Final
Engineering Evaluation/Cost Analysis: RVAAP-28 Suspected Mustard Agent Burial Site at Camp Ravenna Joint Military Training Center Portage and Trumbull Counties, Ohio

September 19, 2016

Prepared by:

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Prepared for:

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REPORT DOCUMENTATION PAGE	*Form Approved* *OMB No. 0704-0188*

1. REPORT DATE *(DD-MM-YYYY)*	2. REPORT TYPE	3. DATES COVERED *(From - To)*
09-19-2016	Technical	2015 - October 2016

4. TITLE AND SUBTITLE	
Final Engineering Evaluation/Cost Analysis: RVAAP-28 Suspected Mustard Agent Burial Site at Former Ravenna Army Ammunition Plant Ravenna, Ohio	5a. CONTRACT NUMBER NA
	5b. GRANT NUMBER NA
	5c. PROGRAM ELEMENT NUMBER NA
6. AUTHOR(S) Angela Schmidt, USACE, Louisville District	5d. PROJECT NUMBER 118064
	5e. TASK NUMBER NA
	5f. WORK UNIT NUMBER NA
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) United States Army Corps of Engineers (USACE), Louisville District 600 Martin Luther King Jr. Place Louisville, Kentucky 40202-0059	8. PERFORMING ORGANIZATION REPORT NUMBER USACE
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES) USACE - Louisville District 600 Martin Luther King Jr. Place Louisville, Kentucky 40202-0059	10. SPONSOR/MONITOR'S ACRONYM(S)
	11. SPONSOR/MONITOR'S REPORT NUMBER(S) NA

12. DISTRIBUTION/AVAILABILITY STATEMENT

Reference distribution page.

13. SUPPLEMENTARY NOTES

None

14. ABSTRACT

This Final Engineering Evaluation/Cost Analysis (EE/CA) identified the appropriate remedial action for the RVAAP-28 Suspected Mustard Agent Burial Site (SMABS) area of concern (AOC) through an evaluation of Alternatives. The EE/CA eliminated the need to do costly studies to evaluate the nature and extent for materials whose use or presence has never been confirmed and there is not a known source/release. The Alternative that was selected in the EE/CA was the "No Action Alternative." Per the No Action Alternative, as long as the SMABS is used by the military, management and operation of the SMABS will be conducted following Army Regulations and requirements outlined in the Contingency Plan, rather than under the cleanup program.

15. SUBJECT TERMS

Engineering Evaluation/Cost Analysis, EE/CA, Alternatives, chemicals, RVAAP-28, Suspected Mustard Agent

16. SECURITY CLASSIFICATION OF: a. REPORT	b. ABSTRACT	c. THIS PAGE	17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
U	U	U	UU	326	Angela Schmidt
					19b. TELEPHONE NUMBER *(Include area code)* 502-315-6313

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Standard Form 298 (Rev. 8/98)
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Ohio Environmental Protection Agency

John R. Kasich, Governor
Mary Taylor, Lt. Governor
Craig W. Butler, Director

October 25, 2016

Mr. Mark Leeper, P.G., MBA
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Re: US Army Ravenna Ammunition Plt RVAAP
Remediation Response
Project records
Remedial Response
Portage County
267000859025

Subject: Review of the "*Final Engineering Evaluation/Cost Analysis: RVAAP-28 Suspected Mustard Agent Burial Site at Camp Ravenna Joint Military Training Center Portage and Trumbull Counties, Ohio*"; Dated September 19, 2016 (Work Activity No. 267-000859-025)

Dear Mr. Leeper:

The Ohio Environmental Protection Agency (Ohio EPA), Northeast District Office (NEDO), Division of Environmental Response and Revitalization (DERR) has received and reviewed the *"Final Engineering Evaluation/Cost Analysis: RVAAP-28 Suspected Mustard Agent Burial Site at Camp Ravenna Joint Military Training Center Portage and Trumbull Counties, Ohio,"* dated September 19, 2016. This document, received by Ohio EPA's NEDO on September 21, 2016, was prepared for the National Guard Bureau – Army National Guard, by the U.S. Army Corps of Engineers, Louisville District.

This document was reviewed by personnel from Ohio EPA's DERR, pursuant to the Director's Findings and Orders. Ohio EPA concurs with the finalized document. If you have any questions or concerns, please do not hesitate to contact me at (330)963-1235.

Sincerely,

Bob Princic for

Nicholas Roope
Site Coordinator
Division of Environmental Response and Revitalization

NCR/nvr

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STATEMENT OF INDEPENDENT TECHNICAL REVIEW

The United States Army Corps of Engineers has completed the Final Engineering Evaluation/ Cost Analysis for the RV AAP-28 Suspected Mustard Agent Burial Site at the Former Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio. Notice is hereby given that an independent technical review has been conducted that is appropriate to the level of risk and complexity inherent in this project. During the independent technical review, compliance with established policy principals and procedures, utilizing justified and valid assumptions was verified. This included review of data quality objectives; technical assumptions, methods, procedures, and materials used; the appropriateness of data used and level of data obtained; and reasonableness of the results, including whether the product meets the customer's needs consistent with the law and existing United States Army Corps of Engineers policy.

Reviewed/Approved by: Nathaniel Peters Date: 8/23/16

Nathaniel Peters, PhD, PE
Independent Technical Reviewer

Reviewed/Approved by: [signature] Date: 8/24/16

Richard Kennard, PG
Independent Technical Reviewer

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Engineering Evaluation/Cost Analysis:
RVAAP-28 Suspected Mustard Agent Burial Site at the Camp Ravenna Joint Military Training Center
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DOCUMENT DISTRIBUTION

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ACRONYMS AND ABBREVIATIONS

AOC	Area of Concern
ARAR	Applicable or Relevant and Appropriate Requirements
ARNG	Army National Guard
bgs	below ground surface
CAIS	Chemical Agent Identification Sets
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Requirements
CRJMTC	Camp Ravenna Joint Military Training Center
CWM	chemical warfare materiel
DERR	Division of Environmental Response and Revitalization
DFFO	Director's Final Findings and Orders
DGM	digital geophysical mapping
DOD	Department of Defense
EE/CA	Engineering Evaluation/Cost Analysis
EQM	Environmental Quality Management, Inc.
ft	feet
HRR	Historical Records Review
in	inch
IRP	Installation Restoration Program
LUCs	Land Use Controls
MEC	Munitions and Explosives of Concern
MMRP	Military Munitions Response Program
NACA	National Advisory Committee on Aeronautics
NAD	North American Datum
NCP	National Contingency Plan
NEDO	Northeast District Office
NERO	Northeast Regional Office
NPL	National Priorities List
NTA	NACA Test Area
NTCRA	Non-Time Critical Removal Action
O&M	operation and maintenance
OHARNG	Ohio Army National Guard
Ohio EPA	Ohio Environmental Protection Agency
RAO	Remedial Action Objective
REIMS	Ravenna Environmental Information Management System
RVAAP	Ravenna Army Ammunition Plant

SAIC	Science Applications International Corporation
Shaw	Shaw Environmental & Infrastructure, Inc. (now CB&I)
SI	Site Inspection
SMABS	Suspected Mustard Agent Burial Site
sq ft	square feet
USEPA	United States Environmental Protection Agency
USACE	United States Army Corps of Engineers
USAEC	United States Army Environmental Command

SECTION 1: INTRODUCTION

This Engineering Evaluation/Cost Analysis (EE/CA) was prepared by the United States Army Corps of Engineers (USACE), Louisville District to identify and assess Alternatives to support the selection of appropriate remedial actions for the RVAAP-28 Suspected Mustard Agent Burial Site (SMABS) area of concern (AOC) at the Camp Ravenna Joint Military Training Center (Camp Ravenna) (formerly the Ravenna Army Ammunition Plant - RVAAP) in Portage and Trumbull counties, Ohio (Figures 1 and 2). The SMABS is referred to as the “suspected” mustard agent burial site because the use of sulfur mustard agent at the former RVAAP, and specifically at this AOC, has never been confirmed. A former RVAAP employee indicated that an area within NACA Test Area was excavated and one 55-gallon drum and 7 small cans (allegedly mustard agent) were removed and identified as nontoxic. This excavation and removal was performed in 1969 and the former employee who identified the location where the materials were buried, was the person who actually buried and treated them with ‘quicklime’ after World War II. The remaining potential for buried mustard agent areas is based solely on verbal historical accounts taken from unconfirmed and undocumented sources.

The sulfur mustard agent (dichlorodiethyl sulfide) is suspected to have been buried at the SMABS AOC prior to the 1950s, but after World War II. Based on unconfirmed verbal evidence, this sulfur mustard agent may have been present in the form of Chemical Agent Identification Sets (CAIS) which typically consisted of glass vials or bottles that contained very small amounts of a chemical agent. However, there is no hypothesis as to why these test kits would ever have been shipped to the former RVAAP employee where none of the personnel were trained to handle mustard agent and where there was no need for such materials. In addition, because mustard agent are considered to be Chemical Warfare Materials - CWM or Chemical Warfare Agents (CWA), there would have likely been some type of shipping record generated as was done for explosives and other hazardous materials. Unfortunately, no such records have been found. See Appendix A for the information regarding the 1969 excavation. After this excavation, several utility work reports continued to mention that someone said there was potentially another area where materials were buried. This other area was near the area where the original excavation had occurred.

Three separate areas have been identified as potential locations where the mustard agent was allegedly buried. These three areas have been investigated and evaluated to determine the presence of mustard agent and or test kits. A Site Inspection (SI) was completed by the USACE Huntsville District in 2015, but because there was no proof that CAIS or mustard agent was or was not buried on the AOC, the SI concluded that the presence of mustard agent could not be completely ruled out for the SMABS AOC and that there is a remote potential for mustard agent to be buried at the AOC. The entire AOC would have to undergo intensive and expensive investigation to prove definitively that mustard agent is not buried on the AOC. Therefore, the Army prepared and implemented a Contingency Plan based on recommendations of the CWM Experts who evaluated the SMABS. As recommended in the 2015 SI, this EE/CA is warranted to streamline the CERCLA process for the SMABS. The EE/CA removes the need to do costly and comprehensive studies to evaluate the nature and extent such as in a Remedial Investigation (RI) for materials whose use or presence has never been confirmed and there is not a known source/release. The EE/CA allows the continuation of the CERCLA process at the SMABS to proceed in a defensible and cost-effective manner and to ensure that appropriate measures are taken to protect human health, the community, and the environment.

This EE/CA was conducted under the United States (U.S.) Department of Defense (DOD) Installation Restoration Program (IRP). In addition, planning and performance of all elements of this work will be in accordance with the requirements of the Ohio Environmental Protection Agency (Ohio EPA) Director's Final Findings and Orders (DFFOs) dated June 10, 2004 (Ohio EPA, 2004).

This EE/CA was completed in compliance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980 and prepared in accordance with the U.S. Environmental Protection Agency's(USEPA) guidance documents *Use of Non-Time Critical Removal Authority in Superfund Response Actions* (USEPA, 2000) and *Guidance on Conducting Non-time-Critical Removal Actions under CERCLA* (USEPA, 1993). As stated in the guidelines, the USEPA has urged Superfund decision makers to broadly use the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) removal authority to achieve quick, protective results at Superfund sites, consistent with legal requirements, including public participation. Most importantly, this EE/CA provides an efficient pathway to assess and evaluate potential Alternatives at the SMABS.

1.1 SCOPE AND PURPOSE

The primary purpose of this EE/CA is to evaluate Alternatives for the SMABS AOC for the three areas that may potentially contain mustard agent test kits. Following CERCLA guidance, this EE/CA identifies removal action objectives (RmAOs), identifies potential removal action Alternatives, and evaluates Alternatives against criteria identified in USEPA's 1993 Guidance on Conducting Non-time-Critical Removal Actions under CERCLA. The final outcome of this EE/CA is to identify the most suitable Alternative that ensures safety and mitigates any potential encounter to CAIS or mustard agent.

1.2 REPORT ORGANIZATION

This report is organized as follows:

- Section 1 presents the introduction, scope and purpose, and report organization.
- Section 2 summarizes the facility description, site background and description, and previous investigations and results.
- Section 3 summarizes the removal action objectives.
- Section 4 summarizes the development of Alternatives and presents the analysis of Alternatives.
- Section 5 presents a comparative analysis of the all four Alternatives.
- Section 6 summarizes agency coordination and public involvement activities.

- Section 7 presents recommended Alternative.

- Section 8 provides references.

- Appendix A presents a 1985 Memo from former RVAAP employee regarding SMABS and photographs and information relative to CAIS and mustard agent kits.

- Appendix B identifies relevant Applicable or Relevant and Appropriate Requirements (ARARs).

- Appendix C presents estimated costs

- Appendix D includes excerpts from Army Regulations and other requirements that address safety and handling of mustard agent.

SECTION 2: SITE DESCRIPTION AND HISTORY

2.1 GENERAL FACILITY

Camp Ravenna, former RVAAP, is located in northeastern Ohio within Portage and Trumbull counties, approximately 1.6 kilometers (km) (1 mile) northwest of the city of Newton Falls and 4.8 km (3 miles) east-northeast of the city of Ravenna (Figure 1). The installation is surrounded by several communities: Windham to the north; Garrettsville 1 mile to the northwest; Newton Falls 1 mile to the east; Charlestown to the southwest; and Wayland 3 miles southeast. The facility is a parcel of property approximately 17.7 km (11 miles) long and 5.6 km (3.5 miles) wide bounded by State Route 5, the Michael J. Kirwan Reservoir, and the CSX System Railroad on the south; Garret, McCormick, and Berry Roads on the west; the Norfolk Southern Railroad on the north; and State Route 534 on the east (Figure 1).

As of September 2013, administrative accountability of the entire 21,683-acre installation has been transferred to the United States Property and Fiscal Officer for Ohio. The installation has been licensed to the OHARNG for use as a military training site known as Camp Ravenna. The RVAAP IRP involves cleanup of former production/operational areas throughout the facility related to operations that were conducted at the former RVAAP facility.

2.2 SMABS BACKGROUND AND CAIS DESCRIPTION

The SMABS AOC is located in the southwestern portion of the former RVAAP (Figure 2). There are three areas identified by former RVAAP employees where CAIS (mustard agent) may have been buried. Each area is discussed separately in the following sections and the three areas are named by the year when they were investigated. The three areas (1998, 2006, and the 2010 Geophysical Investigation Areas) are shown on Figure 3. The Universal Transverse Mercator coordinates for the SMABS AOC are 4557923.53 meters north, 489003.15 meters east, Zone 17T (based on the approximate location of the 1969 U.S. Army excavation area described below). The 1998 Army Excavation Area is approximately 24,329 ft^2. The 2006 Geophysical Investigation Area is approximately 29,644 ft^2 and the 2010 Geophysical Survey area is 26,622 ft^2. The three investigation areas, located both north and south of Hinkley Creek, cover approximately 1.8 acres total.

Based on historical accounts taken from former site personnel, sulfur mustard agent (dichlorodiethyl sulfide) is suspected to have been buried at the AOC, possibly in the form of CAIS. The CAIS test kits typically consisted of glass vials or bottles that contain small amounts of chemical agents. These kits were used by the Department of Defense (DOD) from 1928 to 1969 for training in the detection, handling, and familiarization with chemical warfare agents. Appendix A contains some photographs and other information relative to CAIS and mustard agent.

According to unexploded ordnance (UXO) safety information on the DOD Environment, Safety, and Occupational Health Network and Information Exchange (DENIX) website (https://www.denix.osd.mil/), prior to the early 1970s, one of the approved procedures for disposing of CAIS was burial on training ranges or areas. When buried, CAIS were either buried in their original containers (PIGs) or loose. Normally, CAIS vials were broken before burial and decontaminant was used to neutralize any chemical agent present. Note that the DENIX website references wooden containers. Based on the Description of Chemical Agent Identification Set Types, 2004, the only CAIS packed in nonmetallic (wooden) containers was K945; however, all K945 kits were accounted for by the U.S. Army and destroyed (EQM, 2008). There is no definitive documentation of whether or not CAIS was onsite, so the procedures mentioned above are generic and based on the methods usually used prior to burying CAIS. However, all three accounts suggested that the CAIS were buried.

There is documentation presented in a 1985 Memo prepared by a former RVAAP Safety Engineer who stated that the person actually responsible for burying materials that are consistent with the exterior shipping containers for CAIS in the area where the 1969 excavation occurred, confirmed that he covered the items with lime to ensure they were neutralized (Appendix A). Former employees stated that the mustard agent kits were buried by hand but the depth was not known.

Of the various types of CAIS glass containers that have been identified as potentially containing mustard agent, all are believed to have been packed in metal containers, such as paint- or coffee-type cans, 55-gallon drums, or steel shipping cylinders called PIGs (EQM, 2008). The DOD had an extensive training program for soldiers so it seems unlikely that such mustard agent test kits would have been sent to the former RVAAP since they did not handle or package these materials and the personnel would not have been trained in handling any such materials. The CAIS test kits were sets of glass vials or bottles that contained small amounts of chemical agents. They were employed by all branches of the U.S. Armed Forces from 1928–1969 for the purpose of training in detection, handling, and familiarization with chemical warfare. Most CAIS were destroyed in the 1980s, but the U.S. Army Chemical Materials Agency still occasionally demilitarizes CAIS that are found buried.

As presented in the Preliminary Assessment report for the RVAAP (SAIC, 1996), and supported by subsequent investigation activities described in SI Report and the Probability Assessment (USACE 2015), the SMABS AOC was scored as a low relative risk designation under the DOD's relative risk site evaluation method. This method is similar to the USEPA's Hazard Ranking System Prioritization Model (SAIC 1996). This risk investigation was limited, however, as only two surface soil samples were collected, and mustard agent buried at depth is unlikely to exhibit a surface expression of agent breakdown products.

Precautionary interim restrictions (Seibert stakes) have been placed on SMABS to prohibit access and intrusive activities at the AOC. These restrictions are being utilized to mitigate any potential exposure during the CERCLA investigative process for the AOC.

2.3 PREVIOUS INVESTIGATIONS AT SMABS

2.3.1 Army Excavation (1969)

In 1969, the U.S. Army excavated a suspected burial site immediately west of the National Advisory Committee for Aeronautics (NACA) Test Area (NTA) (EQM, 2008). One 55-gallon drum and seven small rusted cans were recovered from the excavation. All recovered items were empty and no evidence of the presence of mustard agent was observed, as summarized in an internal Army Memorandum dated March 14, 1985. (Appendix A) It should be noted, however, that the original documentation regarding the excavation is no longer available, so it is unknown what exactly occurred during the investigation. See Figure 3 detailing the area that was excavated.

2.3.2 Surface Soil Sampling (1996)

An unidentified and undocumented source reported that the first site excavated in 1969 was incorrectly identified, and that the mustard agent was buried in the wooded area approximately 500 feet south of Hinkley Creek, along an abandoned power line right-of-way (SAIC, 1996). This second suspected site, measuring 270 ft^2, was marked and fenced. However, only remnants of the fence existed in 2006 and the area has since been marked with Seibert stakes to restrict access. See Figure 4 for location of the 1996 survey area.

In 1996, another suspected burial site located in the wooded area approximately 500 feet south of Hinkley Creek along an abandoned power line right-of-way was investigated (SAIC, 1996). This area, measuring approximately 270 square feet, was marked and enclosed by a cyclone fence (Figure 3). Two surface soil samples were collected from this area during the Relative Risk Site Evaluation conducted by the U.S. Army Center for Health Promotion and Preventive Medicine (1996). The surface soil samples were analyzed for thiodiglycol, a mustard agent decomposition product, and no concentrations were detected at or above the method detection limit (22.5 parts per million) (SpecPro, 2004).

2.3.3 Geophysical Survey (1998)

In 1998, SAIC conducted a digital geophysical mapping (DGM) survey of an approximately 18,900-square-foot area along the abandoned power line right-of-way centered around the 270-square-foot formerly fenced area where the surface soil samples were collected in 1996 (Figure 4). The DGM survey identified several anomalies that were determined to most likely have been the result of metallic objects or cultural features located at or near the ground surface. Metal fencing embedded in trees and buried fallen fence posts were discovered during the DGM survey. Some of the anomalies were attributed to a barbed wire fence that once existed in the area. The results of the DGM survey indicated that it was difficult to discriminate these interferences from any potential buried waste containers. The survey did not produce evidence of any signature indicating the presence of disturbed soils or numerous buried metallic objects that would clearly delineate a former burial site (SAIC, 1998).

2.3.4 Groundwater Investigations

Between 2004 and 2005, SpecPro conducted a groundwater investigation under a facility-wide groundwater program that included the installation of six monitoring wells around the perimeter, including locations hydraulically downgradient of the portion of the SMABS AOC located along the abandoned power line right-of-way, as shown on Figure 4. Mustard agent breakdown products were not detected in any of the groundwater samples collected from the downgradient wells during the sampling events (SpecPro 2006). In October 2011, an additional groundwater sampling event was conducted with no detections of mustard agent breakdown products reported from the analyses of the samples drawn from the six monitoring wells (EQM, 2012).

2.3.5 Employee Interviews and Geophysical Survey (2006)

In July 2006, three former facility workers claiming to have knowledge of suspected mustard agent burial areas at the facility were interviewed. One of the former workers interviewed identified a potential area adjacent to the concrete pad at the west end of the National Advisory Committee for Aeronautics (NACA) Test Area (NTA). See Figure 5 to identify the location of the area investigated.

Historical records research helped to determine the location and extent of the SMABS AOC. These records included historical USGS topographic maps and aerial photographs. Based on features identified on these maps and aerial photographs, along with the documented interviews with the former RVAAP employees, a possible burial area was identified measuring approximately one acre and encompassing the original 1969 excavation area (EQM, 2008).

