f. The provision of paragraphs 3-1, 3-2, 3-3, 3-4, and 3-7 also apply.

8-5. Protective clothing and equipment.

a. Approved protective masks will be issued to all personnel who are routinely assigned to agent operations. Training in the use of the masks will be provided. A properly fitted mask with instruction in its use, and how to react in the event of an emergency, will be provided to all transients entering areas in which chemical agent is being used or stored. The mask must be readily available to each individual in the room in which agent is being used or stored.

b. Personal protective clothing such as butyl gloves, aprons, and TAP clothing necessary to protect personnel during operation and for use in case of emergency will be kept readily available. Clothing sizes will be appropriate for the personnel who might need to wear them.

c. Protective gloves worn in laboratory operations will be either standard TAP gloves or nonstandard gloves tested in accordance with the provisions of chapter 4. Butyl 7 mil gloves, NSN 8415-01-138-2501 through 2504 (S, M, L, XL), and 14 mil gloves, NSN 8415-01-138-2497 through 2500, may also be used.

d. Surgical gloves may be used (without testing) only if the total quantity of agent accessible is less than 1 milliliter; a time limit of 5 minutes from the beginning of access to uncontained agent is established; an individual wearing approved gloves (nonsurgical) is dedicated to watch and to provide immediate emergency response for spills, accidents, or agent contact with gloves; and the Chief, local safety office certifies that other approved gloves should not be used. Users of surgical gloves must also avoid sources of ignition.

e. The wearing of protective gloves is intended to preclude any contact of skin with agent. No glove may be used that will not preclude such contact in the event of an actual spill. In addition, the glove must provide reasonable protection against unrecognized contamination.

For types of gloves for which use is authorized, the following procedures are considered reasonable:

(1) Standard gloves (M3, M4, and gloveset gloves).

(a) Prohibit operations with intentional liquid contamination of the gloves.

(b) If liquid agent contamination occurs, decontaminate immediately and continue operation. Upon completion, decontaminate again, remove gloves, place in plastic bag, and remove from hood. Treat as decontaminated (X) clothing until the gloves have been monitored and laundered in accordance with chapter 4 unless contamination is major, in which case they should be disposed of.

(c) If no known liquid contamination occurs, the gloves may be decontaminated, removed, and left inside the hood by the edge. They may be reused in a similar fashion until the end of the day when they will be decontaminated, bagged, removed from the hood, and set aside for later monitoring and laundering.

(2) Nonstandard gloves.

(a) Prohibit operations with high probability of liquid contamination of the gloves. Use time will be measured as elapsed clock time from initial access to potential contamination.

(b) Restrict the use and duration as required by the type of acceptance testing performed.

(c) If liquid contaminated, decontaminate immediately, discontinue operation if it can be done safely, remove gloves, and place in plastic bag or other container, and remove from hood as contaminated waste. Wash hands promptly and thoroughly with soap and water.

(d) If no known liquid contamination occurs, the gloves may be decontaminated and reused as in paragraph 8-5e(1)(c) above, except nonbutyl gloves will be destroyed (in accordance with ch 4) instead of laundered. Mutilation or other means to prevent reuse of gloves to be destroyed is recommended if they are not bagged immediately.

f. All personnel handling agent containers will wear, as a minimum, level E protective clothing with gloves. Supervisors/visitors may wear level F. Protective gloves will be worn by all personnel accessing agent operating areas (e.g., hoods) wherever agent is present in the hood.

(1) Ungloved entry is permitted under the following conditions:

(a) Agent has not been placed within hood confines.

(b) Decontamination status, at least 3X, for hood is known.

(c) Handling of potentially contaminated items/equipment is not conducted.

(2) Removal of protective gloves from hood without decontamination is limited to the following:

(a) Contact with agent, primary agent containers, or potentially contaminated items or equipment has not occurred.

(b) Gloves are not potentially contaminated as a result of experimental procedures being conducted.

(c) If no known liquid contamination occurs, the gloves may be decontaminated, removed, and left inside the hood by the edge. They may be reused in a similar fashion until the end of the day when they will be decontaminated, bagged, removed from the hood, and set aside for later monitoring and laundering.

8-6. Facility requirements

a. All entrances to laboratory rooms in which agent is present will be posted with signs warning personnel of the presence and type of agent within the room and any special entrance requirements.

b. Floors, work surfaces, and walls will have surfaces that resist agent absorption and can be readily decontaminated. Flooring should be coved six inches onto all wall surfaces.

c. Emergency deluge-showers and eye-wash fountains will be readily accessible to all work situations within the laboratory. (Portable eyewash fountains are not acceptable).

d. Entry to laboratory will be restricted to authorized personnel. This restriction can be indicated by signs or enforced by locks. The laboratory or individual rooms or storage/work hoods containing agent must be capable of being locked during nonwork periods and will be locked when unoccupied. All methods employed for locking systems should be consistent with the life safety code requirements for hazardous areas and appropriate security measures.

e. Where in-line canister-type filters are utilized for filtering effluents from laboratory apparatus, a filter-use record will be maintained, noting the date or conditions when replacement is due.

f. Means of egress must be continuously maintained free of all obstructions or impediments to allow full instant use in case of a fire, agent release, or other emergency. Means of egress must not exit into an area of greater hazard. For new construction, one means of egress must be directly to the outside or to a safe area (outside no-effects distances). See paragraph 11-9 for dosage at which this distance is to be calculated.

g. Compressed gas cylinders which are not necessary for current laboratory requirements will be stored in a safely arranged location outside the laboratory.

h. Facilities will be available for washing hands and arms prior to leaving the agent area.

i. Permanent office equipment facilities (including desks) should not be maintained within an agent laboratory room. Desks for note-taking, logs, or record-keeping are acceptable if directly related to the agent operations in that laboratory.

j. Check-valves, vacuum breakers, charcoal filters, and similar means should be used to avoid inadvertent transfer of agents to uncontaminated areas and equipment.