In 2006, EQM conducted a series of geophysical surveys of the area to investigate the possible presence of mustard agent CAIS packaged in metal containers (Figure 5). The survey identified the presence of metallic anomalies buried in the investigation area and a trench-shaped anomaly located at the western edge of the NTA concrete pad and extending to the west. The investigation report noted that most of the metallic anomalies in the area appeared to be buried within 5 feet of the ground surface. This report also noted that steel mill slag was commonly used as fill at the facility and could possibly be the source of the metallic anomalies. The survey did not delineate the horizontal extent of the affected area, and the nature of the metallic anomalies could not be conclusively determined without intrusive investigation (EQM, 2008).

2.3.6 Geophysical Survey (2010)

One of the accounts from the 2006 interviews indicated that the western concrete pad of the NTA may cover part of the suspected burial site. In 2010, Shaw conducted a non-intrusive DGM survey to further evaluate the area around the concrete test pad. The survey areas included locations north, south, and east of the concrete pad to an approximate depth of 5 feet below ground surface. The survey area extended approximately 115 feet east of the concrete pad along the north and south sides of the former NACA crash strip. See Figure 6 for the location of the 2010 investigation area.

The survey data indicated anomalies related to anthropogenic features, and identified two areas south and southeast of the suspected burial site characterized by relatively denser aggregates of individual anomalies (Figure 6). The survey data also identified anomalies beyond the northern edge of the concrete pad that appeared to be linear in nature and possibly related to subsurface utilities. Maps illustrating the NTA utility locations were not available to compare the results from the DGM survey (Shaw 2011).

2.3.7 Probability Assessment (2013)

In 2013, the U.S. Army Engineering and Support Center (USAESC), in coordination with the Army National Guard (ARNG) and OHARNG, prepared a Probability Assessment to document the probability of encountering CWM (e.g., mustard agent gas) prior to conducting intrusive activities at the site. The Probability Assessment utilized the information collected from the previous investigations, DGM surveys conducted at the SMABS AOC, and from the research of available archived records.

Based primarily on the historical accounts of former RVAAP personnel, the Probability Assessment concluded that the probability of encountering CWM or CAIS at the SMABS AOC was “Seldom.” A “Seldom” probability is defined as “remotely possible (and) could occur at some time.” The Probability Assessment recommended that any intrusive activity at the SMABS AOC can be conducted as non-CWM without Munitions and Explosives of Concern (MEC) support. The Probability Assessment also recommended the incorporation of a Contingency Plan in the facility standard operation plans for emergency response actions in the event that a CAIS or an intact item with an unknown liquid fill is encountered during intrusive activities at the SMABS AOC (USAESC, 2013).

2.3.8 Site Inspection Report (2015)

In 2015, the USACE prepared a Site Inspection (SI) report based on the investigations and information collected to date on the SMABS AOC. The SI report recommended an EE/CA and Action Memorandum to determine the cost of investigation of the anomalies detected during the DGM surveys versus the cost of evaluating and selecting remedial Alternatives, such as the installation of a security fence as a Land Use Control (USACE, 2015). The SI report was approved by the Ohio EPA on April 20, 2015.

SECTION 3: REMOVAL ACTION OBJECTIVES

The scope, objectives, justification for the EE/CA, and applicable or relevant and appropriate requirements (ARARs) are described in this section. The RmAOs specify requirements that the selected Alternative must fulfill to protect human health and the environment from contaminants and to meet the evaluation criteria. Additionally, the RmAOs provide the basis for identifying Alternatives in this EE/CA.

3.1 SCOPE AND PURPOSE

Based on historical accounts from former employees of the RVAAP facility, CAIS containing sulfur mustard agent may be buried at the SMABS AOC. Investigations conducted to date have not conclusively ruled out the potential for CAIS or mustard agent-related material to be present at the SMABS. An SI completed at the SMABS AOC in 2015 recommended that an EE/CA and Action Memorandum be prepared for the site to determine the cost of investigation verses the cost of evaluating and selecting removal action Alternatives.

In accordance with the Probability Assessment (USAESC, 2013) and as an Army-required safety measure, a site-specific Contingency Plan for encountering items with unknown liquid fill was developed and finalized for SMABS for potential emergency response actions in the remote event that CWM is encountered. Users and planners of activities in these areas should remain aware of the possibility of contamination and be alert/trained to what actions to take in the event of encountering potential indications of such. The site-specific Contingency Plan is also integrated into installation standard operation plans and the SMABs continues to be managed according to Army Regulations and requirements.

3.2 OBJECTIVES AND GOALS

The objective for the EE/CA is to evaluate the removal action Alternatives for the SMABS AOC for the three areas that may potentially contain mustard agent (and or CAIS). Following CERCLA guidance, this EE/CA identifies removal action objectives, identifies potential removal action Alternatives, and evaluates Alternatives against criteria identified in U. S. Environmental Protection Agency (USEPA) Guidance for *Conducting Non-Time Critical Removal Actions under CERCLA* (USEPA, 1993).

Chemical-specific remediation goals for this EE/CA are not determinable since any indication or detection of mustard agent would be considered unacceptable. A main goal for the Alternatives selected is to ensure that anyone using the AOC is aware of the potential presence of mustard agent and/or to prevent contact with any mustard agent.

The final outcome of this EE/CA is to identify the most suitable Alternative that would mitigate any effects from encounter with CAIS or mustard agent. Recognition of potential CAIS or mustard agent as well as following procedure in the Probability Assessment and Army Regulations readily prevent inadvertent physical contact with mustard agent in soils, inhalation, or ingestion and ensure if there is a release of mustard agent into the environment, it is fully assessed. The Alternative selected in this EE/CA must also ensure that SMABS is managed safely and that future use of the SMABS AOC for military training by the OHARNG can be accomplished safely with appropriate actions.

3.3 JUSTIFICATION FOR PROPOSED ACTION

The SMABS AOC was identified by three former employees who worked at RVAAP, as an area where mustard agent may have been buried. There is no documentation or any other evidence to support the verbal unconfirmed statements. In 1969, the Army excavated an area originally identified as a suspected mustard agent burial site. No mustard agent was found and all containers uncovered during the excavation were empty. In 1996, another area on the SMABS AOC was identified as a potential area where mustard agent was buried but the source is unidentified and undocumented. In 2006, three employees who worked at the former RVAAP were interviewed. These employees claimed to know where there was mustard agent buried on the Installation. One of the former employees identified a third potential area where mustard agent could have been buried. See Appendix A for the 1985 Memo.

Although unsubstantiated, three areas have been identified at the SMABS AOC that may reportedly have had CAIS/mustard agent buried there. All three of these areas will be used for military training that could involve intrusive training activities as well as vehicle traffic. These activities could result in physical contact or could inadvertently release potential mustard agent if it is present and is disturbed. Physical contact or inadvertent releases of mustard agent into the environment could pose safety issues but awareness of the potential hazards greatly would limit any short-term health effects. Evaluation through an EE/CA ensures the selected Alternative meets all three criteria.

3.4 POTENTIAL SOURCES AND RISKS

3.4.1 Mustard Agent and CAIS

No specific documentation on what type or form of mustard agent supposedly to have been buried on SMABS has ever been identified. The only information relative to what is potentially buried is from undocumented sources and memories from former RVAAP employees. These sources have indicated that there were CAIS test kits that contained mustard agent. As stated previously, (https://www.denix.osd.mil/), prior to the early 1970s, one of the approved procedures for disposing of CAIS was burial on training ranges or areas. When buried, CAIS were either buried in their original shipping containers (PIGs) or loose. Appendix A has photographs of some of the test kits.

There were three basic types of CAIS kits;

- Toxic Gas sets with 24 or more glass bottles of 100 mls each used for training in decontamination.
- War Gas Identification sets which contained small ampoules or vials of agent and were used for outdoor training.
- Sniff Sets were used for indoor classroom training which had the mustard agent on charcoal.

The use and variety of the CAIS that would determine the type and quantity of agent that they contained. The CAIS generally contained glass ampoules and vials of the materials or they contained glass bottles. The ampoules were about 1 inch in diameter (1 1/3 ounces) and contained about ½ teaspoon of mustard, chloropicrin, and lewisite in chloroform. They were used in kits called "Detonating Gas Identification Sets" and each kit consisted of a steel cylinder (approximately 38 inches long and 6 ½ inches in diameter) with four sheet metal cans. Each of the sheet metal cans contained 12 vials with the diluted agent. Ampoules were packed in their own sealed metal cans that were surrounded by corrugated fiberboard lining and foam rubber to prevent breakage. The cans were placed in steel bolted, flanged steel drums. Each ampoule was packed in a screw top labeled cardboard tube. Twelve tubes were packaged into press fit metal cans, with four cans per 38" long steel PIG with a bolted, flanged end cover. The K951 CAIS was issued with blasting caps that were packed and shipped in a separate container. The mustard agent would be released as a gas when the vial was detonated with a blasting cap. The soldiers would be positioned downwind prior to the detonation and were instructed to allow the cloud to envelop them or to walk into the cloud if the wind blew the cloud away from them. They were told to take a sniff to be able to recognize the smell and then to exit the cloud and immediately exhale.

The other type of CAIS were call Toxic Gas Set consisted of a steel cylinder with four sheet metal cans. Each can contained 12 glass bottles with 3 ½ ounces of mustard agent. These were commonly referred to as "bulk mustard set." Four bottles were arranged in a set (labeled with heat-resistant paint) and packed with sawdust in a pressure-sealed, metal, 6.5" high can with a sardine-type key on the bottom. Six of the cans were placed in a 38" long steel shipping cylinder (a PIG) with a bolted, flanged end cover. This type of CAIS is usually found either as complete PIGs or as loose bottles. When found loose, the plastic/bakelite screw-top bottle tops tend to leak because mustard is a good solvent for plastic and rubber. Mustard forms a scale or sludge in contact with soil or sawdust and solidifies at cool temperatures. See Appendix A for photographs of the CAIS and containers.

Both the ampoules and the bottles were packed in either metal shipping containers (cans) placed into drums or wooden boxes. The ampoules either contained 5% sulfur mustard in chloroform or 10% nitrogen mustard in chloroform. If the CAIS had glass bottles, then they contained either pure sulfur mustard or nitrogen mustard absorbed on a charcoal base. None of the test kits contained pure mustard agent. The kits contained a dilute form intended to allow soldier to be trained safely without being affected. Most importantly, the soldiers needed to be able to recognize the smell of the gas so they could follow protective measures during wartime.

Normally, CAIS vials were broken before burial and decontaminant was used to neutralize any chemical agent present. Note that the DENIX website references wooden containers. Based on the *Description of Chemical Agent Identification Set Types*, 2004, the only CAIS packed in nonmetallic (wooden) containers was K945; however, all K945 kits were accounted for by the U.S. Army and destroyed (EQM, 2008). There is no definitive documentation of whether or not CAIS was onsite, so the procedures mentioned above are generic and purely speculative based on the methods usually used prior to burying CAIS. Generally, if procedures were properly followed and if CAIS was buried on the SMABS in vials, they should have been broken so that the mustard agent could not be present. According to the DENIX information, the containers would usually have been buried empty. In addition, since the former RVAAP has no record of any type of chemical warfare material or test kits, it is highly unlikely that they were ever on the former RVAAP. If CAIS are buried on SMABS at one of the three sites, they were probably neutralized before being buried. Also, there is no shipping record or transfer record of any mustard agent ever being shipped to RVAAP. The handling and decontamination of the CAIS would have required some training which does not appear to have been published in any of the procedures or safety manuals. It is unclear if the bottles were empty before burying since the mustard agent was absorbed to charcoal and it would likely be destroyed through environmental degradation if the bottles were broken or emptied.

The CAIS contained small glass vials, ampules or bottles which contained small amounts of chemical warfare agents. Each of the sets contained more than two dozen glass vials, each vial contained about 100 milliliters of the chemical agent. There were three subsets of CAIS, distributed in 18 different set configurations. These subsets included bottles of sulfur mustard used to purposely contaminate equipment or terrain for decontamination training. Another type of CAIS were known as "sniff sets" and were used to train soldiers to recognize the color and odor of chemical agents. Used indoors, the sniff sets contained agent-impregnated charcoal and agent simulants; they contained very little actual chemical warfare agent.

3.4.2 Sulfur Mustard Agent in the Environment

Sulfur mustard released into surface soils may be lost by volatilization. Droplets deposited on surfaces evaporate slowly, large quantities may remain intact during cool weather or under winter conditions. Sulfur mustard freezes below 15°C, which allows it to be persistent in soils at low temperatures. Mustard buried deep in the soil, where it cannot vaporize or undergo weathering, can persist for years. Mustard can also degrade in soil through hydrolysis. The rate depends on the moisture in the soil. Thus, the major fate pathways would be hydrolysis in soil due to soil moisture and evaporation at the soil surface. The vapor pressure of mustard is moderate, but is still sufficient for mustard to be in the air immediately surrounding droplets of the liquid. At moderate temperatures (25°C), mustard deposited on the surface of soil will evaporate within 30-50 hr. Factors that influence vaporization include weather, pH, moisture content, porosity of the surface, and physical constituents of the soils.

Hydrolysis is the primary degradation route for sulfur mustard in water. Due to its very low aqueous solubility and the slow rate at which it dissolves, sulfur mustard is considered fairly persistent in the environment. Hydrolysis occurs slowly at lower temperatures. Mustard is not transported through soil into groundwater due to low solubility in water and the rate at which mustard will undergo hydrolysis once dissolved.

Mustard can be biodegraded in soil through the thioether oxidation pathway, hydrolytic dechlorination, reductive dehalogenation and dehydrohalogenation. Sulfur mustard does not bioconcentrate or biomagnify due to its reactivity and it is unlikely that it is transported through the vascular systems of plants since it would almost surely undergo hydrolysis in the process.

Breakdown products of sulfur mustard include thiodiglycol and hydrogen chloride. Under certain conditions minor quantities of 1,4-dithiane and 1,4-oxathiane are also formed. The hydrolysis products of mustard are more water soluble and can migrate at a higher rate than mustard. These materials (1,4-dithiane and 1,4-oxathiane) also degrade more slowly than mustard because the compounds are not utilized by microorganisms as efficiently (ATSDR, 2003; Munro et al., 1999).

The primary concern of contact with mustard agent in liquid or gas form is its ability to function as a blistering agent. Mustard gas, or sulfur mustard (Cl-CH2CH2)2S, is a chemical agent that causes severe burning of the skin, eyes and the respiratory tract. Mustard agent can be absorbed readily via inhalation, ingestion or by contact with the skin or eyes. Unlike chemical nerve agents such as organophosphates or sarin gas, which immediately incapacitate victims, people exposed to mustard gas typically do not exhibit symptoms until 12 to 24 hours after exposure. However, higher concentrations of the gas can cause symptoms to develop within one to two hours. This would not be the case at SMABS if there was some type of inadvertent exposure since the CAIS would only contain small amounts of liquid even if the vials were somehow broken, the release and exposure would be limited. Short-term exposure to low doses of mustard gas is not lethal. Most people recover from their symptoms quickly. If the exposure concentration is very high or prolonged, there could may be permanently disfigured as a result of chemical burns. If the contact is direct and prolonged to the eyes then blindness may occur. Sometime people that are exposed develop chronic respiratory diseases or infections, which can be fatal.

The information is provided to relate to concentrations normally assessed under CERCLA related measures of exposure. In standard cancer risk assessment methods, an estimate for cancer risk was calculated. The USEPA (1991) derives a unit risk of 8.5 x 10-^{2} per microgram/m^3 for mustard. Considering a single 5 minute exposure to mustard agent at a concentration of 0.05 mg/m^3 (chosen to approximate a level 10% of a dose that might cause minimal signs and symptoms), the cancer risk was estimated as 5.8 x 10^{-7} (Perrotta, CDC - http://www.gulflink.osd.mil/agent.html). It is expected that if any encounter with CAIS or mustard agent did occur at the SMABS, it would be at very low concentrations given the hypothetical exposure scenarios. According to the International Agency for Research on Cancer (IARC), the average and maximum atmospheric concentrations of sulfur mustard in combat zones were determined to be around 20 and 33 mg/m^3 (IARC, 1975). The duration of exposure to a given concentration of a chemical is relative to the amount and severity of an effect. The exposure threshold for death from respiratory damage has been estimated to be between 1,000 and 1,500 mg·min/$m^{3.}$ Therefore, fatal exposures on the battlefield in WWI must have lasted between 50 and 75 minutes (the product of 50 minutes and 20 mg/m^3 would equal a Ct of 1,000), if the estimated atmospheric concentrations were sustained, or longer if the concentrations dropped substantially. These are concentrations that are much greater and longer lasting than would result in the atmosphere from release of mustard agent from a CAIS. This is especially true with the mustard agent only being 5% in concentration in chloroform for example.

The Centers for Disease Control (CDC) recommendations for safe levels of exposure to mustard agents and Lewisite provide a useful frame of reference. The CDC published chemical agent control limits for atmospheric exposures to chemical munitions in the Federal Register in 1988 in response to the mandated destruction of all unitary lethal and chemical munitions. The general population exposures limits are 0.0001 and 0.003 mg/m^3 for sulfur mustard and Lewisite, respectively. For workers directly involved in munitions removal and destruction, the limits (averaged over 8 hours) are 0.003 mg/m^3 for both agents (CDC, 1988). These are much lower than would be anticipated in the release from a CAIS vial or bottle.

3.5 APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

The identification and evaluation of ARARs is an integral part of complying with CERCLA and SARA. As defined in the National Contingency Plan (NCP), applicable requirements are "those cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under Federal or state law that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstances at a CERCLA site" (40 Code of Federal Regulations [CFR] 300.5 [1995]). Relevant and appropriate requirements are "those cleanup standards, standards of control and other substantive environmental protection requirements, criteria, or limitations promulgated under federal or state law that, while not applicable to a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site, address problems or situations sufficiently similar to those encountered at the CERCLA site that their use is well suited to the particular site" (40 CFR 300.5 [1995]).

Requirements under Federal or state law may be either applicable or relevant and appropriate to CERCLA cleanup actions, but not both. In the latter case, requirements must be both relevant and appropriate to be ARARs. The Federal regulation must be selected when both a Federal and state ARARs are available or when two potential ARARs address the same issue (even if a state has authorization to administer the Federal program), unless the state has promulgated a more stringent requirement. "More stringent" also includes those state laws or programs that have no Federal counterpart because "they add to the Federal law requirements that are specific to the environmental conditions in the State" (USEPA, 1989).

All CERCLA onsite remedial response actions must comply only with the substantive requirements of a regulation and not the administrative requirements (CERCLA § 121[e]). This position has been reaffirmed in the NCP (55 Federal Register [FR] 8756, March 8, 1990). Substantive requirements pertain directly to the actions or conditions at a site, and administrative requirements facilitate their implementation. Certain administrative requirements should be observed if they are useful in determining cleanup standards at the site (55 FR 8757, March 8, 1990). Offsite actions, on the other hand, are subject to the full requirements of the applicable standards or regulations, including all administrative and procedural regulations.

The selection of ARARs is dependent on the hazardous substances at a site, the physical site characteristics and geographic location. The actions selected as remedy, and are addressed by chemical-, location-, and action-specific ARARs, respectively, as described below:

- Chemical-specific---Chemical-specific requirements define acceptable exposure levels for specific hazardous substances and, therefore, may be used as a basis for establishing preliminary remediation goals (PRGs) and cleanup levels for chemicals of concern (COCs) in the designated media. Chemical-specific ARARs and to-be-considered (TBC) criteria also are used to determine treatment and disposal requirements for removal actions. In the event a chemical has more than one requirement, the more stringent of the two requirements is used. There are no known promulgated Federal chemical-specific cleanup standards for soil. The TBC guidance pertaining to the cleanup objectives for soil include the USEPA Regional Screening Levels (RSLs) (USEPA, 2015).

- Location-specific---Location-specific ARARs set restrictions on the types of removal actions that can be performed based on the physical characteristics of the site or its immediate surroundings. In determining the use of the location-specific ARARs for selection of remedial actions at CERCLA sites, the jurisdictional prerequisites of each regulation must be investigated. Alternative removal actions may be restricted or precluded based on Federal and state laws for hazardous waste facilities or proximity to faults, floodplains, caves, salt-dome formations, salt-bed formations, underground mines, wetlands, wilderness areas, wildlife refuges, wildlife resources, and scenic rivers. None of the previous listed physical characteristics pertain to SMABS or its immediate surroundings; therefore, no location-specific ARARs pertain to this site.

- Action-specific---Action-specific ARARs are technology-based requirements that set controls or restrictions on the design, implementation, and performance levels of removal activities related to the management of hazardous substances, pollutants, or contaminants. Potential action-specific ARARs are presented in Appendix A. These requirements are triggered by the remedial Alternatives selected to remove the mustard agent-impacted soils. If no remedial action was selected under the CERCLA process, compliance with action-specific ARARs would not be required.

In accordance with the National Contingency Plan (NCP) (40 Code of Federal Regulations [CFR] 300.415(j)) on-site removal actions conducted under CERCLA are required to meet ARARs “to the extent practicable, considering the exigencies of the situation.” Shipments of contaminated soils and dry sediments will comply with Federal, State, and local rules, laws and regulations. In addition to the identified applicable and relevant or appropriate requirements (ARARs) for the selected action, the Army will comply with requirements applicable to off-site actions, such as Resource Conservation and Recovery Act (RCRA) hazardous waste transportation requirements under Ohio Administrative Code (OAC) 3745-52-20 to OAC 3745-52-33, and offsite treatment prior to land disposal as required by RCRA’s land disposal restrictions under OAC 3745-270, including alternative land disposal restriction treatment standards for contaminated soil under OAC 3745-270-49. Appendix B presents the ARARs which are applicable to removal action at the SMABS AOC.

SECTION 4: IDENTIFICATION AND ANALYSIS OF ALTERNATIVES

This section describes the removal action Alternatives developed for the SMABS AOC and the individual analysis of each. Removal action Alternatives should assure adequate protection of human health and the environmental, achieve RmAOs, meet ARARs, and if applicable, permanently and significantly reduce the volume, toxicity, and/or mobility of contaminants.

The four Alternatives considered in this EE/CA are:

- Alternative 1 – No Action;
- Alternative 2 – Land Use Controls: Activity Use Restrictions;
- Alternative 3 – Land Use Controls: Security Fence;
- Alternative 4 – Intrusive Investigations and Removal Action.