8-7. Personnel practices.

a. All agents will be stored in a restricted laboratory, locked hood, or other facility to which access can be positively controlled.

b. Prior to assignment to such work, personnel who will work with agents will be trained in the use and handling of toxic agents; in the donning, wearing, and doffing of protective clothing; in the use of decontaminating materials; and in procedures to be followed in the event of a spill or exposure. Key laboratory personnel should be given standardized laboratory analytical procedures training conducted by United States Army Defense Ammunition Center and School (USADACS).

c. When conducting agent activities, only personnel necessary to the operation will be permitted in the laboratory work area; however, a minimum of two qualified persons will be present in accordance with the two-person concept of AR 50-6.

d. The installation fire-fighting personnel and the security force will be notified of the presence and type of agent and room in which it is located.

e. Storage compatibility group standards (AMC-R 385-100) do not apply to research, development, test, and evaluation (RDT & E) stocks of one liter or less. A reasonable effort should be made to group agents of like physiological effects together but generation of additional storage locations is not required to accomplish this.

f. Mechanical pipetting aids will be used for all pipetting of agents or agent solutions.

g. The storage or consumption of food or beverages; the storage or application of cosmetics; the smoking or storage of smoking materials, tobacco

products or other products for chewing; or the chewing of such product in all laboratory areas, is prohibited. Laboratory glassware will not be used to prepare or consume food or beverages.

h. Agent first-aid kits will be maintained in each laboratory operating or storage room in accordance with paragraph 7-6.

i. Each inner container and the outer container of chemical agents and agent candidates will be labeled with its agent and/or code name to properly identify the contents. The label will have a red border and will have dimensions at least 4.5 by 5.5 inches when container size permits. As necessary, the dimensions of labels for small inner containers may be as small as approximately one-fourth those stated above. The color of inner and outer container labels, as well as information thereon, will be identical. Labels will contain the following information:

(1) "TOXIC CHEMICAL" in bold red letters.

(2) The original issue quantity of agent in the container stated in metric terms and the concentration if diluted. This quantity should be updated as required when a formal inventory is conducted.

(3) The operating activity responsible for storage and the numbers of the building and room where the material is stored.

(4) The name and telephone number of the custodian of the material.

(5) The date when the material was first placed in storage.

(6) Special instructions or notes regarding use or removal of the contents.

(7) Some method of identification of the person who prepared the solution or agent quantity.

Those inner containers too small for complete information as above must have name or code name of agent clearly marked and may refer to remainder of information by locally determined system.

8-8. Decontamination.

a. A supply of decontaminating material appropriate and adequate for the type and quantity of agent present and equipment for its use, if required, will be immediately available in the laboratory.

b. Detoxification of agent in a laboratory hood or glovebox is limited to a maximum of 50 grams of agent (neat or in solution) at any one time unless approval for a greater amount is given in the site plan/safety submission.

c. The amount of contamination received by an article is a function of its absorption characteristic, the presence of liquid or vapor agent, the time inside the hood where it is placed, and the type of agent:

(1) Material and equipment exposed to liquid agent must be considered contaminated and must be controlled (decontaminated or contained) and identified (labeled) prior to removal from hood.

(2) Porous material and equipment that has remained in the hood for one week or longer or has been exposed to significant vapor contamination should be considered potentially contaminated and treated as in paragraph 8-8c(1) above.

(3) Glassware, such as bubblers that have not been exposed to liquid contamination, may be removed from a hood.

d. Checking by analytical methods for residual contamination, after detoxification of agent, is not necessary if the agent is known to be in solution, appropriate decontaminants are used in calculated excessive amounts, the time allowed for reaction exceeds many half-lives, and no interference (slowed reactions, low temperatures) or other complications are reasonably expected. Decontaminated solutions which meet these criteria may be considered as XXX and need not be stored in an approved hood. Small quantities of laboratory waste (gloves, paper towels, glassware, etc.) that have been submerged in and thoroughly wetted with appropriate decontaminant for at least 24 hours may also be treated as XXX if not removed from the decontaminant.

e. Laboratory animals injected with or ingesting agent are not considered contaminated unless massive doses relative to the animals are given. Other exposed animals require decontamination and disposal by incineration.

THIS PAGE INTENTIONALLY LEFT BLANK

CHAPTER 9

Storage

9-1. Storage requirements.

a. Standing operating procedures implementing the requirements of this regulation will be established locally and approved in accordance with AMC-R 385-1 and AMC-R 385-100. Emphasis is to be given to the following storage philosophy:

(1) Agent-filled munitions containing explosives will be stored in igloo-type magazines.

(2) Except for mustard-filled ton containers, agent-filled munitions that do not contain explosives will be stored in igloos or other approved storage structures specifically approved by HQ AMC. Mustard-filled ton containers may be stored outdoors.

(3) Magazines or structures used for the storage of agent-filled items or containers will be in a specifically designated area.

(4) Structures used for the storage of agent-filled items will have floors and floor surfacing which can be decontaminated. Bulk agent containers stored outdoors will be placed on steel dunnage (wood dunnage may be used as a temporary measure), positioned over crushed stone, gravel, or porous earth surfaces to minimize atmospheric contamination in event of leakage. Sites should be selected that are not in proximity to surface water sources and which are not located over underground water sources that could become contaminated. Direct drainage to a body of water is prohibited. Provision will also be made to assure compliance with applicable water pollution regulations.

(5) Ton containers of bulk agents will be stored in a horizontal position with the container oriented so that the valves are in vertical alignment. (Due to impurities in mustard agent that tend to clog eduction tubes, containers of H will be oriented so that the valves are in horizontal alignment.)

(6) It is undesirable to have security forces patrolling with masks donned; therefore, agent storage areas (excluding igloo areas) should be checked by first entry monitoring procedures so that patrols may be conducted without masks being worn. In the event it is necessary for security forces to patrol within a toxic storage area (excluding igloo storage areas), and the area has not been checked by first entry monitoring procedures within the previous 24 hours to verify that the area is clear, security forces will wear appropriate protective masks while conducting their patrol. Controls must be established to assure security personnel are notified if monitoring of the area has not be accomplished within 24 hours prior to patrolling.

(7) The ends of ton containers should be kept painted and free from rust to enhance the visual detection of agent leakage at the valves and plugs. Mustard, GB, and VX agents have a solvent action on most paints which cause peeling, dissolution, blistering, and discoloring in the vicinity of the leakage. To facilitate inspection for leakage, shipping bonnets will not be installed on ton containers in storage.

(8) Stacks, groups, or areas of outdoor storage are not quantity limited.