4.1 EVALUATION CRITERIA

Section 300.430(e) of the NCP lists nine criteria by which each remedial Alternative must be assessed. The acceptability and performance of each Alternative against the criteria are evaluated individually so that relative strengths and weaknesses can be identified. However, in an EE/CA a streamlined version of evaluation criteria is considered. In an EE/CA, each of the Alternatives are evaluated using the short- and long-term aspects of three broad criteria: effectiveness, implementability, and cost. Additionally, each of the three broad criteria have sub-criteria that are also considered under each criteria. Consistent with the Guidance for Conducting Non-Time Critical Removal Actions under CERCLA EPA/540-R-93-057 (USEPA, 1993), the four Alternatives were evaluated against the following three broad criteria and associated sub-criteria:

- Effectiveness:
  - Overall protection of human health and the environment:
  - Complies with ARARS,
  - Long-term effectiveness and permanence,
  - Reduction of toxicity, mobility, or volume through treatment, and
  - Short-term effectiveness.
- Implementability:
  - Technical Feasibility,
  - Administrative Feasibility,
  - Availability of services and materials,
  - State (support agency) acceptance, and
  - Community acceptance.
- Cost:
  - Capital costs (including present worth and post removal site control), and
  - Operation and maintenance costs and fees.

4.1.1 Effectiveness Criteria

The USEPA defines effectiveness of an Alternative as the ability to meet the objectives within the scope of the removal action. The criteria that determines the level of effectiveness is the overall protection of human health and the environment; compliance with ARARs; long-term effectiveness and permanence; reduction of toxicity, mobility, or volume; and short-term effectiveness.

4.1.1.1 Overall Protection of Human Health and the Environment

One measure of effectiveness is how well the overall protection of human health (community) and the environment are met by the Alternative. Each Alternative must be evaluated to determine how it achieves and maintains protection of human health and the environment.

4.1.1.2 Compliance with Applicable or Relevant and Appropriate Requirements

Compliance with ARARs addresses whether or not a remedy will meet all of the applicable or relevant and appropriate requirements of other Federal and state environmental statutes and/or provide grounds for invoking a waiver. Compliance with ARARs is required to the extent possible based on the urgency of the situation and the scope of the action contemplated (40 CFR 1300.415(j)). Each Alternative must be evaluated against the ARARs presented in Appendix B. On-site response actions must comply with the substantive requirements that may be an ARAR, where practical.

4.1.1.3 Long-term Effectiveness and Permanence

Long-term effectiveness and permanence is an evaluation of the magnitude of residual risk (risk remaining after implementation of the Alternative) and the adequacy and reliability of controls used to manage the remaining waste (untreated waste and treatment residuals) over the long term once the cleanup goals have been met. Alternatives that provide the highest degree of long-term effectiveness and permanence leave little or no untreated waste at the site, make long-term maintenance and monitoring unnecessary, and minimize the need for land use controls.

4.1.1.4 Reduction of Toxicity, Mobility, or Volume

Reduction of toxicity, mobility, or volume through soil removal is an evaluation of the ability of the Alternative to reduce the toxicity, mobility, or volume of the waste. The evaluation involves an assessment of the amount of hazardous material removed, the degree of reduction in toxicity, mobility, or volume, and the type and quantities of residuals remaining after removal. Reduction of toxicity, mobility, or volume through treatment is the anticipated performance of the treatment technologies that may be employed in a remedy

4.1.1.4 Short-term Effectiveness

Short-term effectiveness addresses the protection of workers and the community during the removal action, the environmental effects of implementing the action, and the time required to achieve media-specific cleanup goals. This criterion accounts for potential threats to workers (e.g., fugitive dust and transportation of hazardous materials), the environment (e.g., potential spills and releases), and reliability of mitigation measures. Short-term Effectiveness refers to the speed with which the remedy achieves protection, as well as the remedy's potential top create adverse impacts on human health and the environment that may result during the construction and implementation period

4.1.2 Implementability Criteria

Implementability addresses the technical and administrative feasibility of implementing an Alternative, the availability of various services and materials required during implementation, and the state and community acceptance. Implementability is a measure of whether a course of action Alternative can be physically and administratively implemented, such as the ability to construct, excavate, or demolish. It is also a measure of the availability of the services and materials needed to implement the Alternative. Other considerations regarding implementability include state agency and community acceptance of a given Alternative.

4.1.2.1 Technical Feasibility

Technical feasibility assesses the reliability of the technology and operational difficulties and the environmental conditions of construction/removal implementation. It assesses the ability to perform the removal in the allotted amount of time. Technical feasibility also takes into consideration the potential need and ease of future removal actions.

4.1.2.2 Administrative Feasibility

The administrative feasibility criterion assesses the coordination of all aspects involved with the removal action, addressing concerns from regulatory agencies, and adherence to non-environmental laws.

4.1.2.3 Availability of Services and Materials

The availability of services and materials to implement the removal actions is evaluated. The evaluation includes an assessment of the availability of materials, availability of contractors and specialists, and the availability of off-site treatment, storage, and disposal of excavated material.

4.1.2.4 State and Community Acceptance

State acceptance considers comments received from agencies of the State of Ohio. The primary state agency supporting this investigation is the Ohio EPA. Community acceptance considers comments made by the community, including stakeholders, on the Alternatives being considered during the public comment period. Comments will be accepted from the community on the EE/CA and the preferred remedy presented in an Action Memorandum.

4.1.3 Cost Criteria

Cost analyses provide an estimate of the dollar cost of each Alternative. This analysis includes an estimate of the capital cost in dollars, annual operation and maintenance (O&M) cost (if applicable), and indicates the period of time to complete the proposed action. Details and assumptions used in developing cost estimates for each of the Alternatives presented in this

EE/CA are provided in Appendix C. Cost figures (provided in Appendix C) were obtained from readily available sources (e.g., Means Site Work Costs Data, vendors, local suppliers, and experience at other sites) and were used to estimate costs for the Alternatives for comparison and estimating purposes. These cost estimates should not be considered the actual cost of designing and implementing a remedial action, but rather relative costs among the Alternatives using consistent assumptions and estimating methods.

4.2 EVALUATION OF ALTERNATIVE 1 – NO ACTION

This Alternative would involve no further CERCLA response action at the SMABS AOC except to document the decision. Implementation of this Alternative would eliminate current management practices of the site as restricted access. Although this Alternative is labeled as "No Action", the Army would continue to manage the AOC according to the recommendations made in the Probability Assessment and developed in the Contingency Plan as per Army and DOD Regulations. Additionally, applicable Army Regulations and requirements as deemed necessary for occupational health and safety will be followed for persons using the SMABS. Management and demarcation of the AOC would be in compliance with Army Regulations and Range Management directives as required in the Contingency Plan. Under this Alternative, Five-Year Reviews would not be conducted as stated in CERCLA 121(c).

4.2.1 Effectiveness of Alternative 1

No additional removal actions would be taken at the SMABS AOC under this Alternative. This Alternative would not provide additional protection of human health and the environment; compliance with ARARs; long- or short-term effectiveness; or reduction of toxicity, mobility, or volume. However, the Army has protective measures in place such as the Contingency Plan as well as occupational exposure requirements and other DOD regulations that under the circumstances, would limit/reduce/and or eliminate any hazards from inadvertent exposure or a release.

Given that no conclusive or documented evidence beyond personal accounts has been presented to confirm the presence of CAIS or other sulfur mustard agent-related materials at the SMABS AOC, there is low probability for the existence of buried mustard agent at the SMABS, which would eliminate the need for any additional removal actions by the Army. Although the anomalies identified from the DGM surveys have not yet been investigated, the nature of the anomalies appears to be non-hazardous and related to cultural or anthropogenic features. Analyses of the groundwater and soil samples collected in and around the SMABS AOC did not indicate the presence of sulfur mustard agent or its breakdown products. Therefore, this Alternative is effective (provides adequate protection of the human health and the environment) as long as the Army maintains status of the AOC by continuing the Contingency Plan and by following applicable Army Regulations and other requirements lie those developed for Range Management.

In a recent article published online (http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1480580/), Lyribozo states that "*to the best of our knowledge, there are no recent reports of exposure to MG in the United States. In fact, the only reported exposures to MG in the United States are the volunteer servicemen exposed in military experiments in the early 1940s. In Europe, however,* *there are ongoing accidental exposures from leftover artillery shells.[4,11,12] In the United States, Public Law 99-145 required the destruction of all US MG stockpiles by September 1994.[7] This was later postponed to 2004. The nearest stockpile of MG to our area of exposure is Pine Bluff Arsenal in Arkansas".* Accordingly, the U.S. stockpile of sulfur mustard, currently stored at seven military installations (Aberdeen Proving Ground, Maryland; Anniston Army Depot, Alabama; Lexington Blue Grass Army Depot, Kentucky; Pine Bluff Arsenal, Arkansas; Pueblo Depot Activity, Colorado; Tooele Army Depot, Utah; Umatilla Depot Activity, Oregon) and one location in the South Pacific (Johnston Island, U.S. Pacific Territory), is under congressional mandate for destruction (Carnes, 1989; Carnes and Watson, 1989). The concentration and quantity of mustard agent in test kits was a low concentration. If the test kits were broken the mustard agent would be a slowly released. Personnel properly trained in the safety, reporting, and handling of such materials would be able to avoid injury and exposure. Since there has not been a reported mustard agent exposure to CAIS in the US, it appears that the DOD and Army Regulations and procedures have been successful. Incidental exposure to buried mustard agent kits has not been reported in the US. The Army and DOD safe practices and awareness training for personnel that may encounter such materials has been protective and effective.

4.2.2 Implementability of Alternative 1

The No Action Alternative would be technically and administratively feasible, and would require no services or materials to be implemented. After several investigations and one excavation at the AOC which were all based on hearsay, no indication or sign of mustard agent was discovered. The Army has determined that CAIS and other sulfur mustard agent-related materials are unlikely to be present at the SMABS AOC based on the historical records review, previous investigations, and DOD policy. There have been no reported injuries in the US from incidental exposure to CAIS which supports that the No Action Alternative would be implementable and would allow usage of the SMABS as long as proper safety issues are addressed for the OHARNG personnel. Additionally, the Army has ongoing Regulations and requirements such as the Contingency Plan already in place (implemented as well as mandated) that will allow the State and community to accept this Alternative, although there will always be some level of uncertainty. Because the Contingency is already in-place and has been fully implemented, this Alternative is implementable.

4.2.3 Cost of Alternative 1

The present value cost to complete Alternative 1 is zero. There is no capital cost associated with No Action Alternative. Any costs relative to the continued use and management of the AOC per the Contingency Plan and Army regulations are not a function of CERCLA or of the EE/CA and are not considered further.

4.3 ALTERNATIVE 2 – LAND USE CONTROLS: ACTIVITY USE RESTRICTIONS

Under this Alternative, the Army would assume that there is a potential that mustard agent is buried on the AOC in at least one of the three locations. This Alternative would involve the implementation of Land Use Controls (LUCs) as an administrative control and would also include some type of demarcation (i.e., Seibert stakes) to identify areas where activities are restricted.

The LUCs developed for this Alternative would allow non-intrusive training activities while preventing vehicular traffic and the use of heavy equipment on the AOC in any of the three areas. Limiting physical access to the AOC ensures that use of the AOC will be controlled and only used as allowed. Additional actions regarding land use controls and mechanisms to develop and regulate activity and use restrictions would be established. The implementation of this Alternative would include continued management and maintenance some type of demarcation to indicate areas where activities are restricted. Additionally, Five-Year Reviews would be conducted as stated in CERCLA 121(c).

4.3.1 Effectiveness of Alternative 2

Under Alternative 2, LUCS would be developed and administered that restrict access to the AOC as well as prohibit intrusive activity (e.g., digging). These LUCs would restrict excavation activities while preventing vehicular traffic and controlling physical access. Also, the implementation of this Alternative would also include continued management and maintenance of Seibert stakes, thereby reducing the potential for direct contact with objects potentially buried in the AOC, which may include CAIS or other sulfur mustard agent-related materials. These administrative and physical controls would provide protection of human health and the environment. Activity use restrictions to prevent intrusive activities and the use of vehicles or heavy equipment of the AOC within the three areas will protect the environment from potential inadvertent releases of mustard agent. This Alternative is compliant with ARARs identified in this EE/CA. Long- and short-term effectiveness of this Alternative would be directly related to the duration and enforcement of the LUCs but would provide a high degree of protectiveness. This Alternative does not involve treatment so no reduction in the potential toxicity, or volume of any existing sulfur mustard agent at the AOC. The mobility would be indirectly affected since restricting traffic and digging would limit disturbance to any materials if buried on the AOC.

4.3.2 Implementability of Alternative 2

This Alternative is technically and administratively feasible, requiring an amendment to the Property Management Plan for the facility. The LUCs are implementable with the proper oversight of the US Army. This Alternative would require additional consideration and training for anyone conducting maintenance and management activities such as natural resource management activities on the site but this is already a routine measure completed by the Installation. Alternative 2 would also require additional signage at the AOC and include the management and maintenance of existing Seibert stakes. Since this Alternative minimizes the possibility of CAIS or other sulfur mustard agent-containing materials being contacted at the AOC, the State and community would likely accept the selection of this Alternative. Because LUCs are already in place and are being managing properly, this Alternative is fully implementable.

4.3.3 Cost of Alternative 2

Primary cost drivers for this Alternative would be the amendment to the facility Property Management Plan, the installation and upkeep of demarcation of the three areas (e.g., signage and Seibert stakes) at the SMABS AOC, a training and briefing program for personnel and trainees, annual inspection of LUC effectiveness, and Five-Year Reviews. As presented in Table 1, the costs developed for this Alternative were based on three primary tasks:

Task 1.0: Project Management Plan/QC Plan
Task 2: Preparation of Work Plan and Support Documents
Task 3: Implementation of Work Plan.

The estimated present worth of this Alternative is $601,618 (Table 1). For cost estimating purposes, a detailed cost estimate for this Alternative is provided in Appendix C. Cost are based on a thirty- year period with 30 Annual Inspections and six Five-Year Reviews. Costs were developed without consideration of the extensive Army/DOD/ and OSHA requirements for worker safety and for the requirements developed specifically by CWA Army Experts for the SMABS as presented in the Contingency Plan.

TABLE 1. Costs for Alternative 2 (Land Use Controls: Activity Use Restrictions).

Task Name	Capital Costs	Total Cost
Task 1.0: Project Management Plan/QC Plan	$8,894	
1.1 Site Safety and Health Plan	$10,134	
1.2 Project Execution/Client Correspondence	$28,577	
Task 2: Preparation of Work Plan and Support Documents	$18,461	
Task 3: Implementation of Work Plan	$6,600	
3.1 Amendment of Property Management Plan	$8,334	
3.2 Installation of Seibert Stakes or some similar other demarcation	$32,178	
3.3 Briefing of On-Site Personnel	$15,503	
3.4 Thirty Annual Inspection of LUCs Effectiveness	$150,562	
3.5 Six Five Year Reviews	$296,641	
3.6 O&M	$25,727	
		$601,618

4.4 ALTERNATIVE 3 – LAND USE CONTROLS: SECURITY FENCE

Under this Alternative, the Army would assume that there is a likely potential that mustard agent is buried as the AOC in at least one of the three locations. This Alternative would involve the implementation of access controls at the SMABS AOC. Implementation of this Alternative would involve the installation of a security fence (and signage) around all three areas of the SMABS AOC where mustard agent or CAIS may have been buried. The fence will consist of a combination of chain link security fence or something comparable, but will fully restrict access and use. The fence will also include gates so maintenance activities such as mowing and other non-intrusive activities (e.g., sampling, surveying, natural resource management, etc.) per the LUCs can occur. Placement of the gates would be determined during the design phase of the gate installation. Additional actions regarding land use controls, monitoring, or access restrictions will also be required as part of this Alternative. All personnel using and accessing the AOC within the fenced area will be briefed on the hazard and use restrictions. Under this Alternative, Five-Year Reviews would be conducted as stated in CERCLA 121(c).

4.4.1 Effectiveness of Alternative 3

Alternative 3 would include the installation of access controls at the SMABS AOC, specifically the installation of security fence around each of the three areas where mustard agent or CAIS is supposedly buried. This Alternative would be fully protective of human health and the environment since restricting all use through physical access to the AOC will eliminate the any direct contact with objects potentially buried in the AOC, which may include CAIS or other sulfur mustard agent-related materials. The administrative and physical controls would provide protection of human health and the environment. This Alternative is compliant with ARARs identified in this EE/CA. Long- and short-term effectiveness of this Alternative would be directly related to the structural integrity and maintenance of the fence and the duration and enforcement of the LUCs. This Alternative would provide a high degree of protectiveness. This Alternative does not involve treatment so no reduction in the potential toxicity, or volume of any existing sulfur mustard agent at the AOC. The mobility would be indirectly affected since restricting traffic and digging would limit disturbance to any mustard agent or CAIS materials if they were actually buried on the AOC.

4.4.2 Implementability of Alternative 3

This Alternative would be technically and administratively feasible, requiring construction crews to install fence. This Alternative would also require inspections and maintenance to uphold the structural integrity of the fence. This Alternative may require the services of construction support qualified in CWM-related activities in the event that excavation activities need to take place at the AOC. This Alternative would likely require some notification system indicating all access as well as all other restrictions at the AOC, a training and briefing program for personnel and trainees, annual inspection of LUC effectiveness, and Five-Year Reviews. Since this Alternative practically eliminates the possibility of encountering CAIS and other sulfur mustard agent-related materials at the AOC, the State and community would likely accept the selection of this Alternative.

This Alternative is technically and administratively feasible, requiring an amendment to the facility Property Management Plan. The LUCs are implementable with the proper oversight of the US Army. This Alternative would require additional consideration and training for anyone conducting maintenance and management activities such as natural resource management activities on the site but this is already a routine measure completed by the Installation.

4.4.3 Cost of Alternative 3

The primary cost drivers for this Alternative would be the labor and materials associated with the installation and continued maintenance of the fence. The estimated present worth of this Alternative is $806,733. For cost estimating purposes, a detailed cost estimate for this Alternative is provided in Appendix C. Cost are based on a thirty- year period with 30 Annual Inspections and six Five-Year Reviews. The total perimeter length around all three areas was assumed to be approximately 3000 feet. As presented in Table 2, the costs developed for this Alternative were based on three primary tasks:

Task 1: Project Management Plan/QC Plan
Task 2: Preparation of Work Plan and Support Documents

Task 3: Implementation of Work Plan.

Costs were developed without consideration of the extensive Army/DOD/ and OSHA requirements for worker safety and for the requirements developed specifically by CWA Army Experts for the SMABS as presented in the Contingency Plan.

TABLE 2. Costs for Alternative 3 (Land Use Controls: Security Fence).

Phase Name	Capital Costs	Total Cost
Task 1: Project Management Plan/QC Plan	$11,102	
1.1 Site Safety and Health Plan	$10,134	
1.2 Project Execution/Client Correspondence	$28,577	
Task 2: Preparation of Work and Support Documents	$18,461	
Task 3: Implementation of Work Plan	$6,600	
3.1 Installation of Security Fence line	$202,282	
3.2 Thirty Annual Inspection of LUCs effectiveness	$150,652	
3.3 Six Five Year Reviews	$296,641	
3.4 O&M	$82,368	
		$806,733

4.5 ALTERNATIVE 4 – INTRUSIVE INVESTIGATION AND REMOVAL ACTIONS

This Alternative would involve an extensive multi-phased approach to fully investigate and destroy/eliminate any mustard agent or CAIS materials that are uncovered in any of the three areas. This Alternative would include an additional historical review to identify any existing records relative to the use, location, transportation, and destruction of mustard agent on RVAAP or similar facilities. Under this Alternative, intensive intrusive and removal actions would be completed at each of the three areas on the SMABS AOC. Before this Alternative can be implemented, numerous Army Safety Regulations and requirements such as those established for CWM handling and removal must be addressed. These Regulations are in addition to those requirements for worker protection and measures required by OSHA and NIOSH for CERCLA actions. This Alternative requires extra worker protection and safety requirements because this Alternative could pose potential exposure to mustard agent and would be considered hazardous working conditions to personnel performing the extensive investigations. This Alternative would require mandatory additional Army and contractor experts such as Health and Safety, Medical, and other specialized experts including but limited to the following:

- U.S. Army Edgewood Chemical Biological Center = (ECBC)
- U.S. Army CBRNE Analytical and Remediation Activity = (CARA)
- Chemical, Biological, Radiological, Nuclear and Explosives = (CBRNE).

Under this Alternative for Phase I and Phase II, an on-site medical emergency facility, decontamination process area, a mustard agent on-site testing lab/area as well as in-situ testing equipment and process areas for decontamination/destruction activities. The extra personnel and requirements are necessary because of the potential exposure to workers. It is highly unlikely that any mustard agent or material would be encountered but these precautions are needed because of the nature of mustard agent being a CWM and for worker protection. It is imperative to ensure worker protection in the event of an unexpected exposure, accident, or release regardless of how negligible the likelihood of encountering mustard agent is for the AOC.

Two types of removal actions would be completed as part of this Alternative. The Phase I component of this Alternative will involve trenching and/or test pits followed by removal and treatment (destruction or decontamination) of the any materials in the 1998 and the 2006 Geophysical Investigation Areas, will be completed on-site. The Phase II of this Alternative would be conducted in the 2010 Geophysical Investigation Area would be handled differently because of the numerous anomalies buried in the area. Each anomaly would be dug out and removed by hand (if it can be done safely) and then would be identified to determine its origin. Soil around each anomaly will be tested for mustard agent. The anomalies would be treated as necessary, stockpiled, and then properly disposed if they are not part of a CAIS or contain chemical agent. Any chemical agents (mustard agent or CAIS) discovered would be treated (destruction or decontamination) on-site. Both types of removal actions would also require confirmation sampling and testing of the soil to ensure that it does not contain mustard agent before being put back in place.