(9) Outdoor storage areas within the chemical area should be separated from magazines or areas containing explosives components by the appropriate minimum magazine distance based on the quantities of explosives.

(10) Munitions or storage containers having different agent fills must be stored separately from each other.

b. Only the minimum number of personnel (but not less than two people), consistent with safe and efficient operations, will be permitted at the operational site. The following rules will be observed:

(1) Work performed in magazines and storage areas will be the types permitted in chapter 18, Storage of Explosives and Ammunition, AMC-R 385-100. Prior to start of operations, monitoring will be accomplished in accordance with the requirements of chapter 3.

(2) Leaking munitions and containers will be handled only by authorized personnel who have been instructed and are qualified in the appropriate procedures to be used.

(3) Leaking munitions will be encapsulated in specially provided containers until final disposition is accomplished. At those installations where magazine space within the chemical area is available, the encapsulated leaker will be stored in a separate magazine. When a separate magazine is not available within the chemical area, the encapsulated leaker should be appropriately identified and retained in the same magazine with similar serviceable munitions, but separated to the greatest extent possible, and a waiver request to provisions of paragraph 11-4b and Table 19-2 of AMC-R 385-100 be submitted to AMC safety. Encapsulated munitions will not be opened within a magazine in which other serviceable munitions are stored.

(4) Material contaminated with chemical agent may be transported from one location to another. The material must be encapsulated so that the concentration of agent on the outside of the encapsulating material does not exceed those in paragraph 2-5a.

c. Chemical Hazard Symbols as described in chapter 11, AMC-R 385-100, will be used to identify areas designated for the storage of agents. Posting of hazard markers will comply with the following:

(1) When a magazine area is used exclusively for storing only one type of chemical agent or agent-filled munition, the entrance to the storage area may be identified with hazard symbols indicating the type of agent stored in lieu of posting hazard symbols on each magazine or storage pad.

(2) When an entire row of magazines or storage pads within a storage area is used exclusively for storing only one type of chemical agent or agent-filled munition, access road entrances servicing that row of magazines or pads may be posted with hazard symbols identifying the chemical agent stored in lieu of posting hazard symbols on each magazine or storage pad.

(3) When a magazine area or outdoor site is used for storing different types of chemical agents or agent-filled munitions, each magazine or storage pad will be posted with a hazard symbol to properly identify the chemical agent stored.

(4) Facilities used for agent manufacturing, filling, processing, etc., will be identified by posting the appropriate agent hazard symbols at entrances into the area and on each separate building when more than one building is involved.

(5) Where topography and/or vegetation would prevent personnel from seeing a chemical hazard marker until arrival at a storage site, a master list will be maintained which indicates igloo location, fire division symbol, and chemical agent type, if applicable. This list will be kept current and available to emergency forces, e.g., guard forces, fire department, chemical accident and incident response and assistance (CAIRA) team, etc.

(6) In addition to the above, fire division symbols must be posted on igloo magazine and outdoor storage sites when such facilities are used for storage of fire division symbols 1 through 4 chemical munitions. When a magazine block contains ammunition/explosives on only one fire division, fire symbols are not required for individual magazines. A fire symbol at each point of entry to the block is sufficient.

d. Wooded areas within, or immediately adjacent to, the border of chemical exclusion areas can significantly reduce the required one-percent lethality distances to both onpost nonrelated inhabited buildings and offpost inhabited buildings. Except for maintaining the required fire break around each magazine and the security clear zone around the perimeter of chemical exclusion areas, cutting or harvesting of trees is prohibited within the one-percent lethality distance unless specifically approved by AMC Field Safety Activity (AMXOS-C). Normal selective thinning not to exceed 70 square feet basal area is acceptable.

e. Explosively configured agent munitions may be stored in the same structure as class 6.1 munitions of the same fill.

9-2. Storage drawings. Storage of chemical agents/munitions will be in accordance with AMC approved standard drawings. Storage drawings and changes thereto will be forwarded to Director, AMC Field Safety Activity, ATTN: AMXOS-C, Charlestown, IN 47111-9669, for safety review.

9-3. Material handling equipment (MHE). Unless specifically authorized by the Field Safety Activity, AMXOS-C, only electrically operated MHE may be used within enclosed areas containing chemical agents or munitions. Requests for authorizations will specifically address the effects of exhaust gases on protective clothing, charcoal cannisters and filter elements, and agent monitoring equipment. Gasoline, diesel, propane, or liquefied petroleum gas (LPG) fueled MHE will not be used in earth covered or Richmond-type magazines because of the hazard of carbon monoxide. Exceptions are specifically approved "clean burning" MHE.

CHAPTER 10

Shipping

10-1. Shipping requirements. This chapter contains the requirements essential for proper handling and transportation of agent-filled munitions and containers. In addition to the shipping requirements outlined herein, the provisions set forth in AR 50-6, AMC-R 55-1, and Title 49 Code of Federal Regulations (Department of Transportation) must be observed.

10-2. U.S. Department of Transportation (DOT) classification.

a. For shipment, mustard, GB, or VX filled munitions and containers are classified by DOT as Poison A, "Poison Gas."

(1) Projectiles, shells, bombs, mines, etc., containing poison A materials but not equipped or packaged with ignition elements, bursting charges, detonating fuzes, or explosive components must be labeled with poison gas label and non-explosive (49 CFR 173.330).

(2) Projectiles, shells, bombs, mines, and grenades containing poison A materials and equipped with ignition elements, bursting charges, detonating fuzes, or explosive components must be labeled with poison gas label and explosive label (49 CFR 173.59).

10-3. Requirement for escort. All shipments of mustards, GB, or VX will be escorted in accordance with AR 50-6 and AR 740-32.

10-4. Responsibilities of agencies initiating and receiving shipments.

a. Reporting of fires, leakage, lost containers, or other types of accidents/incidents must be made immediately, in accordance with AR 385-40.

b. Transportation.

(1) Routing. Routing of shipments will be determined by the controlling transportation movement activity in conjunction with the CONUS Army movement monitor (AMCCOM). Shipping routes should be selected to avoid congested areas and peak traffic periods to the maximum extent practicable and to ensure maximum availability of emergency equipment.

(2) Monitoring for leakage enroute. The items will be monitored for leakage in route. This may be done continuously or at approximately 8-hour intervals or at convenient rest stops. The SOP of the escorting group will outline the procedures to be followed and the equipment to be used.

(3) Rail shipments. Rail shipments of mustard, GB, or VX filled munitions and containers must be accomplished in class A enclosed steel cars and certified as required for explosives class A material. Bulk agent in one-ton containers may also be shipped in ATMX one-ton container cars or in

cars equipped with roller bearings in accordance with DOT transportation regulations, Code of Federal Regulations (CFR), Title 49.

(4) Water shipments. Water shipments of mustard-filled items will be in conformance with Title 46 CFR or the Tariff No. BOE-6000-C. Shipment of GB or VX will be in conformance with U.S. Coast Guard Regulation, CG 108, Military Explosives and Hazardous Munitions.

(5) Air shipments. Shipment of mustard, GB, or VX by military aircraft will be in accordance with TM 38-250, Packaging and Handling of Dangerous or Hazardous Chemical Materials.

10-5. Other regulations. In addition to the shipping requirement outlined as reference above, DA policy is to comply with applicable state or local regulations governing such transportation provided this compliance does not prevent the Army from accomplishing its mission. Note. Public Laws 91-121, as amended by PL 91-441, (50 U.S.C. 1511-1518), specifies procedures for the transportation of lethal chemical agents except for research quantities or emergency disposal situations.

10-6. Shipment of dilute solutions.

a. For purposes of shipment, dilute solutions (as defined in para 1-3g, this regulation) can be shipped as class B poisons without need for escort.

b. Dilute solutions will be prepared for shipment in the following manner:

(1) Cap dilute solution container and seal with parafilm tape.

(2) Overpack in metal can with tight-fitting lid (or a non-shatterable container when double contained material is shipped in a secondary metal overpack container) which contains sufficient absorbent material for amount of liquid.

(3) Seal rim with parafilm tape.

(4) Place in dry ice or cold packs, as necessary.

c. Ship solutions in accordance with DOT requirements for hazardous materials, Title 49 CFR, paragraphs 173.344 and 173.359.

10-7. Shipment of bubbler samples. Bubbler samples that have been determined to be dilute (samples taken from an area where significant contamination is not expected and where no positive readings from a gross level detector/monitor were obtained) will be prepared and shipped in accordance with paragraph above, and the following:

a. Depending on the collection media in the bubbler, requirements other than toxicity (e.g. flammability) will be determined locally and included for shipping.

b. Maximum number of bubbler samples per shipping container will be limited to sixteen with total liquid not exceeding eight ounces.

c. Bubblers should be placed in dry ice or cold packs for shipment as necessitated by paragraph 3-1d.

10-8. On-Post Transportation.

a. Prior to any on-post movement of toxic chemical agent, a hazard analysis will be performed for the total operation.

b. The hazard analysis should include but not be limited to--

(1) Personnel protection.

(2) MHE.

(3) Procedures used in removal from storage.

(4) Item containment.

(5) Loading and unloading of the transportation vehicle.

(6) Suitability of the transportation vehicle (i.e., bed of impermeable material required, open bed or closed van).

(7) Transportation route to include distances involved, population exposure, surface types, and traffic to be encountered.

(8) Monitoring requirements.

THIS PAGE INTENTIONALLY LEFT BLANK

CHAPTER 11

Separation Distance Criteria

11-1. General.

a. The risk to personnel at any point in the path of a chemical agent cloud released from munitions as a result of an accident or leakage is a function of the inherent toxicity of the agent. The mean concentration is influenced by the general climatic conditions, particular temperature gradient near the ground, and the topographical features. Persistent agent concentrations are even more affected by natural conditions since in view of the time factor involved much wider variations are likely to occur and alter diffusion and cloud travel characteristics. Evaporation from the source is an additional factor which varies considerably with temperature, wind speed, and the vapor pressure of the agent. The accidental functioning of the burster charge in a chemical munition resulting in maximum aerosolization of the agent filler will require prompt action to identify the path and downwind concentration of the agent cloud.

b. In consideration of the variables involved, operational facilities, activities, and storage sites must be selected to provide the maximum separation distance to nonrelated personnel located on the installation as well as to the general public.

11-2. Public access exclusion distance (PAED). The PAED is defined as the greater of the inhabited building distance (based on the fragment hazard distance or the net explosive weight (NEW) of the munitions) or the one percent lethality distance defined below. For siting purposes, the PAED is analogous to IHBD for explosives and personnel not directly associated with chemical operations are not to be allowed within the PAED. Evacuation or protection of personnel prior to exposure may be allowed in lieu of absolute exclusion. Details of the evacuation procedures will be included in the site plan and safety submission.

11-3. Maximum credible event (MCE). In accordance with standards established by Department of Defense, the potential for an accident or incident must be carefully analyzed to determine the MCE that could occur and cause agent release. For chemical munitions which have explosive components assembled in them, the MCE will be based on functioning of the most disruptive component which would produce maximum release of agent. The MCE must be realistic with a reasonable probability of occurrence. The propagation characteristics of the munition and damage to adjacent munitions sufficient to cause leakage of the agent filler must also be considered. For chemical munitions without explosive components, spillage or leakage of the agent fill usually determines the MCE. Other factors affecting the MCE are rate of release, puddle size, time of decontamination, type of surface, and the agent's characteristics.

11-4. One-percent lethality distance. The one-percent lethality distance is calculated from a given MCE and meteorological conditions (temperature, wind

speed, etc.) and is established as the distance at which the dosage from an MCE or actual agent release would be 150 mg-min/m^3 for H and HD agents, 75 mg-min/m^3 for HT agent, 10 mg-min/m^3 for GB agent, 4.3 mg-min/m^3 for VX vapor, and 0.1 mg for inhalation/deposition of liquid VX. The meteorological conditions used will be the existing conditions in the event of an actual agent release or the realistic worst-case conditions used will be the existing conditions for siting purposes. Meteorological information must be obtained from an accurate source with the methodology presented in DDESB Technical Paper No. 10, Methodology for Chemical Hazard Prediction. The use of the AMC Handbook for chemical hazard prediction and the several available computer programs which are consistent with DDESB Technical Paper Number 10 should be used to facilitate calculations.