In the Phase I at the 1998 and 2006 Geophysical Investigation Areas, intrusive investigations would be performed by personnel in protective gear and would involve excavation of test pits or trenches using an excavator or similar device. Initially, these areas will be cleared of any obstacles and/or vegetation that would interfere with the excavation, identifying/locating utilities, setting up a decontamination facility, and establishing an on-site emergency health center. A visual survey would be completed by UXO-trained, safety, and CWM-trained personnel to categorize materials as chemical hazards (i.e., mustard agent), MEC, MD, and/or cultural debris. Once the uncovered item is categorized, it will be removed and safely treated. If it is considered potentially MEC or MC, then UXO-qualified personnel would determine whether the MEC is acceptable to move. If the item is determined acceptable to move, the MEC would be transported to a prearranged onsite location for destruction and disposal. However, if the item is determined unacceptable to move, the MEC would be blown-in-place. Inert MD items would be removed from the area and transported offsite for disposal. Excavated soil will be placed on plastic liners next to each trench for examination and confirmation testing. Personnel will visually examine the excavated soil. If any sign of a mustard test kit or material is identified in the soil, then the soil surrounding the item would also be tested using field test kits to determine the presence of mustard agent. The item will be handled by CWM-trained personnel and removed to the decontamination area for further analysis, destruction, and removal. Due to the uncertainty of the existence of a sulfur mustard agent burial site, trenches would be developed over the entire surface area of the 1998 geophysical area (24,329 ft^2) and over the entire 2006 geophysical area (3,294 ft^2).

In the Phase II at the 2010 geophysical area, only investigation of the anomalies would be evaluated in this Alternative followed by subsequent removal activities (disposal, destruction, treatment, etc. depending upon the nature of the anomaly). Intrusive investigation of the anomalies identified from the geophysical investigations conducted at the SMABS AOC during the 2010 indicate a high density of anomalies related to anthropogenic features, and identified two areas south and southeast of the suspected burial site characterized by relatively denser aggregates of individual anomalies. The survey data also identified anomalies beyond the northern edge of the concrete pad that appeared to be linear in nature and possibly related to subsurface utilities.

A visual and magnetometer-assisted surface survey would be completed by UXO-trained personnel to locate anomalies (metallic objects). Metallic objects located on the ground surface would be identified as chemical hazards (i.e., mustard agent), MEC, MD, and/or cultural debris. Once the anomaly is categorized, it will be removed and safely treated. If it is considered potentially MEC or MC, then UXO-qualified personnel would determine whether the MEC is acceptable to move. If the item is determined acceptable to move, the MEC would be transported to a prearranged onsite location for destruction and disposal. However, if the item is determined unacceptable to move, the MEC would be blown-in-place. Inert MD items would be removed from the area and transported offsite for disposal. Following the surface survey, any obstacles, surface structures, or vegetation (trees and brush) that would interfere with the subsurface geophysical survey would be removed. The cleared vegetation debris would be stockpiled outside the proposed excavation area to be handled and disposed of in accordance with USACE requirements.

Next, DGM and intrusive investigation would be conducted to map and remove subsurface metallic anomalies to a minimum depth of 1 foot BLS within the 2010 Geophysical Investigation Area. Anomalies should be identified to the detection depth allowed by the selected geophysical instruments used in the DGM and if anomalies are identified below the minimum 1 foot BLS, these anomalies also would be investigated. An intrusive investigation using hand excavation methods (i.e., shovels, trowels) would then be completed until the anomaly source is identified. The UXO-qualified personnel would destroy any MEC identified during subsurface investigation in a similar manner as the surface MEC encountered during the surface survey. The CWM personnel would remove and destroy any potential mustard agent identified. If the presence of mustard agent material is confirmed, the soils around the material would be tested using field test kits. Any mustard agent materials would be further assessed to determine what source was buried at the AOC and to compare to nationwide records. For example, the batch number and kit type would help pinpoint when and potentially how many test kits or mustard agent could have been shipped to the former RVAAP. The soils free of any Mustard Agent Materials, MEC and MD would be reused at the site for backfilling the small excavations.

4.5.1 Effectiveness of Alternative 4

Once completed, Alternative 4 would be effective at providing adequate protection of human health and the environment since it would result in the removal of potential hazards in the surface and subsurface related to any identified mustard agent or materials. Extensive worker protection and hazardous materials training would be required for all personnel involved in this Alternative. Army Regulations and specific CWM experts from several Army Agencies must be on site during the investigation so that all Army safety requirements would be followed in addition to OSHA and NIOSH and other worker-protection Regulations to make this Alternative protective of workers. This Alternative would be permanent and effective in the long-term because identified mustard agent or materials would be destroyed and there would be a total reduction in the volume if discovered. This Alternative would comply with action-specific ARARs provided in Section 3. Reduction in toxicity is not relevant since materials would be destroyed and removed. Reduction in mobility may only be relevant where physical evidence indicates that natural physical forces in the area (e.g., frost heave, erosion) are possible to potentially expose mustard agent or materials or to move these materials to the subsurface. The implementation of this Alternative would be conducted in accordance with health and safety procedures and responsibilities identified in Engineer Regulation (ER) 385-1-97, as well as those in DA-PAM 385-30, and TRADOC Pamphlet 385-1.

Due to the uncertainty associated with the low potential to find sulfur mustard agent-containing material based on previous investigations, a removal action can only be estimated. This Alternative is compliant with ARARs identified in this EE/CA. Long- and short-term effectiveness of this Alternative would be directly related to the outcome of the investigation and any resultant removal action; conceptually, the additional investigation would either identify sulfur mustard agent-containing material that would be removed and disposed, or demonstrate that sulfur mustard agent-containing material or CAIS are not buried at the SMABS AOC.

It is anticipated that Five-Year Reviews would not be conducted as stated in CERCLA 121(c). Completion of this Alternative would eliminate any potential source of mustard agent in each of the three areas so that the AOC would meet Unrestricted (Residential) Land Use and no other requirements such as compliance with the Contingency Plan would be required.

4.5.2 Implementability of Alternative 4

Both Phase I and Phase II of this Alternative would be technically and administratively feasible, and would require specialized personnel as stated above, additional personnel qualified in CWM-related activities, an on-site medical emergency facility, ambulatory services, mustard agent treatment process area, in-situ and ex-situ testing process and area, worker protection monitoring, and other specialized processes and services needed to conduct the investigation, identification, and, if necessary, excavation, treatment, and disposal of the anomalies.

Administrative feasibility would require advanced logistical and management support of all workers as well as oversight from Army experts. In order to minimize the potential risk to workers, the investigation would be conducted more cautiously and would require more time than excavation through the use heavy construction equipment. All services and materials required for this Alternative are readily available. This Alternative would likely be acceptable to the regulatory agencies and the community because results of this investigation would positively prove the presence or absence of CAIS/mustard agent being buried at the AOC.

4.5.3 Cost of Alternative 4

The primary cost drivers for this Alternative for both Phases would be the labor, equipment, and materials associated with the extensive trenching activities, investigation of the anomalies, intense health and safety requirements, temporary-emergency facility, onsite testing and analyses, destruction/decontamination area and process, CWM and UXO experts and training, and other worker protection requirements (i.e., medical monitoring and personal protective equipment). Cost details for this Alternative are provided in Appendix C.

The estimated present worth of Phase I of this Alternative is $1,289,946 (Table 3). The estimated present worth of Phase II of this Alternative is $1,309,504 (Table 4). The combined estimated present worth of Phase I and Phase II of this Alternative is $2,599,450. For cost estimating purposes, it is assumed that the interim removal actions would be completed within 1 year.

For cost savings purposes, several of the mandatory items required for this Alternative such as development of a Project Management Plan were mainly included in Phase I and not duplicated in the Phase II costs. Other reduced cost for the Phase II included no labor or expenses to setup and develop the onsite testing and medical facilities.

TABLE 3. Phase 1 Costs for Alternative 4 (Intrusive Investigations and Removal Actions).

Phase Name	Capital Costs	Total Cost
Task 1: Project Management Plan/QC Plan	$16,190	
1.1 Site Safety and Health Plan	$18,150	
1.2 Project Execution/Client Correspondence	$66,902	
1.3 Jurisdictional Wetland Delineation	$64,374	
Task 2.0 Preparation of Work Plan and Support Documents	$48,181	
Task 3: Implementation of Work Plan	$66,136	
3.1 Vegetation, Clearing, Wetland Protection and Erosion Control	$53,943	
3.2 Excavation of Test Pits (Trenches)	$374,264	
3.3 Medical Testing, Disposal, Confirmation Analysis	$278,414	
3.4 Analysis, Examination, and Disposal of IDW	$61,143	
3.5 Data Management/Data Validation	$13,451	
3.6 Surveying and Mapping	$73,628	
Task 4: Investigation Report	$155,163	
		$1,289,946

TABLE 4. Phase II Costs for Alternative 4 (Mustard Agent and MEC Removal and Destruction/Decontamination).

Phase Name	Capital Costs	Total Cost
Task 1: Project Management Plan/QC Plan	$9,814	
1.1 Site Safety and Health Plan	$18,150	
1.2 Project Execution/Client Correspondence	$64,982	
Task 2.0 Preparation of Work Plan and Support Documents	$48,181	
Task 3: Implementation of Work Plan	$66,136	
3.1 Vegetation Clearing	$53,943	
3.2 Excavation of Anomalies	$309,864	
3.3 Medical Testing, Disposal, Confirmation Analysis, IDW	$516,157	
3.4 Analysis, Examination, and Disposal	$36,295	
3.5 Data Management/Data Validation	$13,451	
3.6 Surveying and Mapping	$70,534	
Task 4: Closure Report	$101,991	
		$1,309,504

It is likely that the actual total costs could vary since there are no details regarding the source or quantity of materials that may be encountered during implementation of this Alternative. For the Phase I, it was assumed that 168 trenches of 20 feet long by 15 feet wide by 3 feet deep would be required to fully assess the two areas. As reported in the Mustard Memo from 1985 (Appendix D), the materials that were removed in 1969 were only 18 inches below the surface so 3 feet deep is a reasonable assumption.

For the Phase II, for cost estimating purposes, an anomaly density of 1000 anomalies/acre was assumed. The assumed anomaly density was used to calculate the total number of anomalies for intrusive investigation. Additional assumptions and detailed costs for each Phase are provided in Appendix C.

SECTION 5: COMPARATIVE ANALYSIS OF ALTERNATIVES

The comparative analysis is used to evaluate the performance of each Alternative with respect to effectiveness, implementability, and costs. This analysis also identifies the advantages and disadvantages of the Alternatives relative to one another.

The comparative analysis for the four Alternatives in this EE/CA is presented in Table 5. Based on the analysis, the major difference is the cost of the Alternatives. One consideration that is not shown in the evaluation criteria for the EE/CA is the use of the AOC as a military training location and the effects of limiting and controlling the area according to CERCLA when Army Regulations are fully protective under the circumstances based on the evidence and available information and recommendations from CWM Experts.

TABLE 5. Comparative Analysis of Alternative for the EE/CA at the SMABS RVAAP - 28.

Alternative	Evaluation Criteria		
	Effectiveness	Implementability	Costs
1 - No Action	Effective Overall	Already Implemented	$0
2 - Land Use Controls - Activity Restrictions	Effective Overall	Readily Implementable	$601,618
3 - Land Use Controls - Security Fence	Effective Overall	Readily Implementable	$806,733
4 - Phase I Trenching and Phase II Anomaly Removal, Decontamination/ and or Destruction	Effective Overall	Readily Implementable	$2,599,450

SECTION 6: AGENCY COORDINATION AND PUBLIC INVOLVEMENT

The CERCLA 42 U.S.C. 9617(a) requires that an Administrative Record be established "at or near the facility at issue." Relevant documents regarding the RVAAP Restoration Program have been made available to the public for review and comment. The Administrative Record for this project is available at the following location:

Camp Ravenna Joint Military Training Center (Camp Ravenna)
Environmental Office
1438 State Route 534 SW
Newton Falls Ohio 44444
(330) 872-8003

Note: Access is restricted to Camp Ravenna, but the file can be obtained or viewed with prior notice to Camp Ravenna.

In addition, an Information Repository of current information and final documents is available to any interested reader at the following libraries:

Reed Memorial Library
167 East Main Street
Ravenna, Ohio 44266

Newton Falls Public Library
204 South Canal Street
Newton Falls, Ohio 44444-1694

The RVAAP Restoration Program has an online resource for restoration news and information. This website can be viewed at www.rvaap.org.

The Ohio EPA is the lead regulatory agency for the restoration activities at the former RVAAP. The draft EE/CA will be submitted for review and comment as required under the DFFOs. After the Army has responded to Ohio EPA's comments and the Agency approves the decision and selected Alternative, the EE/CA will be finalized and published for public review and comment as described in the following.

Community involvement is a necessary part of the CERCLA process and the DFFOs. The NCP requires that a public notice describing the EE/CA and announcing a public comment period be published in a major local newspaper. The Army will notify the local newspaper to announce the availability of the Final EE/CA for public review. A public comment period of 30 days will commence following release of the EE/CA report to provide the public appropriate opportunities for involvement in site-related decisions. The Army will respond to significant comments received during the public comment period. These comments will be considered in the final selection of an Alternative for the SMABS.

SECTION 7: RECOMMENDED ALTERNATIVE

Alternative 1 (No Action) is the recommended action for the SMABS AOC. This recommendation is based several pieces of information and the findings of the previous investigations conducted at the AOC. The presence of mustard agent or CAIS has never been verified and is based on undocumented assertions and statements that contradict historical records, standards, and practices followed by DOD and other agencies. Accordingly, there is no evidence of a source, release, or any indication that mustard agent was ever used on the former RVAAP that would require additional CERCLA investigation at this time. This is further supported in the Probability Assessment completed by Army Experts in CWM and mustard agent.

The Probability Assessment represents a thorough investigation into historical records, past investigations, geophysical studies, etc. and weighs these using *Chemical Warfare Materiel Responses and Related Activities Guidance and other such as DA PAM 385-30 Mishap Risk Management (2007).* In the Probability Assessment, the chance (probability) to encounter CWM during intrusive activities is categorized as one of the following presented in Table 3-3 from the DA PAM 385-30.

Table 3–3
Mishap Risk Management Process Probability Categories

Probability	Symbol	Definition
Frequent	A	Occurs very often; known to happen regularly.
Likely	B	Occurs several times; a common occurrence.
Occasional	C	Occurs sporadically, but is not uncommon.
Seldom	D	Remotely possible; could occur at some time.
Unlikely	E	Can assume will not occur but not impossible.

Source: DA PAM 385-30, 1 FEB 2010

In the Probability Assessment, the SMABS was assigned a “Seldom - D” Probability Category. The “Seldom - D” category was based on historical site use, DOD practices and handling, previous investigations, historical records, and no first hand documentation of the CAIS or related materials being buried on the SMABS except for the area where the former RVAAP employee buried items after World War II. These items were where the former employee identified them and they were identified as nontoxic and were removed in 1969. The Seldom - D category means that encountering CWM is remotely possible and could occur at some time. If the No Action Alternative is accepted, the Army regulations would still require management of the three areas and would require safety and awareness training on the Contingency Plan that includes but is not limited to procedures that must be taken if an encounter occurs and what to do if an exposure occurs. Appendix D provides excerpts from some of these protective Regulations and requirements. The difference between the No Action Alternative and Alternative 2 (LUCS and Activity Use restrictions) is that Alternative 2 disregards the opinion of CWM Experts and does not recognize the ability of the Army to ensure protectiveness and safety management of the SMABS by following Army regulations, guidance, and the Contingency Plan. Both Alternatives would that ensure any encounter with mustard agent would be properly handled and evaluated.

The LUCs that would be developed for Alternative 2 would essentially be what the Army already has in place in the Contingency Plan and standard operation plans with the exception that Alternative 2 would keep the SMABS in the CERCLA process and would require implementation of additional remedial action (e.g., signage and Seibert stakes) and Five-Year Reviews.

The SI concluded that in addition to developing the Contingency Plan as recommended in the Probability Assessment an "*EE/CA and Action Memorandum be prepared to determine the cost of investigation verses the cost of evaluating and selecting remedial Alternatives (i.e., LUCS), such as fencing the site off*." After review of the effectiveness, implementability, and costs of the four Alternatives assessed in this EE/CA, Alternative 1 - No Action (under CERCLA) is the best Alternative and this Alternative recognizes the ability of the Army to proactively and effectively manage the SMABS, while ensuring any CAIS or mustard agent encountered is properly and safely addressed and handled by Army CWM experts. In addition, as done at other facilities where mustard agent was suspected but never found, the Contingency Plan includes a stop work provision if a mustard agent or CAIS is encountered. The identified CAIS or mustard agent would be evaluated and if necessary, the SMABS area would be re-entered into the CERCLA process and the evaluation process would be re-initiated to assess the source.

The Conclusions and Summary of the Probability Assessment indicate that "work in the area can be conducted as non-CWM, with the following conditions:

- Mission-related activities shall include Contingency Plans for emergency response should CWM be encountered.
- The Contingency Plan must be approved by the Commander or designated representative.
- If CAIS or an intact item filled with liquid be encountered in the field, then work shall cease and the Contingency Plan will be implemented.
- Users and planners should remain aware of potential to encounter mustard agent in the area.

These conditions have been met and are being implemented by the OHARNG.

Additional discussion and rationale is provided in the following lines of evidence to support the selection of the No Action (CERCLA) Alternative.

- Results of the Probability Assessment indicate that the SMABS is a Seldom - D category so the chance of encountering CAIS or mustard agent is remote.
- Any unsafe CAIS or mustard agent would be readily recognized if encountered. At that time, an evaluation and assessment would be initiated and if necessary, the SMABS would be re-entered into the CERCLA process and investigations would be implemented as warranted.
- Ravenna Arsenal Inc. Interoffice Memorandum dated March 1, 1985 provides details regarding the origin and information about the potential locations (Appendix D). As stated

in the Memo, records from the Safety Files #37, Water Project, West Branch dated 1969, 70, 71, 72, and 73, P-15, Project #5752690 (MUCOM) Pema #4911, Title: Modernization Utilities - Phase I, indicate that an alleged mustard agent gas burial site was surveyed to include excavation and removal of 55 gallon drum and 7 cans by the 68th EOD personnel. The drum and the 7 cans were empty. The former employee who was on hand reported that he had been in charge of burying these materials after World War II. This Memo also mentions a 1971 report from the Chief Safety Officer that there was a second reported gas burial site located 100 to 150 yards south of the previous excavated site existed but this did not appear to be based on any valid information and that there was no documentation as well as the source of the statement was unknown.

- There were no anomalies identified in the area 100 to 150 feet south of the 1969 excavation area.

- No sulfur mustard agent-containing material or CAIS was discovered during the 1969 excavation at the AOC.

- No CWM were used at the former RVAAP and were not produced there. Numerous records of ammunition and explosives exists and the former RVAAP had specific handling and Standard Operating Procedures that have no mention of CWM or mustard agent. This further supports that mustard agent was likely not used or stored on the former RVAAP. There is no mention of mustard agent in former RVAAP Safety Manuals that would have contained information for safe handling. .

- No mustard agent breakdown chemicals were detected in surface soils samples collected at the AOC in 1996 or in groundwater samples collected from down-gradient monitoring wells from 2004 through 2005 and 2011.

- The metallic anomalies identified in the geophysical surveys conducted in 1998, 2006, and 2010 do not indicate the presence of a possible burial pit for CAIS.

- The DOD and Army practices for safe disposal of mustard agent was to empty and neutralize the material before burying them or destroying them. Therefore, if CAIS is buried on SMABS, it would have been emptied and neutralized according to Army and DOD practice. There have been no reported exposures to mustard agent in the US since World War II training. There are a lot of reasons but mainly because the mustard agent was controlled and stockpiled mostly at several locations or is at military facilities. If there is material uncovered outside of military facilities, it is marked and was likely deactivated. Military personnel who investigate and take removal actions on CWM follow safety precautions and regulations and have been fully protected while doing intensive removal actions. This indicates that the Contingency Plan would be enough to protect personnel in the event of encountering CWM during intrusive training activities.

- Standard Operating Procedures, Army Regulations and the Contingency Plan requirements and procedures ensure that the Army is managing the site protectively and safely. Additionally, CWM experts have reviewed and investigated this site and identified the requirements necessary to properly manage and use this site.

- The DOD and Army has protective measures already in place that would allow the site to be used with appropriate precautions and warnings, as well as proven success in such measures. Army Regulations as well as the Contingency Plan require that the three areas continue to be identified so that anyone using these areas are aware and can recognize any materials such as CAIS as well as know what to do in the event that any encounter occurs. These allow the SMABS to be used with appropriate range management and safety.

The Probability Assessment is a standard DOD-document that is used by the Army to determine if and how to use an area where CWM may have been used. The SMABS was determined to be Seldom - D rating category. Mustard agent has been used by the military in various forms but only used for training purposes in the United States unlike other countries such as Germany where there is continually munitions with CWM uncovered. Much of our mustard agent was stockpiled after World War II. The CAIS and other test kits used to train soldiers only contained a small amount of the agent. There has not been a reportable mustard agent exposure in the United States since the soldiers were trained in World War II. In most instances, the mustard agent was buried after it was deactivated as done on the former RVAAP referenced in the 1985 Memo (Appendix A). At military facilities where CAIS/mustard agent was known to be buried, it was found to have been deactivated and clearly marked. Given that the DOD and the Army have well-documented, protective measures and proven regulations in place to fully protect the soldiers and have demonstrated this successfully, the alternative (No Action) would provide reasonable safety and protective measures that are required regardless of CERCLA. These are mandatory and would be fully implemented. The SMABS AOC should be removed from additional consideration under CERCLA and managed according to Army Regulations and safe practices as stated in the Contingency Plan.