11-5. **Inhabited building distance.** Inhabited building distance for chemical munitions containing both explosive components and agent filler will be as shown in applicable tables of AMC-R 385-100, based on the hazard class involved. Most chemical munitions within AMC are (12)1.2 hazard class. This distance category is applicable to separation of nonrelated operations, conventional ammunition storage, and installation boundaries from chemical operations.

11-6. **Intraline distance.** Intraline distance for chemical munitions containing both explosive components and agent filler will be as shown in applicable Tables of AMC-R 385-100, based on the hazard class of the munition involved. This distance category is applicable to separation of related operations, facilities, and support facilities within an operating area such as maintenance buildings, change-houses, lunch rooms, field offices, laboratories, laundries, and storage magazines. The intraline distance will be a minimum of 100 feet whether or not explosive components are involved, unless otherwise approved by AMC Field Safety Activity (AMXOS-SE).

11-7. **Magazine distance.** Magazine distance for chemical munitions containing both explosive components and agent filler will be as shown in applicable Tables of AMC-R 385-100, based on the hazard class of the munition involved. For storage of dissimilar class 6.1 agents (without explosives) the magazine distance is 50 feet.

11-8. **Public highway and railroad distance (PHD).** For chemical hazard distance computation purposes, all state and multilane interstate highways and major railroad lines will be considered as inhabited areas and the greater of Public Traffic Route (AMC-R 385-100) or one-percent lethality distance will apply. With respect to the application of one-percent lethality distance, other roads and railroads will be evaluated on a case-by-case basis with consideration given to the traffic density for peak periods.

11-9. **Evacuation/protective distance.** In the event of an actual agent release that threatens unprotected personnel, every effort must be made, in proper coordination with civil authorities, to evacuate or offer protective advice (i.e., remain in homes, etc.) to all people that are determined to be within the anticipated no significant effects (2 mg-min/m^3 for mustard, 0.33

mg-min/m^3 for GB, 0.25 mg-min/m^3 for VX vapor, and 0.011 mg for inhalation deposition of liquid VX) arc downwind from the agent release, based on the installations hazard prediction calculations.

11-10. Quantity distance criteria specific to chemical munitions. In addition to requirements specified in chapter 17, AMC-R 385-100, the following criteria are applicable to toxic chemical munitions:

a. PAED will be applied from toxic chemical facilities, storage, and operations to nonrelated facilities and their related support facilities.

b. A minimum of inhabited building distance will be applied from conventional munitions storage, operations, and facilities to toxic chemical facilities and their related support facilities.

c. Combined chemical and explosive change-houses will be partitioned and will be separated by the appropriate one-percent lethality distance or inhabited building distance from each area served.

d. Site security control center (SSCC). Facilities for housing security personnel who are required by their mission to have a quick reaction capability in the immediate vicinity of a potential accident/incident site will be sited not less than barricaded intraline distance based on the amount of explosives stored in nearby magazines. If sited inside a sixty-degree angle from the unbarricaded door end of an igloo, unbarricaded intraline distance will be used. In any case, the distance will not be less than 150 feet.

e. Conventional ammunition storage magazines and toxic chemical storage magazines are required to be separated by magazine distance.

f. Drinking water may be located 100 feet upwind per paragraph 7-3d. Eating, drinking, chewing, and smoking areas must be located at unbarricaded intraline distance per requirements of paragraph 17-10d(2), AMC-R 385-100. If such area is within the exclusion area, approval by AMC Field Safety Activity is required.

g. For siting of toxic chemical facilities which present different hazards, PAED will be applied. Where similar hazards are presented, unbarricaded intraline distance (UBID) is appropriate.

h. For siting chemical facilities and operations, the PAED calculated in accordance with paragraph 11-2 will not extend beyond the boundaries of government-controlled land. Operational and meteorological restrictions need to be applied to keep hazard distances on post.

The proponent of this regulation is the U.S. Army Materiel Command. Users are invited to send comments and suggested improvements on DA Form 2028 (Recommended Changes to Publications and Blank Forms) to Director, USAMC Field Safety Activity, ATTN: AMXOS-C, Charlestown, IN 47111.

FOR THE COMMANDER:

OFFICIAL:

JERRY C. HARRISON
Brigadier General, USA
Chief of Staff

YAULANDA D. POWELL
Chief, Operations Branch

DISTRIBUTION:
A1, B1, & B6 (ATTN: Safety Offices)
Chairman, Department of Defense Explosives Safety Board, ATTN: DDESB-KT, 2461 Eisenhower Avenue, Alexandria, VA 22331 (2)
HQDA(DAPE-HRS) WASH DC 20310-0505 (10)
HQDA(DAMO-SWC) WASH DC 20310-0505 (2)
COMMANDER (2 each)
U.S. Army WESTCOM, ATTN: APOP-NC, Ft. Shafter, HI 96858-5100
U.S. Army Europe and 7th Army, ATTN: AEAGA-S, APO, NY 09043-0101
U.S. Army Training and Doctrine Command, ATTN: ATEN-S, Fort Monroe, VA 23651-5000
U.S. Army Forces Command, ATTN: AFPR-PS, Ft. McPherson, GA 30330-6000
U.S. Army 59th Ord Bde, ATTN: AEUSA-OS/AEUSA-CN, APO, NY 09189 (5)
U.S. Army Technical Escort Unit, ATTN: SMCTE, APG, MD 21010-5433
U.S. Army Environmental Hygiene Agency, APG, MD 21010-5433
U.S. Army Medical Institute for Chemical Defense, ATTN: SGRD-UV-SS, APG, MD 21010-5425
U.S. Army Chemical Center and School, ATTN: ATZN-CM, Ft. McClellan, AL 36205-5020
U.S. Army Ordnance Missile and Munitions Center & School, ATTN: ATSK-EI Redstone Arsenal, AL 35897-6700
U.S. Army Chemical Nuclear Agency, ATTN: MONA-CM, Ft. Belvoir, VA 22060-5606
U.S. Army Combined Arms Center Development Activity, ATTN: ATZL-CAM-M, Ft. Leavenworth, KS 66027-5300
U.S. Army Materiel Systems Analysis Activity, ATTN: AMXSY-LA, APG, MD 21005-5071
U.S. Army Chemical Research, Development, and Engineering Center, ATTN: SMCCR-SF, APG, MD 21010-5423 (30)
U.S. Army Natick Research and Development Center, ATTN: STRNC-S, Natick, MA 01760-5017
Program Manager for Chemical Muitions, ATTN: AMCPM-CM-S, APG, MD 21010-5401 (15)
Anniston Army Depot, ATTN: SDSAN-DAS-DF, Anniston, AL 36201-5046
Lexington-Blue Grass Army Depot, ATTN: SDSRR-LAS, Lexington, KY 40511-5004
Newport Army Ammunition Plant, ATTN: SMCNE-EN, Newport, IN 47966-0121

Pine Bluff Arsenal, ATTN: SMCPM-SA, Pine Bluff, AR 71602-9500
Pueblo Army Depot Activity, ATTN: SDSTE-PUA-SA, Pueblo, CO 81001-5000
Rocky Mountain Arsenal, ATTN: SMCRM-SF, Commerce City, CO 80022-2180
Tooele Army Depot, ATTN: SDSTE-SAF, Tooele, UT 84074-5010
Umatilla Army Depot Activity, ATTN: SDSUM-S, Hermiston, OR 97838-9544
DIRECTOR
USAMC Field Safety Activity, ATTN: AMXOS-C, Charlestown, IN 47111-9669 (75)
U.S. Army Defense Ammunition Center and School, ATTN: SMCAC-ASM, Savanna, IL 61074-9639 (5)
AMCSF-C (25)
B LEAD (3,741)

THIS PAGE INTENTIONALLY LEFT BLANK

APPENDIX A

References

DOD 6055.9-Std	DOD Ammunition and Explosive Safety Standard
AR 40-3	Medical, Dental, and Veterinary Care
AR 40-5	Preventive Medicine
AR 50-6	Chemical Surety Program
AR 55-16	Movement of Cargo by Air and Surface
AR 55-56	Transportation of Dangerous or Hazardous Materials
AR 55-228	Transportation by Water of Explosives and Hazardous Cargo
AR 55-355	Defense Traffic Management Regulation
AR 70-18	Laboratory Animals, Procurement, Transportation, Use, Care, and Publicity
AR 385-10	Army Safety Program
AR 385-32	Protective Clothing and Equipment
AR 385-40	Accident Reporting and Records
AR 385-60	Coordination with Department of Defense Explosives Safety Board
AR 385-64	Ammunition and Explosives Safety Standards
AR 740-32	Responsibilities for Technical Escort of Dangerous Materials
DA Pam 40-8	Special Occupational Safety and Health Standards for the Evaluation of Occupational Exposure to Agent GB.
DA Pam 738-750	The Army Maintenance Management System (TAMMS)
TB 740-10	Quality Control Depot Serviceability Standards
TB Med 502	Occupational and Environmental Health Respiratory Program

TB Med 577	Sanitary Control and Surveillance of Field Water Supplies
TM 3-220	Chemical, Biological, and Radiological (CBR) Decontamination
TM 3-250	Storage, Shipment and Handling of Chemical Agents and Hazardous Chemicals
TM 3-4243-203-12	Operator's and Organizational Maintenance Manual: Decontaminating Apparatus, Power-Driven, Truck-Mounted 400-Gallon, M9
TM 3-4230-209-12	Operator's and Organizational Maintenance Manual: Decontaminating Apparatus, Power-Driven, Skid-Mounted, Multipurpose, Nonintegral, 500-Gallon, ABC M12A1
TM 3-4240-202-14	Operator's Organizational, DS, and GS Maintenance Manual: Mask, CBR, FIELD, ABC-M17, and Accessories
TM 3-4240-204-12&P	Operator's and Organizational Maintenance Manual: Mask, Chemical-Biological: Special Purpose
TM 3-4240-204-14	Operator's, Organizational, DS, and GS Maintenance Manual: Mask, Chemical-Biological: Special Purpose, M9A1; Mask, Chemical-Biological: Special Purpose, M9, and Accessories
TM 3-4240-279-10	Operator's Manual Mask, Chemical-Biological Field M17, M17A1, M17A2
TM 3-6665-225-12	Operator's and Organizational Maintenance Manual: Alarm, Chemical Agent, Automatic: Portable, Manpack M8
TM 3-6665-254-12	Operator's and Organizational Maintenance Manual: Detector Kit, Chemical Agent, ABC-M18A2
TM 8-285	Treatment of Chemical Agent Casualties
TM 10-277	Protective Clothing for Chemical Operations
TM 38-250	Packaging and Materials Handling: Packaging and Materials for Transportation by Military Aircraft
TM 55-602	Movement of Special Freight
FM 3-20	Technical Escort Operations

FM 3-21	Chemical - Biological Accident Contamination Control
SB 3-30-2	Protective Mask Canisters and Filter Elements, Serviceability Lists
SB 742-1	Ammunition Surveillance Procedures
AMC Suppl 1 to AR 385-10	Army Safety Program
AMC-R 190-3	Preservation of Order Activities
AMC-R 350-4	Training and Certification Program for Operating Personnel Involved in Conventional and/or Toxic Chemical Ammunition Operations
AMC-R 385-100	AMC Safety Manual
AMC Suppl 1 to AR 385-40	Accident Reporting and Records
MIL STD 105	Sampling Procedures and Tables for Inspection by Attributes
MIL STD 282	Filter Units, Protective Clothing, Gas-Mask Components, and related Products: Performance Test Methods

Code of Federal Regulations, Title 49, Parts 171-177, Hazardous Materials Regulations, and Part 178, Shipping Container Specifications (Department of Transportation, Washington, DC).

THIS PAGE INTENTIONALLY LEFT BLANK

APPENDIX B

Qualitative Protective Mask Fit Testing

B-1. Isoamyl acetate test.

a. Introduction.

(1) The test depends on the odor of isoamyl acetate, so-called banana oil because of its odor.

(2) The test consists of two parts, odor sensitivity check and mask fit check.

(3) Select a location for testing that is free of sources of ignition because isoamyl acetate is flammable. The flash point is 77° F and the lower explosive limit in air is 1 percent. The safe limit in air is 0.25 percent.

(4) Test chamber should be in a well ventilated room separate from where the face piece selection and sensitivity check are performed in order to avoid olfactory fatigue.

(5) Chamber consists of a plastic enclosure about 24 inches in diameter that covers the head and upper body of the test subject. A clear 55-gallon drum liner suspended upside down on a suitable frame is adequate.

b. Equipment and supplies.