SECTION 8: REFERENCES

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FIGURES

Note:
The scale is for the Upper Map Only
Showing the Former RVAAP/Camp
Ravenna Location

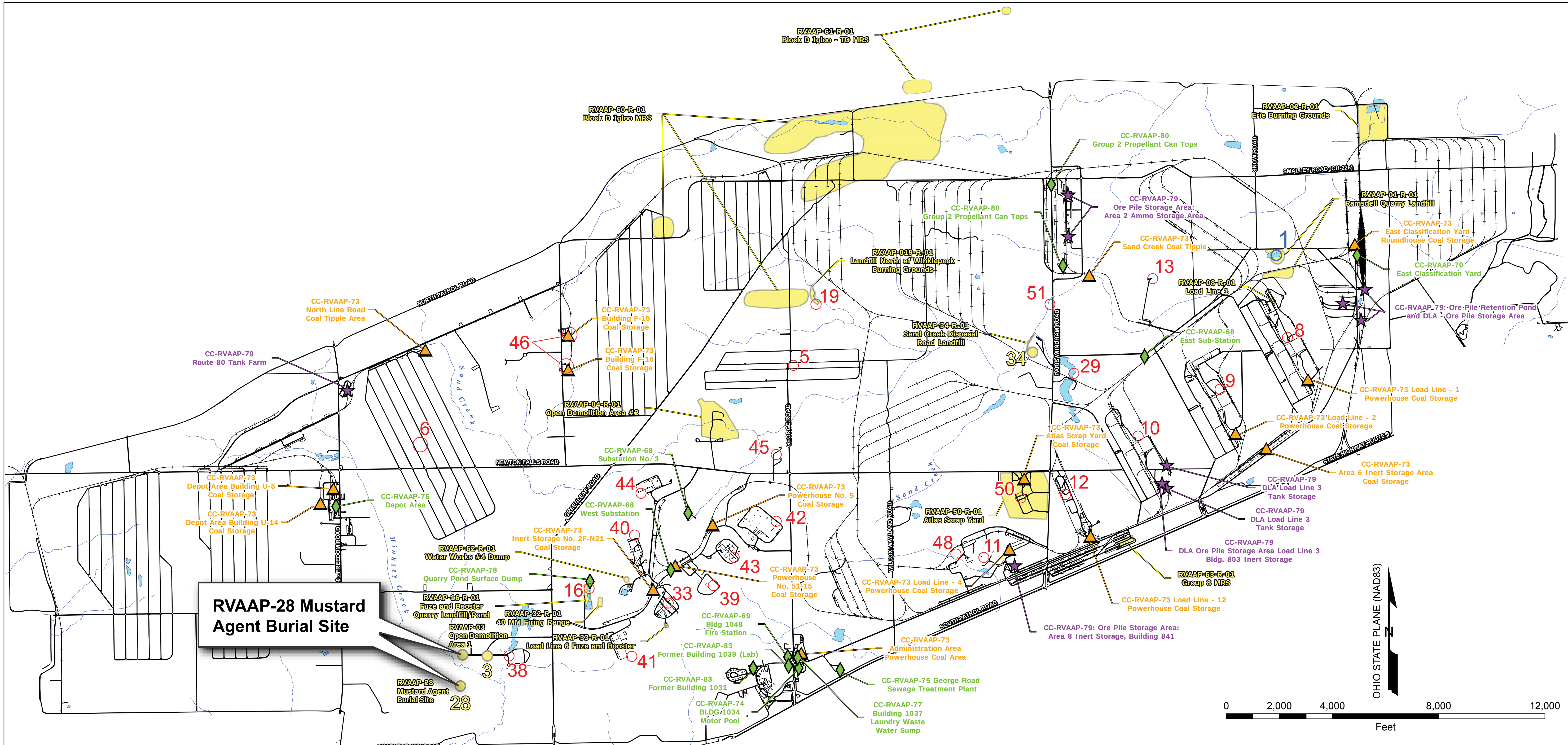
U.S. ARMY CORPS OF ENGINEERS
LOUISVILLE DISTRICT

INSTALLATION RESTORATION PROGRAM

CAMP RAVENNA
RAVENNA, OHIO

Shaw Environmental & Infrastructure, Inc.
(A CB&I Company)
150 Royall Street
Canton, MA 02021

FIGURE 1 -- CAMP RAVENNA INSTALLATION LOCATION MAP



LEGEND OF SITES

IRP SITES (29 SITES)	
RVAAP-01	RAMSDELL QUARRY LANDFILL
RVAAP-03	OPEN DEMOLITION AREA 1
RVAAP-05	WINKLEPECK BURNING GROUNDS
RVAAP-06	C BLOCK QUARRY
RVAAP-08	LOAD LINE 1
RVAAP-09	LOAD LINE 2
RVAAP-10	LOAD LINE 3
RVAAP-11	LOAD LINE 4
RVAAP-12	LOAD LINE 12
RVAAP-13	BLDG 1200 AND DILLUTION/SETTLING POND
RVAAP-16	FUZE AND BOOSTER QUARRY LANDFILL/PONDS
RVAAP-19	LANDFILL NORTH OF WINKLEPECK BURNING GROUND
RVAAP-28	MUSTARD AGENT BURIAL SITE
RVAAP-29	UPPER AND LOWER COBBS POND
RVAAP-33	LOAD LINE 6
RVAAP-34	SAND CREEK DISPOSAL ROAD LANDFILL
RVAAP-38	NACA TEST AREA
RVAAP-39	LOAD LINE 5
RVAAP-40	LOAD LINE 7
RVAAP-41	LOAD LINE 8
RVAAP-42	LOAD LINE 9
RVAAP-43	LOAD LINE 10
RVAAP-44	LOAD LINE 11
RVAAP-45	WET STORAGE AREA
RVAAP-46	BUILDINGS F-15 AND F-16
RVAAP-48	ANCHOR TEST AREA
RVAAP-50	ATLAS SCRAP YARD
RVAAP-51	DUMP ALONG PARIS-WINDHAM ROAD
RVAAP-66	FACILITY-WIDE GROUNDWATER
RVAAP-67	FACILITY-WIDE SEWERS

COMPLIANCE RESTORATION SITES (13 SITES)	
CC-RVAAP-68	ELECTRIC SUBSTATIONS (E,W,No.3)
CC-RVAAP-69	BUILDING 1048 - FIRE STATION
CC-RVAAP-70	EAST CLASSIFICATION YARD
CC-RVAAP-72	FACILITY-WIDE USTS (45 SITES)
CC-RVAAP-73	FACILITY-WIDE COAL STORAGE
CC-RVAAP-74	BUILDING 1034 MOTOR POOL HYDRAULIC LIFT
CC-RVAAP-75	GEORGE ROAD SEWAGE TREATMENT PLANT
CC-RVAAP-76	DEPOT AREA
CC-RVAAP-77	BUILDING 1037 LAUNDRY WASTE WATER SUMP
CC-RVAAP-78	QUARRY POND SURFACE DUMP
CC-RVAAP-79	DLA ORE STORAGE SITES
CC-RVAAP-80	GROUP 2 PROPELLANT CAN TOPS
CC-RVAAP-83	FORMER BUILDINGS 1031 AND 1039

MMRP SITES (14 SITES)	
RVAAP-001-R-01	RAMSDELL QUARRY LANDFILL MRS
RVAAP-002-R-01	ERIE BURNING GROUNDS MRS
RVAAP-004-R-01	OPEN DEMOLITION AREA #2 MRS
RVAAP-008-R-01	LOAD LINE 1 MRS
RVAAP-016-R-01	FUZE AND BOOSTER QUARRY MRS
RVAAP-019-R-01	LANDFILL NORTH OF WINKLEPECK MRS
RVAAP-032-R-01	40MM FIRING RANGE MRS
RVAAP-033-R-01	FIRESTONE TEST FACILITY MRS
RVAAP-034-R-01	SAND CREEK DUMP MRS
RVAAP-050-R-01	ATLAS SCRAP YARD MRS
RVAAP-060-R-01	BLOCK D IGLOO MRS
RVAAP-061-R-01	BLOCK D IGLOO -TD MRS
RVAAP-062-R-01	WATER WORKS #4 DUMP MRS
RVAAP-063-R-01	GROUP 8 MRS

Symbol	
○ (red)	CERCLA
○ (blue)	RCRA
▭	MMRP SITES
◆	COMPLIANCE RESTORATION SITES - APPROVED
★	DLA ORE STORAGE AREAS (7 SITES)
▲	COAL STORAGE AREAS (17 SITES)
●	AOC UNDER A/E SERVICES CONTRACT

CAMP RAVENNA
RAVENNA, OHIO

Figure 2
Camp Ravenna
Facility Map

US Army Corps
of Engineers
Louisville District

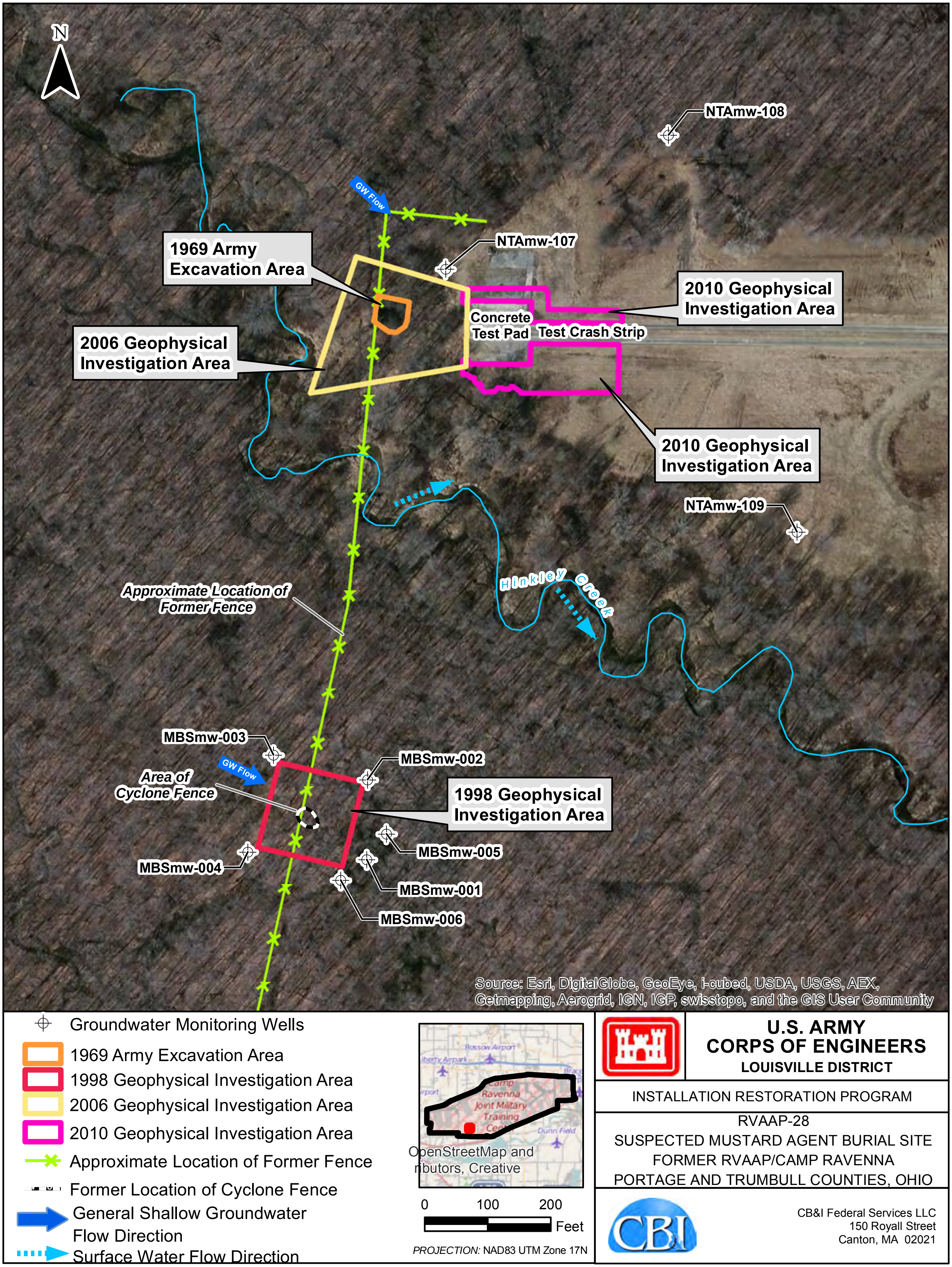
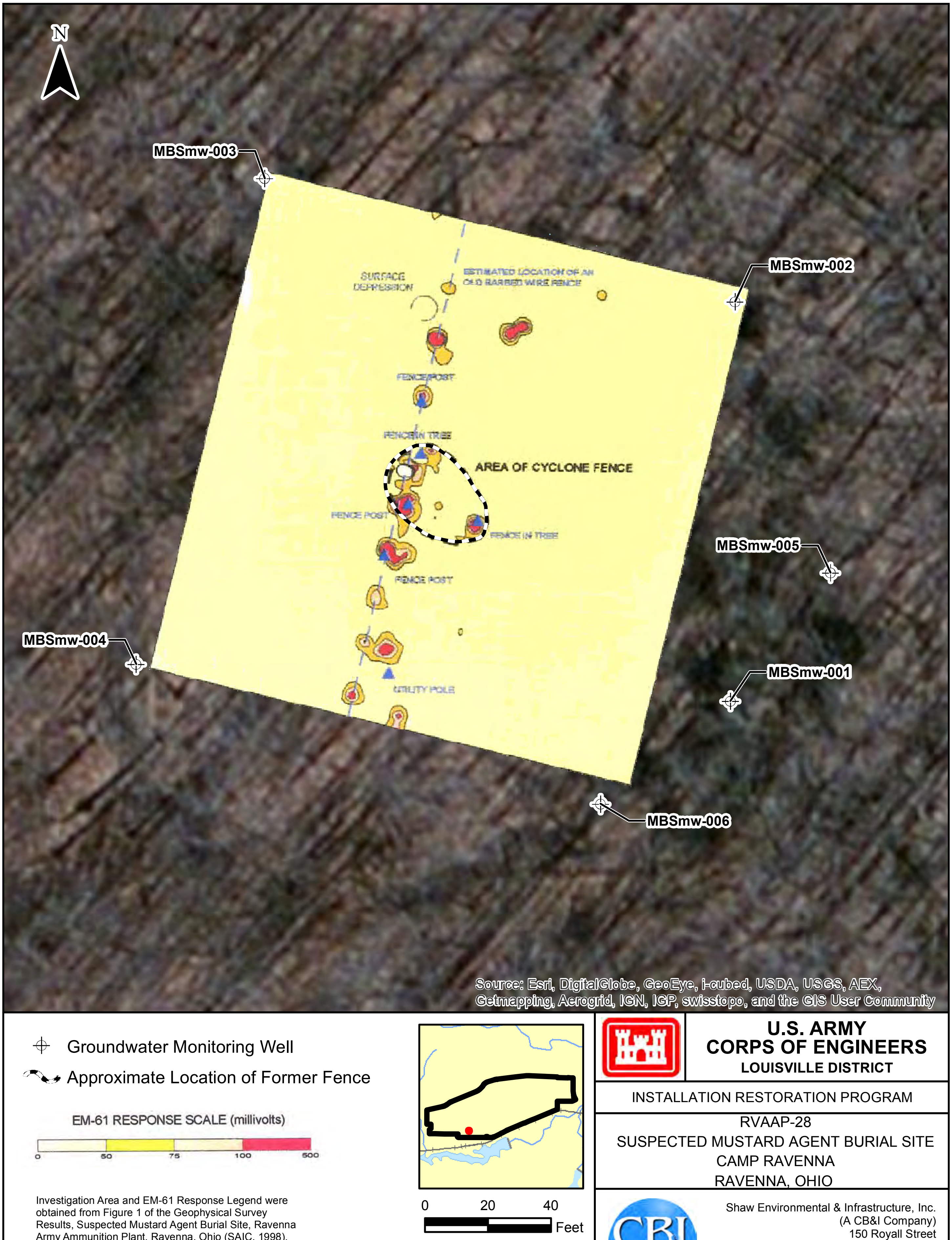


FIGURE 3 -- SUSPECTED MUSTARD AGENT BURIAL SITE MAP



Investigation Area and EM-61 Response Legend were obtained from Figure 1 of the Geophysical Survey Results, Suspected Mustard Agent Burial Site, Ravenna Army Ammunition Plant, Ravenna, Ohio (SAIC, 1998).

U.S. ARMY
CORPS OF ENGINEERS
LOUISVILLE DISTRICT

INSTALLATION RESTORATION PROGRAM

RVAAP-28
SUSPECTED MUSTARD AGENT BURIAL SITE
CAMP RAVENNA
RAVENNA, OHIO

Shaw Environmental & Infrastructure, Inc.
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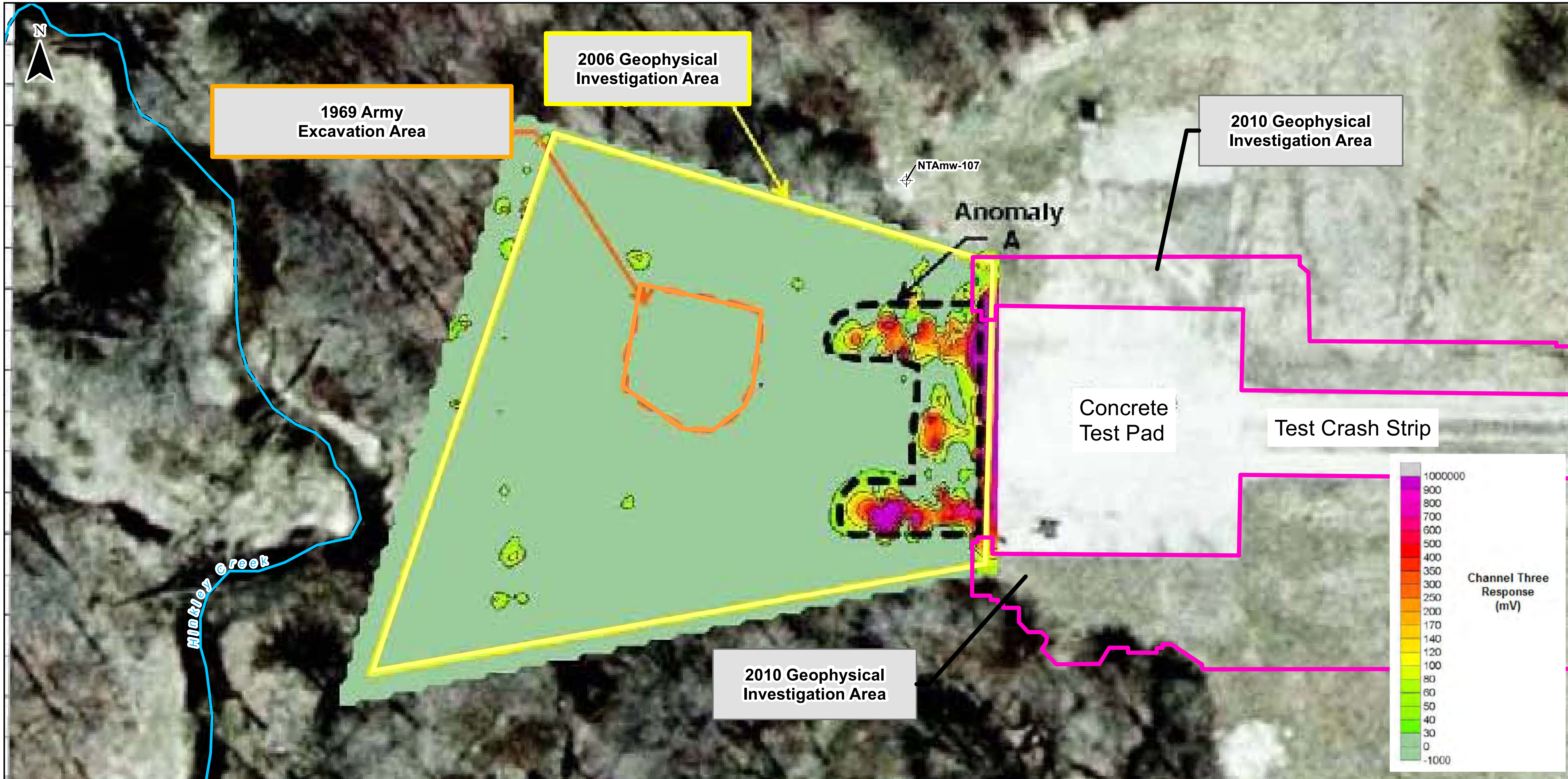
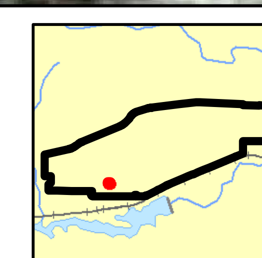
150 Royall Street
Canton, MA 02021

FIGURE 4 -- 1998 GEOPHYSICAL INVESTIGATION AREA AND RESULTS



2010 Geophysical Investigation Area
2006 Geophysical Investigation Area
1969 Army Excavation Area
Anomaly A
Groundwater Monitoring Well

Map and Channel Three Response Legend were obtained from Figure 4 of the Final Report on the Geophysical Investigation, Suspected Mustard Agent Burial Site, Ravenna Army Ammunition Plant, Ravenna, Ohio (Environmental Quality Management, Inc, 2008).