(1) 55-gallon drum liner and suitable frame.

(2) Supply of 4-inch x 5-inch pieces of absorbent paper.

(3) Small bottle (2 to 4 ounces) of isoamyl acetate, eyedroppers calibrated in milliliters (ml), and a supply of cotton-tipped swabs.

(4) Four 1-liter glass jars with metal lids (e.g., Mason or Ball jars).

(5) A stock solution of 1 ml of isoamyl acetate in 800 ml of odor-free water in a 1 liter container (from (4) above). Fresh solutions will be made up weekly.

(6) Two 1-liter containers (from (4) above), each containing 500 ml of odor- free water. These will be the blank solutions in the sensitivity test.

(7) A sensitivity solution of 0.5 ml of stock solution in 500 ml of odor-free water in a 1 liter container (from (4) above). Fresh solutions will be made daily.

(8) Preparation or expiration date should be marked on the containers of the stock and sensitivity solutions.

c. Odor sensitivity test.

(1) In a room separate from the test chamber set up the two containers of blank solutions and the container of the sensitivity solution in random order.

(2) Instruct the test subject to identify the container of the sensitivity solution (isoamyl acetate solution) by opening lids and smelling.

(3) If subject is unable to distinguish between the odor of the liquid in containers, olfactory impairment is assumed and B-2 below applies.

(4) Don and adjust protective mask prior to entering the test chamber room.

d. Fit Check.

(1) Instruct the test subject to hang absorbent paper, which has been folded in half and wetted with 0.5 ml of isoamyl acetate, on the hook in the top of the chamber (examiner may accomplish prior to subject being tested).

(2) Wait two minutes before allowing the test subject to enter the chamber. This allows the isoamyl acetate concentration to reach the required level of 150 ppm (nominal).

(3) Instruct the test subject to enter the test chamber and perform each exercise listed below for 30 seconds:

(a) Normal breathing.

(b) Deep breathing. Be certain breaths are deep and regular.

(c) Turn head from side to side. Be certain movement is complete, with one turn every second. Avoid bumping of the respirator on the shoulders.

(d) Nod head up and down. Be certain motions are complete and made about every second. Avoid bumping of the respirator on the chest.

(e) Talking. Read a paragraph that incorporates the full range of speech sounds such as the so-called rainbow passage used by speech therapists. Be certain the paragraph is read aloud and slowly.

(f) Normal breathing.

(4) Mask fit is deemed adequate if the banana oil odor of the isoamyl acetate is not detected at any time during the fit test.

(5) Terminate the test if the isoamyl acetate odor is detected at any point during the test. Detection of the banana oil odor of the isoamyl acetate by the subject indicates that the mask does not fit or is defective.

(6) Instruct test subject to remove the wetted paper when leaving the test chamber and deposit in a closed container.

(7) If test is not passed satisfactorily, either because of improper mask size or mask is found to be defective, instruct test subject to obtain a new mask and repeat the entire fit test sequence.

(8) If mask is found to be defective, a new mask will be issued and the defective mask identified and turned in as unserviceable.

B-2. CS (irritant) chamber testing. When an individual's olfactory senses are impaired, it will be necessary to test the mask for fit and leakage in an irritant chamber. The CS chamber method as prescribed in FM 21-48 should be used or a test can be made using a commercially available smoke tube containing stannic chloride. Tubes of this type produce an acid smoke that is very irritating. The smoke tube test should be conducted in still air in an area that can be ventilated after the test.

THIS PAGE INTENTIONALLY LEFT BLANK

APPENDIX C

Mask Wearing Procedure

C-1. Donning the protective mask. The mask is donned using the following procedures:

a. Stop breathing. Do not take a deep breath.

b. With left hand, pull open the carrier flap, and with the right hand reach into the carrier, grasp the front portion of the face piece in the area of the voicemitter-outlet valve assembly, and withdraw the mask from the carrier.

c. Grasp the left side of the face piece with the left hand and the right side of the face piece with the right hand. Slip the thumbs under the head harness straps. Separate the hands to open the face piece.

d. Seat the chin in the chin pocket and slip the head harness straps over the head to pull the mask up onto the face (do not slip the head harness straps over the head and then pull the mask down over the face).

e. Make sure that the head harness straps lie flat against the head.

f. Place the palm of one hand over the openings in the bottom of the outlet valve cover. Expel the air that has been held in the lungs, forcing exhaled air to escape around the face piece, therefore, clearing the mask of contaminated air.

g. Press the palms of the hands over the canister inlet (M9) or the inlet valve caps (M17). Inhale lightly and hold the breath for approximately 10 seconds to determine whether an airtight seal of the mask against the face has been obtained as indicated by collapse of the face piece.

h. Resume normal breathing.

i. Fasten neck strap (M9 mask only).

C-2. Doffing the protective mask.

a. Remove the protective mask only in an area known to be free of agent contamination, including personal contamination.

b. Unfasten neck strap (M9 mask only).

c. Pull up from the chin and remove over the head.

d. Record use-time or take other locally determined actions to comply with paragraph 4-4c.

THIS PAGE INTENTIONALLY LEFT BLANK

APPENDIX D

Hot Line Operations

D-1. **Hot Line Operations** will be established following a chemical accident or incident as required by the installation CAIRA Plan. The purpose is to provide a systematic means to decontaminate potentially contaminated personnel and equipment leaving a CAI site.

D-2. **Site Selection.** The site for hot line operations should be preselected where possible for storage and operations. The site selected should--

a. Be upwind of the accident site.

b. Be as close to the accident site as feasible.

(1) Initially not closer than the fragmentation distance of the munition involved (normally 1200 feet).

(2) After explosive ordnance reconnaissance has been conducted and/or the CAI site has been evaluated free of any explosive hazard, the hot line may be moved closer to the site provided the area between the initial site and the proposed new site has not been contaminated by agent. The minimum distance will be 50 meters from the incident site.

c. Provide for an area for parking vehicles and large equipment to include turnaround space without having to backup or advance toward CAI site.

d. Have an area for decontamination of vehicles and large equipment.

D-3. **Description.** The hot line operations area will consist as a minimum of--

a. **Hot line.** The downwind end of hot line operations.

b. **Contamination Reduction Area (CRA)** The area between the hot line and the contamination control line which is use for the decontamination of personnel and equipment. The CRA should have--

(1) An equipment drop for radios, detection equipment, tools, and weapons.

(2) Decontamination station for equipment.

(3) Step-in decontamination pans leading to the personnel decontamination stations.

(4) Personnel decontamination station (PDS).

(5) Monitoring station for personnel and equipment.

(6) An area for decontaminating, monitoring, and handling medical casualties.

c. **Contamination Control Line (CCL).** A line separating the contamination reduction Area from the clean area. It will be established immediately upwind from the CRA.

(1) Only those personnel and equipment which have processed through the decontamination process and found free of contamination will cross the CCL.

(2) The CCL should be a minimum of 50 meters upwind from the hot line.

(3) If at anytime the clean area upwind of the CCL becomes contaminated, the CCL will be reestablished in a clean area.

d. **Clean Area.** Upwind of the contamination control line will be the clean area. All weather facilities for bathing and redressing will be provided for individuals who have processed across the CCL. These facilities may be fixed, semi-fixed, semi-mobile, or mobile or a combination. Care is to be exercised in use of outside showering facilities during adverse weather conditions to prevent hypothermia. The CAI control officer will consult the medical officer regarding the use of outdoor showers during adverse weather. The installation medical officer and safety officer will be consulted regarding health hazards associated with antifreezing substances used in outdoor showering facilities.

D-4. Establishment of hot line operations.

a. Initially and immediately a minimum of two persons in proper toxic agent protective clothing will report to a site upwind of the CAI to establish the hot line. These individuals should be prepared to perform emergency decontamination procedures and monitoring of personnel and equipment prior to establishment of the PDS. Primary emergency decontamination should be restricted to agent exposures and medical casualties requiring expeditious transport to the medical treatment facility (MTF) and to themselves (para D-4d).

b. The approach to the proposed hot line will generally be from an upwind direction. Approximately 1 mile from the incident/accident site, protective clothing will be donned. While moving toward the hot line, periodic agent sampling will be done to reassess the level of protective clothing.

c. At the appropriate distance from the CAI site (para D-2b), monitor the proposed CCL. If the test is negative, advance toward the CAI site 50 meters and perform two more tests 50 meters apart on an axis that is perpendicular to the route of advance. If these two tests are negative, move to center of the

three test sites and perform vapor tests (fig D-1). If all tests are negative and there is no visual evidence of agent, the team can unmask in accordance with FM 21-40.

d. If any of the tests are positive, the team will decontaminate themselves as best as possible and move back to the area just short of the last negative test site and await the arrival of personal decontamination equipment and process through it.

e. All monitoring will be conducted with rapidly responding devices (e.g., M8 series alarms, blue band tubes) used in a stationary position.

f. A determination of wind speed and direction will be made at least every 30 minutes. If smoke grenades are used, caution should be taken to ensure that smoke does not engulf personnel, limiting vision and/or causing exposure to smoke. Keep a minimum of 50 meters upwind from personnel.

D-5. **Command and Control.** There should be one individual exercising control of all personnel and equipment at the CCL. All emergency crews dispatched to the CCL are to report to and be dispatched to the CAI site by the CCL controller.

a. Communications are to be established with the chemical accident/incident site and the Emergency Operations Center.

(1) Emergency teams on separate independent 2-way radio networks are to keep the CCL controller apprised of current situation in their areas of responsibility.

(2) The CCL controller is to continually update the CAI control officer of actions taken and status of those actions.

b. Strict control must be maintained on the casualties through the hot line.

c. Supervisors and the CCL controller must be aware of the current physiological condition of the emergency response personnel and any heat imposed limitations.

D-6. **Agent Contamination Control.** One of the primary goals of CAIRA is to contain agent contamination and, if it cannot be contained immediately, to restrict the contamination to the CAI site and prevent the spread of agent to other areas. Every effort is to be taken to prevent the contamination of the environment and ground water systems through liquid runoff during recovery operations.

D-7. **Additional information** outlined in FM 3-21 may be used as a guide to hot line operational procedures.

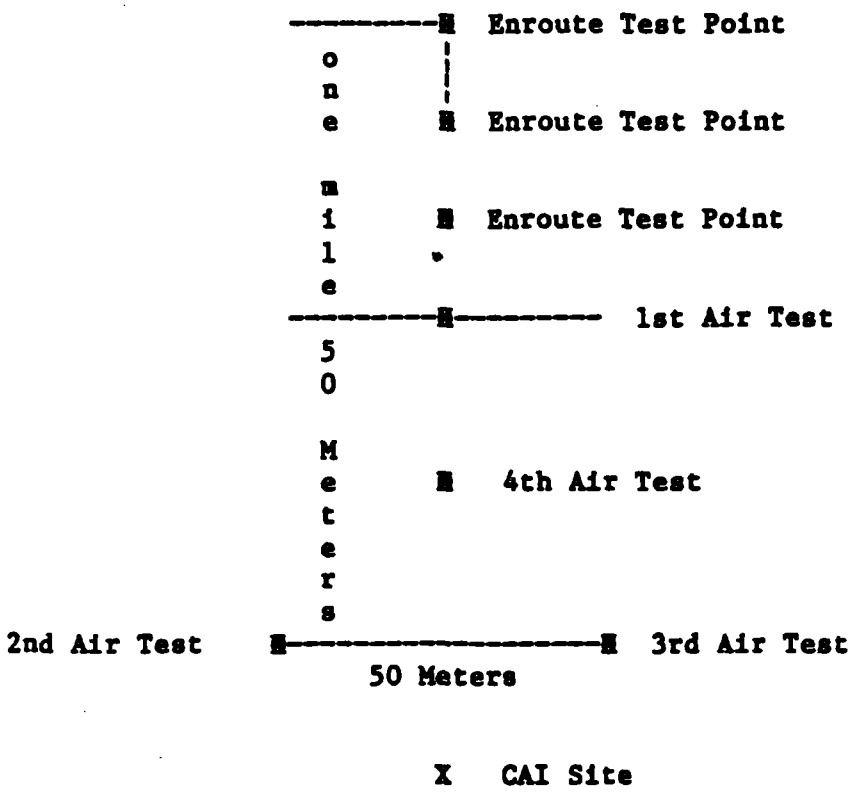


Figure D-1. Hot line setup with only negative monitoring results.