0 40 80 Feet

PROJECTION: NAD83 UTM Zone 17N

U.S. ARMY
CORPS OF ENGINEERS
BALTIMORE DISTRICT

INSTALLATION RESTORATION PROGRAM

RVAAP - 28
SUSPECTED MUSTARD AGENT BURIAL SITE
CAMP RAVENNA
RAVENNA, OHIO

Shaw Environmental & Infrastructure, Inc.
(A CB&I Company)
150 Royall Street
Canton, MA 02021

FIGURE 5 -- 2006 GEOPHYSICAL INVESTIGATION AREAS AND RESULTS

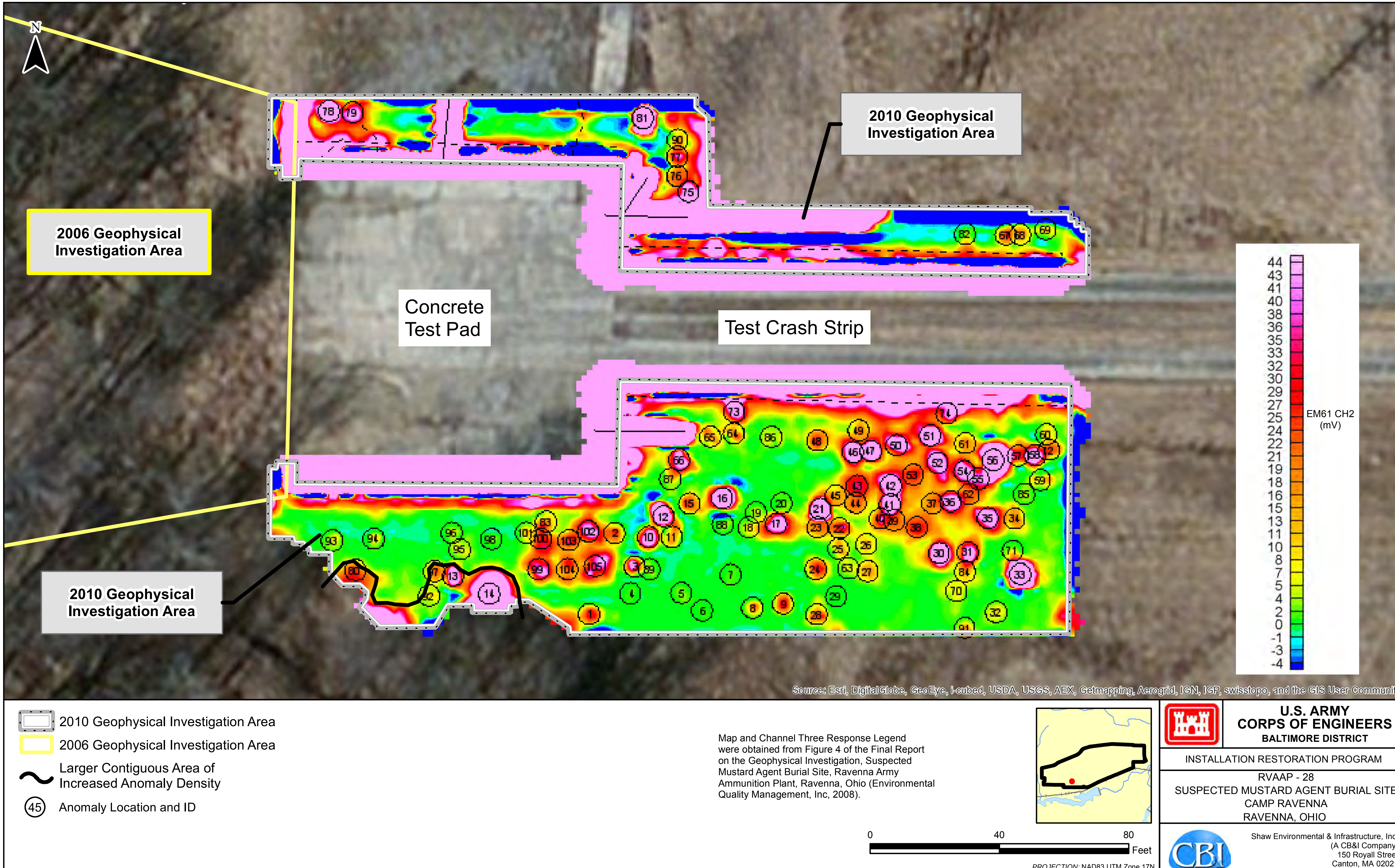


FIGURE 6 -- 2010 GEOPHYSICAL INVESTIGATION AREA AND RESULTS

APPENDIX A: 1985 Memo Regarding SMABS from Former RVAAP Employees and Photographs of CAIS and Relative Information

RAVENNA ARSENAL, INC.

INTEROFFICE
March 14, 1985

TO MR. H. R. COOPER

FROM G. L. WOLFGANG

SUBJECT POSSIBLE MUSTARD GAS LOCATION

Memo
REFERRING TO LETTER OF Feb. 25, 1985
same subject

Harold there is reason to believe that a quantity of something is buried in the old NACA area, what I'm not sure. Safety Project Files, file #37, Water Project, West Branch dated 1969, 70, 71, 72 and 73, P-15, Project #5752690 (MUCOM) Pema #4911, Title: Modernization Utilities - Phase I, indicate that an alleged mustard gas burial site was surveyed to include excavation and removal of 55 gallon drum and 7 cans by the 68th EOD personnel in August of 1969. Drum and cans were located approximately 18 inches below ground surface with no evidence of toxic contamination. Mr. Barnhart who was in charge of burying these items stated they were buried and covered with "quicklime" after World War II. 7 small cans were marked "Detonating War Gas", but as noted above no toxic contamination was found.

On June 11, 1971 Mr. G. E. Joyce, Chief, Safety Office Ravenna Army Ammunition Plant notified O. D. Riesterer, DA 2496 Disposition Form, that a second reported gas burial site located approximately 100 - 150 yards South of previous excavated site exists. No information was ever presented as to how, what, who etc. etc. provided Mr. Joyce with this 2nd alleged burial site. In previous discussions with Mr. O. D. Riesterer, former RAI Safety Engineer, he could not confirm Mr. Joyce's alleged burial site, (nor could I); however, the alleged site is presently marked and fenced.

I am not concerned about this alleged mustard gas burial site, but I am concerned about the whole NACA burning grounds area. Since this was the official War Department burning grounds from 1941 - 1948, and the area was never officially decontaminated, many types of materials could be buried or be located above ground at this site. No War Department records were available through AMC in the late 60's early 70's to substantiate type of material buried/burned or the extent of contamination.

The "mustard gas site" is a non-problem compared with shells etc. that may be buried etc. in the NACA burning ground area. If the alleged mustard gas site was officially decontaminated an explosives (projectiles etc) hazard would still exist.

Should RAI management decide to officially decontaminate the mustard gas site, I will officially contact "our" EOD detachment and schedule decontamination.

GLW

G. L. Wolfgang

GLW:ceh
cc: File

RECEIVED
MAR 14 1985
Engineering

FACT SHEET

WW . IL

. ICAL MATERIALS AGENCY

Chemical Agent Identification Sets

The U.S. Army used Chemical Agent Identification Sets (CAIS) from 1928 to 1969 to train Soldiers and sailors in the safe handling, identification and decontamination of chemical warfare agents. The Army produced the identification sets in large quantities and various configurations, distributing the items over a broad area.

The sets consist of chemical agents placed in glass ampoules, vials and bottles then packed in metal shipping containers or wooden boxes. In some cases, after use in training, the Army buried CAIS items. Occasionally, only the glass vials or bottles containing chemical agent from CAIS were buried.

Many sets have been discovered periodically in storage and at burial sites. In the early 1980s, the Army destroyed approximately 21,000 CAIS, the entire quantity then left in storage.

Periodically, a recovery of additional CAIS items occurs. When this happens, the U.S. Army Non-Stockpile Chemical Materiel Project destroys the items using their proven mobile treatment technologies. Small quantities of these items are destroyed using the Single CAIS Access and Neutralization System while the Rapid Response System treats larger quantities of CAIS.

If you encounter these items, please call your local emergency personnel. Do not touch or move these items as they may contain small amounts of chemical agent.

CAIS CONFIGURATIONS	
Glass ampoules and vials 	**Could contain:** *5% lewisite in chloroform* *Pure phosgene* *GA-simulant* *5% sulfur mustard in chloroform* *10% nitrogen mustard in chloroform* *Pure cyanogen chloride* *50% chloropicrin in chloroform*
Glass bottles 	**Could contain:** *Pure sulfur mustard* *Lewisite on charcoal* *Chloropicrin on charcoal* *Solid chloroacetophenone* *Sulfur mustard on charcoal* *Nitrogen mustard on charcoal* *Solid triphosgene* *Solid adamsite*

For more information, contact the CMA Public Affairs Office at
(410) 436-3629
(800) 488-0648

Sulfur mustard
Bis (2-chloroethyl) sulfide
Military designation: H, HS, HD

Description: Sulfur mustard, a blister agent, is a colorless to light yellow to dark brown oily liquid, depending upon the age and relative purity of the material. Although sulfur mustard does not evaporate readily it may pose both a liquid contact hazard and a vapor hazard to the eyes, skin or respiratory tract, particularly at temperatures above its freezing point of 59 F (distilled mustard). Sulfur mustard has the odor of garlic or horseradish and its vapor is approximately 5.5 times heavier than air.

Non-military uses: Sulfur mustard has been used as a tool in medical research to study the basic biochemical mechanisms of DNA damage and to repair inside cells. The recognition that mustard kills rapidly growing cells led to the development of a new class of chemotherapeutic drugs. Some of the nitrogen mustards, such as mechloroethamine, alkeran, leukeran and cytoxan, are still used today for the treatment of certain types of cancer.

Military uses: Sulfur mustard was first introduced to the battlefield by the Germans against the British on July 12, 1917, and it was used most recently in 1986 by Iraq against Iran. A variety of munitions have been filled with sulfur mustard including projectiles, mortars and bombs. Mustard is also a component of chemical agent identification sets and is stockpiled in ton containers. This chemical agent may be dispersed from munitions as a vapor, aerosol, or in liquid droplets.

Health effects: High concentrations of mustard vapor may cause irritation and inflammation of the eyes, nose, throat, skin and respiratory tract. The first signs or symptoms of mustard exposure are usually delayed from four to six hours after initial contact, though this delay may vary from two to 24 hours. The eyes may become gritty with itching or burning, followed by reddening of the conjunctivae, swelling of the eyelids and difficulty in keeping the eyes open in bright light. The skin may redden, with stinging pain, burning or itching, followed by blistering. The respiratory tract effects may include sneezing, hoarseness, coughing, and difficult breathing. Mustard may be absorbed into the bloodstream and affect the gastrointestinal tract, causing nausea, vomiting or diarrhea. Mustard can also be absorbed by the bone marrow and can destroy the stem cells that produce white blood cells, platelets and red blood cells. Human epidemiologic studies indicate that long-term inhalation exposures to sulfur mustard may cause cancer of the larynx, nasopharynx and lungs. Animal studies suggest that long-term mustard exposure may have developmental effects on the unborn fetus. Damage to the respiratory tract and eyes may persist following acute, high level exposures to mustard vapor.

Environmental fate: The persistence of sulfur mustard in soil will depend on the soil type, the amount of mustard in the soil, the depth of contaminated soil beneath the surface and the weather conditions. Sulfur mustard contamination of surface soil may persist for weeks, and deeper soil may remain contaminated from small pockets of liquid mustard for years. Mustard is relatively insoluble in water; however, once dissolved, it breaks down into less toxic degradation products such as thiodiglycol, hydrochloric acid and sulfonium salts. Because of its relatively rapid hydrolysis once in solution, mustard is not thought to be transported through the soil by groundwater. It is also unlikely that mustard is transported through the vascular system of plants, since it would undergo hydrolysis in the process.

For more information, contact the CMA Public Affairs Office at
(410) 436-3629
(800) 488-0648

M256A1 Chemical Agent Detector Kit

U.S. Army Equipment Information

Used to detect and identify blood, blister and nerve agents present either as liquid or as vapor. May be used to determine when it is safe to unmask, to locate and identify chemical hazards (reconnaissance), and to monitor decontamination effectiveness. The M256 is not an alarm; it is a tool used after soldiers have received other warnings about the possible presence of chemical warfare agents, and have responded by putting on their chemical protective clothing.

The M256 consists of a carrying case, a booklet of M8 paper, 12 disposable sampler-detectors individually sealed in a plastic laminated foil envelop, and a set of instruction cards attached by a lanyard to the plastic carrying case. The case is made from molded, high impact plastic and has a nylon carrying strap and a nylon belt attachment. The case measures seven inches high, five inches wide, and three inches in depth. The entire kit weighs 1.2 pounds. The kit can operate in temperatures ranging from minus 25 degrees Fahrenheit (-32 degrees Celsius) to 120 degrees Fahrenheit (49 degrees Celsius).

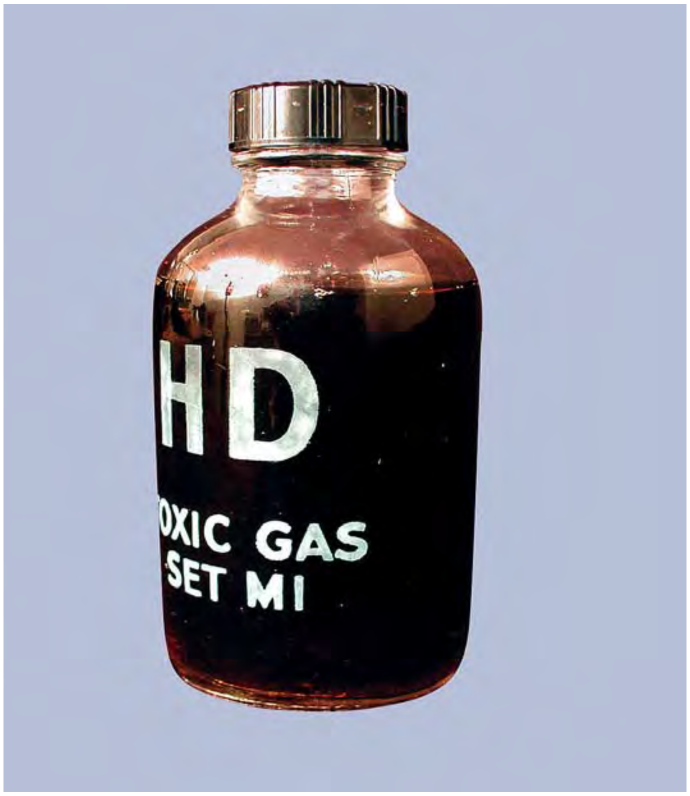
The M8 paper is used to test liquid substances for the presence of nerve agents and blister agents. It is similar to the litmus (pH) paper that is found in almost any laboratory in that a test result is indicated in both types of paper by a change in color. The difference is that M8 paper is specifically designed (dye-impregnated) to react to nerve agents and blister agents in liquid form (M8 Paper is also issued to soldiers as a separate piece of chemical detection equipment). The soldier blots the M8 paper on a suspected liquid agent and observes for color change. There is a color chart inside the front cover of the booklet for comparison. The M8 paper comes in 4" x 2.5" booklets, each containing 25 sheets of detector paper.

Each sampler-detector contains a square impregnated spot for blister agents, a circular test spot for blood agents, a star test spot for nerve agents, and a lewisite detecting tablet and rubbing tab. The test spots are made of standard laboratory filter paper. There are eight glass ampoules, six containing reagents for testing and two in an attached chemical heater. When the ampoules are crushed between the fingers, formed channels in the plastic sheets direct the flow of liquid reagent to wet the test spots. Each test spot or detecting tablet develops a distinctive color which indicates whether a chemical agent is or is not present in the air. The use of eel enzyme for the nerve test in place of horse enzyme provides for an improvement to the M256A1 Kit by detecting lower levels of nerve agent. Any type of mustard is also detectable as long as vapor is present. By following the directions on the foil packets or in the instruction booklet, a soldier can conduct a complete test with the liquid-sensitive M8 paper and the vapor-sensitive sampler-detector in approximately 20 minutes.

A M256A1 trainer simulator was developed to provide realistic training while avoiding unnecessary exposure to potentially carcinogenic reagents in the M256A1 detector kit. The M256A1 trainer contains 36 pre-engineered detector tickets and an instruction booklet. The pre-engineered detector tickets show color changes comparable to those seen when the M256A1 detector kit is used in clean or contaminated environments.

Agents Detected:

- Hydrogen Cyanide / AC / Blood (cyanide)
- Cyanogen Chloride / CK / Blood (cyanide)
- Mustard / H / Blister; Nitrogen Mustard / HN / Blister
- Distilled Mustard / HD / Blister; vPhosgene Oxime / CX / Blister
- Lewsite / L / Blister
- Nerve Agents / V and G / Nerve



The following is from: https://innotechproducts.wordpress.com/2010/12/16/chemicalbiological-field-detection-in-the-military/

Chemical/Biological Field Detection in the Military

Posted on December 16, 2010 by innotechprod

The use of Chemical/Biological Detection Kits is commonplace in today's United States Military. First used in World War II, their design and application have evolved over the last century into the kits that are familiar today. But the story behind their origins and their evolution helps us understand how and why these kits perform as they do today, and where they are headed in the future.

Jeffery K. Smart, Command Historian of the Historical Research and Response Team at the Aberdeen Proving Ground in Maryland wrote a comprehensive history of these kits entitled *History of Chemical and Biological Detectors, Alarms, and Warning Systems*. What is presented in this article is strictly a synopsis, and borrows heavily from Mr. Smart's work. His article is found online at the United States Chemical Corps Museum.

The United States Military has been using some form of a chemical detector since the First World War. Their inception was a reaction to the use of chemical weapons, specifically mustard gas, by the Germans. That particular gas got its name from its smell, which was similar to mustard.

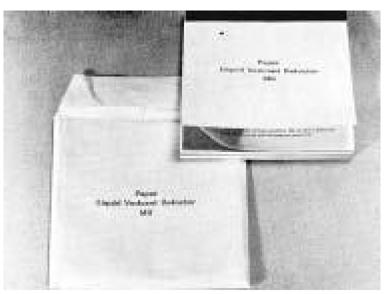
When the United States entered the war in 1917, the U.S. Army had no ability to detect chemical weapons. In fact, early on in the conflict, soldiers were trained to use the sniff test. This literally involved sniffing the air to see if a chemical agent was present by its odor. For detecting low levels, the test was fairly successful. However, when higher concentrations were present, there was an increased danger of over exposure, which could lead to incapacitation or death. The sniff test had some obvious drawbacks.

The danger that the sniff test represented led to the testing of various detection concepts. The first was the Copper Flame Test Lantern. It involved a lantern like apparatus that burned a copper oxide wick. The burning copper caused the flame to turn green. Air was then passed over the flame. If the green copper flame turned blue-green in color, then mustard gas was present.

Other tests used chemicals such as Selenious Acid, Iodine Pentoxide, Iodic Acid or Hydrogen Sulfide that, when mixed, or heated with the mustard gas in the air, would indicate the mustard presence. Other concepts involved reactive paints, and the use of animals to detect dangerous vapors. In fact, it was even proposed to use snails as a detector. It was thought that they might behave differently in the presence of mustard gas. However, none of these ideas were perfected for field use. The need for a mustard gas detector went unfulfilled by the end of the war.

In 1933, the Chief of the U.S. Chemical Warfare Service saw the need for a chemical agent detector that soldiers could easily use in the field. Nine years later, at the beginning of the Second World War, the M4 Vapor Detection Kit went into service. It was the first kit to carry the “M” designation, which stands for Military, and it was the first, true, chemical agent detector kit.

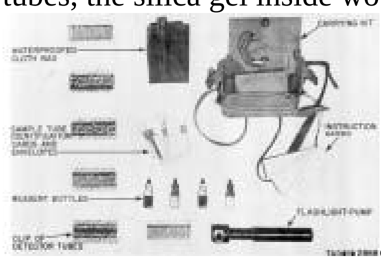
The M4 was a reagent kit, using a new chemical, DB3, which changed color when mustard gas was present. The kit was essentially a wooden box, that housed 36 detector tubes, a rubber sampling bulb, developing solution, DB3 reagent, and matches. The kit also detected high levels of chloracetophenone (CN) and cyanogen chloride (CK) agents in the air. There were more than 41,000 kits created between 1942 and 1943. It was out of service and obsolete by 1945.



In 1942, M6 Liquid Detector paper was standardized. It used a British developed detector paint called B-1, and applied it to cardboard sheets, and bound them in a book. This was the forerunner to M8 Paper. It detected mustard gas, but required the gas to fall onto the paper. M6 also detected some nerve agents. It was in service until 1963.

Another way to detect mustard gas was the M7 Detector Crayon. It originally used Johnson's "Glocoat" floor wax because it reacted to mustard gas. However, Glocoat was soon replaced by the more effective Impregnate I and Congo red dye. These reagents were used in a wax suspension similar to a Crayon. The M7, when rubbed on a surface, turned blue if a mustard agent was present. The M7 Crayon was used from 1942 until 1965.

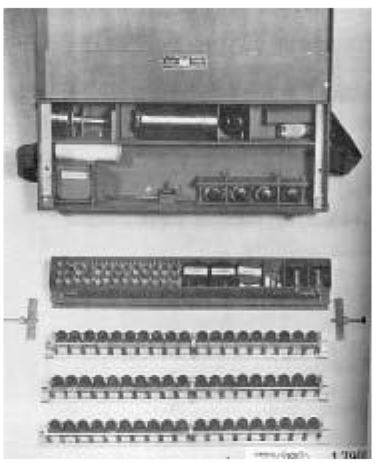
In 1943, the Chemical Warfare Service developed the M9 Chemical Agent Detector Kit. It was one of the most significant wartime developments in the area of chemical detection. The M9 kit was a reagent kit that contained a sampling pump, reagents, and detector tubes, all in a small case. The entire kit weighed less than two pounds. When air was pumped into the detector tubes, the silica gel inside would change color to indicate the presence of a certain



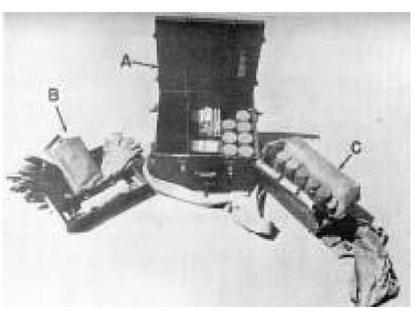
agent. The kit detected 11 different agents, and different colors indicated different agents. There were over 82,000 of these simple to use kits produced during the war. Even though they did not detect Hydrogen Cyanide or nerve agents, these kits remained in service until 1954.

Detecting Hydrogen Cyanide was a priority, though. So, in 1947 the M9A1 was released. The main difference in this kit, and its predecessor the M9, was the inclusion of detector tubes to pick up the presence of Hydrogen Cyanide. The military only procured about 500 of these kits, and it was eventually replaced by the M9A2 in 1952.

M10 (E10) Chemical Agent Analyser Kit was adopted in 1945. It filled the need for collecting more complete data samples than could be gathered by other compact, field kits. It also served as a compact laboratory. These kits were not issued to field troops, but were instead used by technicians with chemistry training. The M10 could not detect nerve agents, but did detect most other chemicals. The kit used detector tubes, papers, and solutions to collect and detect agents. The kit was much more robust than the standard issue field kits. It weighed 26 pounds and was transported by truck. Only 10 kits were ever used, and it was replaced by the M10A1 in 1952.



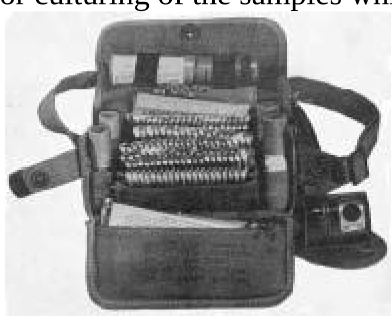
In 1945, the M11 Smoke Identification Kit was released. Designed to be used by a technician in a mobile laboratory, the M11 identified most toxic smokes in the field, as well as non-toxic smokes. It was obsolete in 1956.



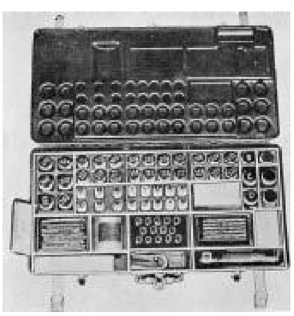
The need to sample chemical agents in the field prompted the production of the M12 Agent Sampling Kit. It, also, was used with a mobile laboratory. It was designed to collect liquid and solid samples, but could also, with the use of the included detector paper, quickly detect and identify agents. The M12 kit was not standard issue, and needed a technician to operate it.

During the War, as rumors persisted that the Germans and Japanese both had Biological Warfare programs, the United States began one of their own. The need was urgent, because these agents were not detectable by the five senses. These were living organisms, and detection demanded a more complicated process. However, technology did not exist at the time to detect, or identify biological agents effectively. In fact, the only means of detecting a biological attack was the widespread sickness that would follow it. It would take 50 years to find the answers. Until then, the military relied on sampling suspected agents in the field, and having them identified in a laboratory.

To this end, in 1957 the Chemical Corps standardized the M17 Biological Sampling Kit. However, it was unable to sample all biological agents. This deficiency eventually led to the kit being declared unsuitable. The Army and Navy only procured about 450 kits for training purposes. It weighed 18 pounds, and could collect samples from aerosols, surfaces, water, food, and materiel. It also allowed for culturing of the samples while they were transported to a laboratory for identification.



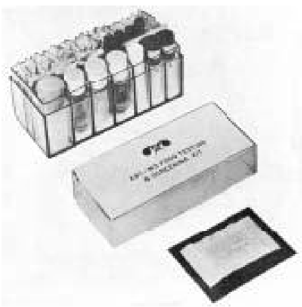
Throughout the 1950s, the need to identify nerve agents, and warn against their presence, became the primary concern for the U.S. Chemical Corps. This led to the development of the M9A2 Chemical Agent Detector Kit in 1952. It was the first kit capable of detecting nerve (G-Agents). The M9A2 was the precursor of the M18 line of kits. It remained in service until 1965.



The M10 kit also got a makeover in 1952. The new kit, the M10A1, was given the ability to detect nerve agents, and was repackaged in a plastic case, reducing its weight to 15 pounds. Only a few hundred were ever procured by the military, and the kit's use was ended in 1967 when the M18A2 was standardized.

During World War II, the Medical Service developed and used a testing kit for detecting contaminants in food and water. Following the war, the Medical Service upgraded these kits with the ability to detect chemical nerve agents.

Needing a detection kit that could be used with water, the Military's Chemical Corps took noticed and standardized the kit in 1953. Designated the M2 Water Testing Kit, it was designed to detect chemical agents in water that had not been chlorinated. The kit came in a plastic case, and included reagents, a metal scoop, glassware, and cleaning equipment. The M2 was the first water testing kit, and was the precursor of the M272, in use today. The M2's use was discontinued in 1996.



Seeing that the M2 kit had, in a previous version, detected chemical agents in food, the Chemical Corps decided to release a kit that would perform that task. The M3 Chemical Agents Food Testing and Screening Kit was standardized in 1953 to detect warfare agents in food. The kit was used in the field, and consisted of reagents, a vesicant crayon, medicine droppers, test papers and notepaper. It was housed in a plastic case. The M3 detected arsenic, mustard and G-series nerve agents. While the kit was in use, over 10,000 units were procured, until it was obsolete in 1967.

Also in 1953, the Chemical corps issued the M4 Poisonous Water Testing Kit to the Army Medical Service to certify drinking water supplies. It tested for mustard, arsenic, G-agents, cyanide, and heavy metal poisons. It was replaced in 1959 by the M4A1, which corrected packaging problems in the M4. A V-agent detection capability was added in

1962. Over 1000 kits were procured by the military between 1951 and 1963, with 137 used in Vietnam. The kit was no longer used after 1970.

In 1954, the M6 Paper was reduced in size form a five-inch square, and renamed the M6A1 Liquid Vesicant Detector Paper. It detected mustard and G-agents. Nearly 40,000 of the M6A1 Paper books were procured through the 1960s. The M6A1 was discontinued in 1996.

The M15 Chemical Agent detector Kit was standardized in 1956, after prompting by the Navy for a shipboard detector. It was designed to detect dangerous vapor concentrations of mustard and nerve agents (G-agents). Color changes in detector tubes indicated the presence of an agent. The kit was worn on a belt, and was housed in a canvas case.

Needing better test sensitivity than what the M9A2 offered, the Chemical Corps developed the M18 in 1957. It detected most chemical vapor warfare agents, including G-agents. It could also sample agents for analysis later, when identification was not possible. Its primary purpose was ongoing testing to determine if it was safe to unmask after a chemical attack. The redesigned kit made it easier to operate, and reduced its weight and size. The M18 could easily be carried with an over the shoulder strap. Before it was made obsolete in 1965, over 19,000 kits were used. The M18 kit is the predecessor of the M18A3 Chemical Agent Detector Kit used today.

The decade of the 1960s brought a trend of improving established kits, and introduced a redeveloped detection technology that remains with us today. In 1963, M8 Chemical Agent Detector paper was standardized. M8 Paper was actually a Canadian development that the U.S. Chemical Corps adopted. As it does today, it then came in booklets of 25 sheets. Each sheet reacted to nerve V-agents and G-agents, or blister (mustard H) agents by turning the paper a certain color: blue for V, yellow for G, and red for blister agents. The original design had a color chart on the inside cover for easy identification, just as it continues to do today. A continuing drawback of M8 Paper is that some non-dangerous liquids can give false positive readings.

In 1961, an improved version of the M15 kit was released, with the new name M15A1

Chemical Agent Detector Kit. This kit was designed to meet certain needs identified by the Navy. It could detect both nerve G- and V-agents, and also mustard, cyanogens chloride (CK) and phosgene oxime (CX). The Army and Navy procured some 43,000 kits between 1962 and 1965. The kit was deemed obsolete in 1970.

A slightly different version of the M15A1 included M8 Paper. This kit was dubbed the M15A2 in 1964. Nearly 67,000 kits were used by the Army and Navy through 1967.

An improved M18 kit was introduced in 1961 and dubbed the M18A1 Chemical Agent Detector Kit. With M6A1 Paper and M7A1 Detector Crayons as part of the kit, it was able to detect most chemical agents including nerve V-agents. Between 1962 and 1964, the military used over 10,000 of these kits. Its use was discontinued in 1970.

A later version of the M18A1 replaced the older M6A1 Paper with M8 Paper, and named the M18A2. It was ready for use in 1964, and over 16,000 kits were procured from 1965 to 1968.

The M10A1 Analyzer kit introduced in 1952 was replaced in 1964 with the M19 CBR

Agent Sampling and Analyzing Kit. This kit was used by technicians and chemical intelligence teams in the field to identify warfare agents, to carry out preliminary processing of those agents, and to determine contaminated areas. The kit consisted of items that were coded with fluorescent paint. This allowed for identification at night with a small ultraviolet lamp. The M19 was in service until 1996.

Another analyzing kit was introduced in 1964. The M34 Sampling and Analyzing Kit was originally intended as a refill kit for the M19, but it was eventually reclassified as a separate kit. It was used to sample soil, water and surfaces for chemical and biological agents. The M34 was replaced in 1999 by the M34A1, which is still in service today.

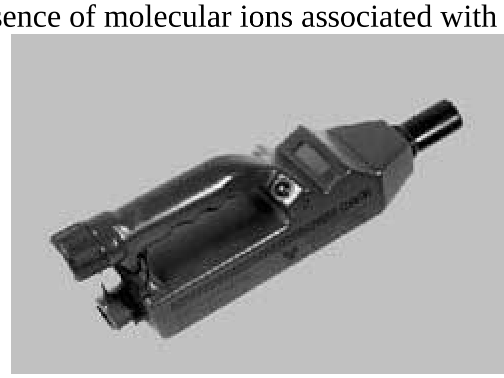
During the 1970s, the Army continued to improve the detector kits. It standardized the M256 in 1977. The kit's function was to be as a monitoring device, notifying soldiers when it was safe to unmask after an attack. The M256 detected chemical agents in the air, and liquid agents on surfaces. The kit was designed to be light and came in a plastic carrying

case, and weighed just over 1 pound. It contained 12 sampler-detectors, ampoules with reagent, and M8 paper.

Generally, the kit worked well. But its sensitivity when detecting nerve agents was disappointing. It used an enzyme derived from horses for the detection of nerve agents. This enzyme was not the very efficient. In 1986, the M256, and the use of horse enzyme, became obsolete, and was replaced by the improved M256A1. The updated kit used eel enzyme, which proved to have a higher level of sensitivity. This kit was used extensively during Operation Desert Storm, and continues to be used today.

Just as the M256A1 was established during the 1980s, so too would other detection  methods still in use become standardized during this period. For example, there was a need to be able to attach a liquid agent detector paper to a soldier's uniform, vehicles or a structure. This prompted the development of M9 Chemical Agent Detector paper in 1980. M9 uses a detector dye that, when contaminated with liquid chemical agents, changes color. The M9 also has an adhesive back, allowing it to stick to various surfaces. The 30 feet roll comes in a dispenser with a serrated edge for easily tearing off segments.

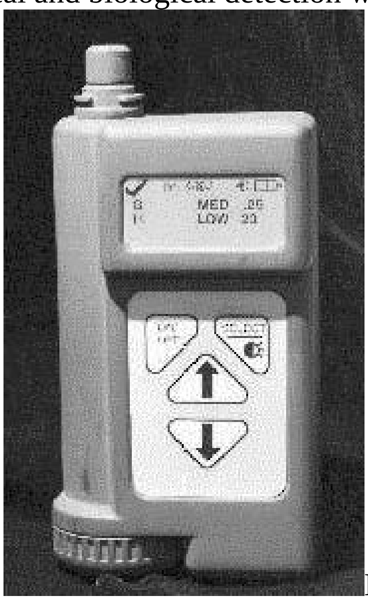
Another kit standardized in the 1980s and still in use today is the M272 Water Testing Kit. Its predecessor, the M2, had been standardized back in 1953 and needed updating. The new kit was light weight, compact, and easy to use. It was intended for testing water to see if it was contaminated. The M272 was able to detect most chemical agents in both treated and untreated water.

The 1980s brought with it the computer revolution. New, smaller personal computers became widely available because of the microprocessor. Soon, many devices were redesigned to take advantage of the speed and power that the microprocessor brought to products. In light of these developments, the military identified the need for a handheld, electronic detection device. The result was the Chemical Agent Monitor (CAM). The unit weighed about 5 pounds, and detected the presence of molecular ions associated with certain chemical vapors.  The CAM was classified as limited procurement in 1985. Even though it was originally a U.K. design, the CAM was standardized for field use by the U.S. military in 1988.

The CAM was updated in 1993 with the introduction of the Improved Chemical Agent Monitor (ICAM). The ICAM had updated electronics, which allowed for improved reliability and reduced maintenance and repair costs.

The M34 kit, standardized in 1964, contained breakable glass vials, and what had become by the 1990s outdated soil sampling techniques. In 1999, the M34A1 was introduced. The new kit had done away with components that had a limited shelf-life. It also had updated soil, surface and liquid sampling components, as contained a booklet of M8 Paper for chemical agent detection. The M34A1 is still in use today.

Chemical and biological detection will continue to evolve in the future.



Kits will morph into handheld devices, such as the Joint Chemical Agent Detector (JCAFD). The JCAD will be an electronic, portable monitoring unit and small point chemical agent detector. The unit will be handheld, and fit easily in a uniform pocket. The specs require the device to automatically detect, identify and quantify chemical agents inside an aircraft or ship. The unit must be able to warn personnel before agent levels become harmful.

In the field, detection systems such as the Joint Service Lightweight Standoff Chemical Agent Detector (JSLSCAD) will be used. It is a light weight, stand-alone fully automatic detection system. It will scan the surrounding environment for chemical warfare agent vapors. It will be able to scan in a 360 degree radius, and at a distance of 5 kilometers.

In the area of biological detection, the Short Range Biological Standoff Detection System (SR-BSDS) is currently being tested. It detects biological vapor clouds by using an ultraviolet laser, and laser induced fluorescence, at a distance up to 5 kilometers. The unit will provide early warning capability and alert other biological detectors.

As technology evolves, so does the capability to introduce new and different chemical and biological agents that will overcome existing detection technologies. Thus, the story of chemical/biological field detection is one of technological evolution and change. As new techniques and new methods were developed in the past, kits were improved and updated to incorporate the changes. As we move forward in the new millennium, technological advancements will continually be introduced to update and improve our methods of detection.

APPENDIX B: Applicable or Relevant and Appropriate Requirements

Appendix B
Applicable or Relevant and Appropriate Requirements

Activity	Standard, Requirement, Criteria, or Limitation	Citation	Description of Requirement	Comment
Chemical-Specific	Clean Air Act (CAA)	42 U.S.C. §§ 7401 – 7671q (1991, as amended) 40 CFR § 61 (1991)	General	
Chemical-Specific	CAA - Standards	40 CFR § 61.223 (1991)	Establishes national primary and secondary ambient air quality standards.	
Chemical-Specific	Transportation of hazardous materials	40 CFR §§ 1801-1819 (1991, as amended)	Establishes requirements for the transportation of hazardous materials off-site	
Chemical-Specific	Hazardous Materials Transportation Act (HMTA) of 1974, as amended by the Hazardous Materials Transportation Uniform Safety Act (HMTUSA) or 1990	49 U.S.C. §§ 1801-1819 (1991, as amended); regulations promulgated: 40 CFR §§ 100-180		

Appendix B

Applicable or Relevant and Appropriate Requirements

Activity	Standard, Requirement, Criteria, or Limitation	Citation	Description of Requirement	Comment
Chemical-Specific	Chemical agent standards – U.S. Public Health Service	Federal Register Vol. 53, No. 50, pg. 8504-8507	U.S. Public Health Service chemical agent standards.	
Chemical-Specific	Reportable quantities – hazardous substances	40 CFR 116-117	Reportable quantities for hazardous substances	
Chemical-Specific	Resource Conservation and Recovery Act (RCRA)	40 CFR 260-280	RCRA	
Action-Specific	National Contingency Plan (NCP)	40 CFR 300	National Contingency Plan	
Action-Specific	CERCLA cleanup standards	42 U.S.C. 9621	CERCLA cleanup standards	
Action-Specific	DOT – shipping containers	49 CFR 178	DOT – shipping containers	
Action-Specific	Exemption to DOT regulations for chemical or biological agent transportation	PL 91-441 sec. 506 (b)(4)	Exemption to DOT regulations for chemical or biological agent transportation	
Action-Specific	Non-bulk packaging	49 CFR 212	Non-bulk packaging	
Action-Specific	Transportation tracking	49 CFR 213	Transportation tracking	

Appendix B
Applicable or Relevant and Appropriate Requirements

Activity	Standard, Requirement, Criteria, or Limitation	Citation	Description of Requirement	Comment
Action-Specific	Transportation – power brake law	49 CFR 232	Transportation – Power Brake Law	
Action-Specific	Environmental Protection and Army Enhancement	AR 200-1	Requires U.S. compliance with all environmental statutes and regulations and consultation with federal, state, and local regulatory agencies	
Location-Specific	National Ambient Air Standards	40 CFR 50	National Ambient Air Quality Standards	
Location-Specific	Endangered Species Act	16 U.S.C. §§ 1531-1544 (1991, as amended) 50 CFR § 200 (1991) 50 CFR § 402 (1991)	Requires action, including consultation with Department of Interior, to conserve endangered species and critical habitats upon which endangered species depend.	

Appendix B
Applicable or Relevant and Appropriate Requirements

Activity	Standard, Requirement, Criteria, or Limitation	Citation	Description of Requirement	Comment
		50 CFR § 10 (1991)	Regulates the taking, possession, transportation, sale, purchase, barter, exportation, and importation of wildlife; lists wildlife species.	No taking of wildlife will occur under alternatives proposed.
To Be Considered	Ohio Administrative Code	Chapter 3734	Solid and Hazardous Waste	May be applicable to the storage and transport of IDW

APPENDIX C: Estimated Cost Details

Rollup Costs for EE/CA RVAAP-28 Suspected Mustard Agent Burial Site		
Alternative	**Title**	**Cost**
1	No Action - Contingency Plan and Army Safety Protective Measures	$0
2	Land Use Controls - Activity Restrictions	**$601,618**
3	Land Use Controls - Security Fence	**$806,733**
4	Phase I - Trenching 1998 and 2006	$1,289,946
	Geophysical Investigation Areas	
4	Phase II - Mustard Agent and MEC Destruction and Removal	$1,309,504
	in the 2010 Geophysical Investigaiton Area	
4	Total Phase I and II combined	**$2,599,450**

Alternative 2 - Land Use Controls and Activity Restrictions

	Unit Price	Unit	Task 1.0: Project Management Plan (PMP) / Quality Control Plan (QCP)		Task 1.1: Site Safety and Health Plan (SSHP)		Task 1.2: Project Execution/Client Correspondence		Task 2.0: Preparation of Work Plan and Support Documents		Task 3.0: Implementation of Work Plan		Task 3.1: Amendment of Property Management Plan		Task 3.2: Installation of Seibert Stakes		Task 3.3: Briefing of On-Site Personnel		Task 3.4: Annual Inspection of LUCs Effectiveness		Task 3.5: Five-Year Reviews		Task 3.6: O&M		Totals	
			Quantity	Unit Total	Quantity	Unit Total	Quantity	Unit Total	Quantity	Unit Total	Quantity	Unit Total	Quantity	Unit Total	Quantity	Unit Total	Quantity	Unit Total	Quantity	Unit Total	Quantity	Unit Total	Quantity	Unit Total	Quantity	Unit Total
Direct Labor																										
Project Manager	$ 120.00	hour	8	$ 960.00	8	$ 960.00	16	$ 1,920.00	16	$ 1,920.00	8	$ 960.00	8	$ 960.00	8	$ 960.00	8	$ 960.00	120	$ 14,400.00	24	$ 2,880.00		$ -	224	$ 26,880.00
Health and Safety Manager	$ 115.00	hour		$ -	24	$ 2,760.00		$ -		$ -	24	$ 2,760.00		$ -		$ -	24	$ 2,760.00	120	$ 13,800.00	32	$ 3,680.00		$ -	224	$ 25,760.00
Technical Manager/Project Engineer	$ 120.00	hour	24	$ 2,880.00	16	$ 1,920.00	80	$ 9,600.00	40	$ 4,800.00	24	$ 2,880.00	24	$ 2,880.00	16	$ 1,920.00	24	$ 2,880.00	480	$ 57,600.00	120	$ 14,400.00		$ -	848	$ 101,760.00
Chemist	$ 100.00	hour		$ -		$ -		$ -		$ -		$ -		$ -		$ -		$ -		$ -		$ -		$ -	0	$ -
UXO Technician II	$ 95.00	hour		$ -		$ -		$ -		$ -		$ -		$ -		$ -		$ -		$ -		$ -		$ -	0	$ -
UXO/CWA On-Site Supervisor	$ 115.00	hour		$ -		$ -		$ -		$ -		$ -		$ -		$ -		$ -		$ -		$ -		$ -	0	$ -
Risk Assessor/ Medical Professional	$ 140.00	hour		$ -		$ -		$ -	24	$ 3,360.00		$ -		$ -		$ -	8	$ 1,120.00		$ -	32	$ 4,480.00		$ -	64	$ 8,960.00
GIS Specialist	$ 100.00	hour		$ -		$ -		$ -		$ -		$ -		$ -		$ -	8	$ 800.00		$ -	24	$ 2,400.00		$ -	32	$ 3,200.00
Project Administrator	$ 70.00	hour	8	$ 560.00		$ -		$ -	8	$ 560.00		$ -		$ -		$ -		$ -		$ -		$ -		$ -	16	$ 1,120.00
Engineer/Geologist/Scientist	$ 100.00	hour	24	$ 2,400.00	24	$ 2,400.00	80	$ 8,000.00	40	$ 4,000.00		$ -	24	$ 2,400.00		$ -	16	$ 1,600.00	240	$ 24,000.00	100	$ 10,000.00		$ -	548	$ 54,800.00
Technician	$ 75.00	hour		$ -		$ -		$ -		$ -		$ -		$ -	120	$ 9,000.00		$ -		$ -		$ -	240	$ 18,000.00	360	$ 27,000.00
Surveyor	$ 60.00	hour		$ -		$ -		$ -		$ -		$ -		$ -		$ -		$ -		$ -		$ -		$ -	0	$ -
Clerical	$ 46.00	hour	24	$ 1,104.00	24	$ 1,104.00	40	$ 1,840.00	40	$ 1,840.00		$ -	24	$ 1,104.00		$ -	16	$ 736.00	240	$ 11,040.00	48	$ 2,208.00		$ -	456	$ 20,976.00
		hour		$ -		$ -		$ -		$ -		$ -		$ -		$ -		$ -		$ -		$ -		$ -	0	$ -
Direct Labor Total			88	$ 7,904.00	96	$ 9,144.00	216	$ 21,360.00	168	$ 16,480.00	56	$ 6,600.00	80	$ 7,344.00	144	$ 11,880.00	104	$ 10,856.00	1200	$ 120,840.00	380	$ 40,048.00	240	$ 18,000.00	2772	$ 270,456.00
Total Direct Labor (Profit Included)				$ 7,904.00		$ 9,144.00		$ 21,360.00		$ 16,480.00		$ 6,600.00		$ 7,344.00		$ 11,880.00		$ 10,856.00		$ 120,840.00		$ 40,048.00		$ 18,000.00		$ 270,456.00
Other Direct Costs																										
Airfare	$ 1,000.00	rnd trp		$ -		$ -	4	$ 4,000.00		$ -		$ -		$ -	3	$ 3,000.00	2	$ 2,000.00		$ -	2	$ 2,000.00		$ -	11	$ 11,000.00
Lodging	$ 77.00	day		$ -		$ -	8	$ 616.00		$ -		$ -		$ -	12	$ 924.00	4	$ 308.00		$ -	2	$ 154.00		$ -	26	$ 2,002.00
Rental Vehicle	$ 60.00	day		$ -		$ -	4	$ 240.00		$ -		$ -		$ -	8	$ 480.00		$ -		$ -	3	$ 180.00		$ -	15	$ 900.00
Per Diem	$ 46.00	day		$ -		$ -	8	$ 368.00		$ -		$ -		$ -	12	$ 552.00	10	$ 460.00		$ -	6	$ 276.00		$ -	36	$ 1,656.00
Lab Analysis (Soil)	$ 60.00	LS		$ -		$ -		$ -		$ -		$ -		$ -		$ -		$ -		$ -		$ -		$ -	0	$ -
Lab Analysis (Waste)	$ 645.00	LS		$ -		$ -		$ -		$ -		$ -		$ -		$ -		$ -		$ -		$ -		$ -	0	$ -
Data Validation	$ 2,500.00	LS		$ -		$ -		$ -		$ -		$ -		$ -		$ -		$ -		$ -		$ -		$ -	0	$ -
Fuel	$60.00	tank		$ -		$ -	4	$ 240.00		$ -		$ -		$ -	6	$ 360.00		$ -		$ -		$ -		$ -	10	$ 600.00
Office Trailer	$ 1,000.00	month		$ -		$ -		$ -		$ -		$ -		$ -		$ -		$ -		$ -		$ -		$ -	0	$ -
Portable Toilette	$350	month		$ -		$ -		$ -		$ -		$ -		$ -		$ -		$ -		$ -		$ -		$ -	0	$ -
Safety Supplies	$100.00	each		$ -		$ -		$ -		$ -		$ -		$ -	3	$ 300.00		$ -		$ -		$ -		$ -	3	$ 300.00
Documents	$50.00	each	15	$ 750.00	15	$ 750.00		$ -	30	$ 1,500.00		$ -	15	$ 750.00		$ -	15	$ 750.00	450	$ 22,500.00	90	$ 4,500.00		$ -	630	$ 31,500.00
20-Yard Roll Off Box (Rental)	$300.00	each		$ -		$ -		$ -		$ -		$ -		$ -		$ -		$ -		$ -		$ -		$ -	0	$ -
Seibert Stakes	$65.00	each		$ -		$ -		$ -		$ -		$ -		$ -	150	$ 9,750.00		$ -		$ -		$ -	90	$ 5,850.00	240	$ 15,600.00
Non-Haz Material Disposal	$85.00	ton		$ -		$ -		$ -		$ -		$ -		$ -		$ -		$ -		$ -		$ -		$ -	0	$ -
Hazardous Material Disposal	$ 250.00	drum		$ -		$ -		$ -		$ -		$ -		$ -		$ -		$ -		$ -		$ -		$ -	0	$ -
SWPP Supplies	$ 700.00	LS		$ -		$ -		$ -		$ -		$ -		$ -		$ -		$ -		$ -		$ -		$ -	0	$ -
Soil Backfill/Restoration	$ 25.00	yd		$ -		$ -		$ -		$ -		$ -		$ -		$ -		$ -		$ -		$ -		$ -	0	$ -
Survey Equipment Rental	$ 200.00	Day		$ -		$ -		$ -		$ -		$ -		$ -		$ -		$ -		$ -		$ -		$ -	0	$ -
Water Pump Rental	$ 500.00	Week		$ -		$ -		$ -		$ -		$ -		$ -		$ -		$ -		$ -		$ -		$ -	0	$ -
Water Removal Materials	$ 4,000.00	LS		$ -		$ -		$ -		$ -		$ -		$ -		$ -		$ -		$ -		$ -		$ -	0	$ -
Sampling Supplies	$ 100.00	LS		$ -		$ -		$ -		$ -		$ -		$ -		$ -		$ -		$ -		$ -		$ -	0	$ -
Brush Clearing Equipment	$ 2,000.00	LS		$ -		$ -		$ -		$ -		$ -		$ -		$ -		$ -		$ -		$ -		$ -	0	$ -
Backhoe + Certified Operator	$ 155.00	hour		$ -		$ -		$ -		$ -		$ -		$ -		$ -		$ -		$ -		$ -		$ -	0	$ -
																									0	
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																									0	
Other Direct Costs Subtotal				$ 750.00		$ 750.00		$ 5,464.00		$ 1,500.00		$ -		$ 750.00		$ 15,366.00		$ 3,518.00		$ 22,500.00		$ 7,110.00		$ 5,850.00	0	$ 63,558.00
G&A on Other Direct Costs Subtotal	22.10%			$ 165.75		$ 165.75		$ 1,207.54		$ 331.50		$ -		$ 165.75		$ 3,395.89		$ 777.48		$ 4,972.50		$ 1,571.31		$ 1,292.85	0	$ 14,046.32
Profit on ODC	10.00%			$ 75.00		$ 75.00		$ 546.40		$ 150.00		$ -		$ 75.00		$ 1,536.60		$ 351.80		$ 2,250.00		$ 711.00		$ 585.00	0	$ 6,355.80
Total ODC+Profit+G&A				$ 990.75		$ 990.75		$ 7,217.94		$ 1,981.50		$ -		$ 990.75		$ 20,298.49		$ 4,647.28		$ 29,722.50		$ 9,392.31		$ 7,727.85	0	$ 83,960.12
Total				$ 8,894.75		$ 10,134.75		$ 28,577.94		$ 18,461.50		$ 6,600.00		$ 8,334.75		$ 32,178.49		$ 15,503.28		$ 150,562.50	Per Review	$ 49,440.31		$ 25,727.85		$ 601,617.67
																					6 reviews	$ 296,641.86				

1.0	**$**	**8,894.75**
1.1	**$**	**10,134.75**
1.2	**$**	**28,577.94**
2.0	**$**	**18,461.50**
3.0	**$**	**6,600.00**
3.1	**$**	**8,334.75**
3.2	**$**	**32,178.49**
3.3	**$**	**15,503.28**
3.4	**$**	**150,562.50**
3.5	**$**	**296,641.86**
3.6	**$**	**25,727.85**
Total =	**$**	**601,617.67**

Assumptions:

1) This estimate is for contractor costs only.

2) Task 1.2 includes one (1) Kick-Off meeting at the RVAAP facility, (32) monthly progress reports, (32) records of conversations, (64) bi-weekly progress updates, (32) meeting minutes documentation, and one (1) RAB meeting.

3) Task 3.3 assumes briefing of on-site personnel on the excavation restrictions at the SMABS AOC will be conducted by the contractor for the first year. These briefings are expected to be conducted by on-site Army personnel thereafter.

4) Does not include costs of Army Regulations, Contingency Plan requirements and DOD/OSHA Regulations, or OHARNG costs.

5) Total perimeter area requiring delimits for ~ 3000 linear feet

6) Assume 30 Annual inspections will be done by local Contractor.

7) Assume 6 Five -Year reviews will be conducted.

Alternative 3 - Land Use Controls and Security Fencing

	Unit Price	Unit	**Task 1.0: Project Management Plan (PMP) / Quality Control Plan (QCP)**		Task 1.1: Site Safety and Health Plan (SSHP)		Task 1.2: Project Execution/Client Correspondence		**Task 2.0: Preparation of Work Plan and Support Documents**		**Task 3.0: Implementation of Work Plan**		Task 3.1: Installation of Security Fenceline		Task 3.2: Annual Inspection of LUCs Effectiveness		Task 3.3: Five-Year Reviews		Task 3.4: O&M		Totals	
			Quantity	Unit Total	Quantity	Unit Total	Quantity	Unit Total	Quantity	Unit Total	Quantity	Unit Total	Quantity	Unit Total	Quantity	Unit Total	Quantity	Unit Total	Quantity	Unit Total	Quantity	Unit Total
Direct Labor																						
Project Manager	$ 120.00	hour	8	$ 960.00	8	$ 960.00	16	$ 1,920.00	16	$ 1,920.00	8	$ 960.00	16	$ 1,920.00	120	$ 14,400.00	24	$ 2,880.00	60	$ 7,200.00	276	$ 33,120.00
Health and Safety Manager	$ 115.00	hour		$ -	24	$ 2,760.00		$ -		$ -	24	$ 2,760.00		$ -	120	$ 13,800.00	32	$ 3,680.00		$ -	200	$ 23,000.00
Technical Manager/Project Engineer	$ 120.00	hour	24	$ 2,880.00	16	$ 1,920.00	80	$ 9,600.00	40	$ 4,800.00	24	$ 2,880.00	32	$ 3,840.00	480	$ 57,600.00	120	$ 14,400.00	120	$ 14,400.00	936	$ 112,320.00
Chemist	$ 100.00	hour		$ -		$ -		$ -		$ -		$ -		$ -		$ -		$ -		$ -	0	$ -
UXO Technician II	$ 95.00	hour		$ -		$ -		$ -		$ -		$ -		$ -		$ -		$ -		$ -	0	$ -
UXO/CWA On-Site Supervisor	$ 115.00	hour		$ -		$ -		$ -		$ -		$ -		$ -		$ -		$ -		$ -	0	$ -
Risk Assessor	$ 140.00	hour		$ -		$ -		$ -	24	$ 3,360.00		$ -		$ -		$ -	32	$ 4,480.00		$ -	56	$ 7,840.00
GIS Specialist	$ 100.00	hour		$ -		$ -		$ -		$ -		$ -		$ -		$ -	24	$ 2,400.00		$ -	24	$ 2,400.00
Project Administrator	$ 70.00	hour	8	$ 560.00		$ -		$ -	8	$ 560.00		$ -		$ -		$ -		$ -		$ -	16	$ 1,120.00
Engineer/Geologist/Scientist	$ 100.00	hour	24	$ 2,400.00	24	$ 2,400.00	80	$ 8,000.00	40	$ 4,000.00		$ -		$ -	240	$ 24,000.00	100	$ 10,000.00		$ -	508	$ 50,800.00
Technician	$ 75.00	hour		$ -		$ -		$ -		$ -		$ -	320	$ 24,000.00		$ -		$ -	480	$ 36,000.00	800	$ 60,000.00
Surveyor	$ 60.00	hour		$ -		$ -		$ -		$ -		$ -		$ -		$ -		$ -		$ -	0	$ -
Clerical	$ 46.00	hour	72	$ 3,312.00	24	$ 1,104.00	40	$ 1,840.00	40	$ 1,840.00		$ -		$ -	240	$ 11,040.00	48	$ 2,208.00		$ -	464	$ 21,344.00
		hour		$ -		$ -		$ -		$ -		$ -		$ -		$ -		$ -		$ -	0	$ -
Direct Labor Total			136	$ 10,112.00	96	$ 9,144.00	216	$ 21,360.00	168	$ 16,480.00	56	$ 6,600.00	368	$ 29,760.00	1200	$ 120,840.00	380	$ 40,048.00	660	$ 57,600.00	3280	$ 311,944.00
Total Direct Labor (Profit Included)				$ 10,112.00		$ 9,144.00		$ 21,360.00		$ 16,480.00		$ 6,600.00		$ 29,760.00		$ 120,840.00		$ 40,048.00		$ 57,600.00		$ 311,944.00
Other Direct Costs																						
Airfare	$ 1,000.00	rnd trp		$ -		$ -	4	$ 4,000.00		$ -		$ -	4	$ 4,000.00		$ -	2	$ 2,000.00		$ -	10	$ 10,000.00
Lodging	$ 77.00	day		$ -		$ -	8	$ 616.00		$ -		$ -	40	$ 3,080.00		$ -	2	$ 154.00		$ -	50	$ 3,850.00
Rental Vehicle	$ 60.00	day		$ -		$ -	4	$ 240.00		$ -		$ -	20	$ 1,200.00		$ -	3	$ 180.00		$ -	27	$ 1,620.00
Per Diem	$ 46.00	day		$ -		$ -	8	$ 368.00		$ -		$ -	40	$ 1,840.00		$ -	6	$ 276.00		$ -	54	$ 2,484.00
Lab Analysis (Soil)	$ 2,400.00	LS		$ -		$ -		$ -		$ -		$ -		$ -		$ -		$ -		$ -	0	$ -
Lab Analysis (Waste)	$ 645.00	LS		$ -		$ -		$ -		$ -		$ -		$ -		$ -		$ -		$ -	0	$ -
Data Validation	$ 2,500.00	LS		$ -		$ -		$ -		$ -		$ -		$ -		$ -		$ -		$ -	0	$ -
Fuel	$60.00	tank		$ -		$ -	4	$ 240.00		$ -		$ -	8	$ 480.00		$ -		$ -		$ -	12	$ 720.00
Office Trailer	$ 400.00	month		$ -		$ -		$ -		$ -		$ -		$ -		$ -		$ -		$ -	0	$ -
Portable Toilette	$70	month		$ -		$ -		$ -		$ -		$ -		$ -		$ -		$ -		$ -	0	$ -
Safety Supplies	$100.00	each		$ -		$ -		$ -		$ -		$ -		$ -		$ -		$ -		$ -	0	$ -
Documents	$50.00	each	15	$ 750.00	15	$ 750.00		$ -	30	$ 1,500.00		$ -		$ -	450	$ 22,500.00	90	$ 4,500.00		$ -	600	$ 30,000.00
Security Fence	$40.00	linear ft		$ -		$ -		$ -		$ -		$ -	3000	$ 120,000.00		$ -		$ -		$ -	3000	$ 120,000.00
Concrete Paving & Equipment	$2.50	sq ft		$ -		$ -		$ -		$ -		$ -		$ -		$ -		$ -	7500	$ 18,750.00	7500	$ 18,750.00
Non-Haz Material Disposal	$85.00	ton		$ -		$ -		$ -		$ -		$ -		$ -		$ -		$ -		$ -	0	$ -
Hazardous Material Disposal	$ 250.00	drum		$ -		$ -		$ -		$ -		$ -		$ -		$ -		$ -		$ -	0	$ -
SWPP Supplies	$ 4,000.00	LS		$ -		$ -		$ -		$ -		$ -		$ -		$ -		$ -		$ -	0	$ -
Soil Backfill/Restoration	$ 25.00	yd		$ -		$ -		$ -		$ -		$ -		$ -		$ -		$ -		$ -	0	$ -
Survey Equipment Rental	$ 200.00	Day		$ -		$ -		$ -		$ -		$ -		$ -		$ -		$ -		$ -	0	$ -
Water Pump Rental	$ 500.00	Week		$ -		$ -		$ -		$ -		$ -		$ -		$ -		$ -		$ -	0	$ -
Water Removal Materials	$ 4,000.00	LS		$ -		$ -		$ -		$ -		$ -		$ -		$ -		$ -		$ -	0	$ -
Sampling Supplies	$ 100.00	LS		$ -		$ -		$ -		$ -		$ -		$ -		$ -		$ -		$ -	0	$ -
Brush Clearing Equipment	$ 2,000.00	LS		$ -		$ -		$ -		$ -		$ -		$ -		$ -		$ -		$ -	0	$ -
Backhoe + Certified Operator	$ 155.00	hour		$ -		$ -		$ -		$ -		$ -		$ -		$ -		$ -		$ -	0	$ -
																					0	
																					0	
																					0	
																					0	
																					0	
Other Direct Costs Subtotal				$ 750.00		$ 750.00		$ 5,464.00		$ 1,500.00		$ -		$ 130,600.00		$ 22,500.00		$ 7,110.00		$ 18,750.00	0	$ 187,424.00
G&A on Other Direct Costs Subtotal	22.10%			$ 165.75		$ 165.75		$ 1,207.54		$ 331.50		$ -		$ 28,862.60		$ 4,972.50		$ 1,571.31		$ 4,143.75	0	$ 41,420.70
Profit on ODC	10.00%			$ 75.00		$ 75.00		$ 546.40		$ 150.00		$ -		$ 13,060.00		$ 2,250.00		$ 711.00		$ 1,875.00	0	$ 18,742.40
Total ODC+Profit+G&A				$ 990.75		$ 990.75		$ 7,217.94		$ 1,981.50		$ -		$ 172,522.60		$ 29,722.50		$ 9,392.31		$ 24,768.75	0	$ 247,587.10
Total				$ 11,102.75		$ 10,134.75		$ 28,577.94		$ 18,461.50		$ 6,600.00		$ 202,282.60		$ 150,562.50		$ 49,440.31		$ 82,368.75		$ 806,732.65

$ 296,641.86
For 6 Five Year Reviews

1.0	**$**	**11,102.75**
1.1	**$**	**10,134.75**
1.2	**$**	**28,577.94**
2.0	**$**	**18,461.50**
3.0	**$**	**6,600.00**
3.1	**$**	**202,282.60**
	$	**-**
3.2	**$**	**150,562.50**
3.3	**$**	**296,641.86**
3.4	**$**	**82,368.75**
Total =	**$**	**806,732.65**

Assumptions:

1) This estimate is for contractor costs only.

6) Assume inspections are done by local contractor (30 inspections)

2) Task 1.2 includes one (1) Kick-Off meeting at the RVAAP facility, (32) monthly progress reports, (32) records of conversations, (64) bi-weekly progress updates, (32) meeting minutes documentation, and one (1) RAB meeting.

3) Unit rate for fenceline includes cost for gate for secure access.

3) Task 3.3 assumes briefing of on-site personnel on the excavation restrictions at the SMABS AOC will be conducted by the contractor for the first year.Rest of briefings conducted by on-site Army personnel thereafter.

4) Does not include costs of Army Regulations, Contingency Plan requirements and DOD/OSHA Regulations, or OHARNG costs.

5.) Total perimeter area requiring fencing for ~ 3000 linear feet

7) Assume 6 Five Year Reviews

Alternative 4 - Phase I - Trenching, Treatment, Removal/Destruction/Replacement

	Unit Price	Unit	**Task 1.0: Project Management Plan (PMP) / Quality Control Plan (QCP)**		Task 1.1: Site Safety and Health Plan (SSHP)		Task 1.2: Project Execution/Client Correspondence		Task 1.3: Jurisdictional Wetland Delineation		**Task 2.0: Preparation of Work Plan and Support Documents**	
			Quantity	Unit Total	Quantity	Unit Total	Quantity	Unit Total	Quantity	Unit Total	Quantity	Unit Total
Direct Labor												
Project Manager	$ 120.00	hour	24	$ 2,880.00	16	$ 1,920.00	40	$ 4,800.00	16	$ 1,920.00	24	$ 2,880.00
Health and Safety Manager	$ 115.00	hour		$ -	40	$ 4,600.00	16	$ 1,840.00	16	$ 1,840.00		$ -
Technical Manager/Project Engineer	$ 120.00	hour	40	$ 4,800.00	40	$ 4,800.00	200	$ 24,000.00	120	$ 14,400.00	120	$ 14,400.00
Chemist	$ 100.00	hour		$ -		$ -	16	$ 1,600.00	16	$ 1,600.00	40	$ 4,000.00
UXO Technician II	$ 95.00	hour		$ -		$ -		$ -		$ -		$ -
UXO/CWA On-Site Supervisor	$ 115.00	hour		$ -		$ -		$ -		$ -		$ -
Risk Assessor/Medical Officer	$ 140.00	hour		$ -		$ -		$ -		$ -	40	$ 5,600.00
GIS Specialist	$ 100.00	hour		$ -		$ -	16	$ 1,600.00	24	$ 2,400.00	40	$ 4,000.00
Project Administrator	$ 70.00	hour	24	$ 1,680.00		$ -		$ -		$ -	8	$ 560.00
Engineer/Geologist/Scientist	$ 100.00	hour	40	$ 4,000.00	40	$ 4,000.00	200	$ 20,000.00	120	$ 12,000.00	120	$ 12,000.00
Technician	$ 75.00	hour		$ -		$ -		$ -	120	$ 9,000.00		$ -
Surveyor	$ 60.00	hour		$ -		$ -		$ -	40	$ 2,400.00		$ -
Clerical	$ 46.00	hour	40	$ 1,840.00	40	$ 1,840.00	120	$ 5,520.00	40	$ 1,840.00	60	$ 2,760.00
				$ -		$ -		$ -		$ -	1	$ -
				$ -		$ -		$ -		$ -		$ -
Direct Labor Total			168	$ 15,200.00	176	$ 17,160.00	608	$ 59,360.00	512	$ 47,400.00	453	$ 46,200.00
Total Direct Labor (Profit Included)				$ 15,200.00		$ 17,160.00		$ 59,360.00		$ 47,400.00		$ 46,200.00
Other Direct Costs												
Airfare	$ 1,000.00	rnd trp		$ -		$ -	4	$ 4,000.00	4	$ 4,000.00		$ -
Lodging	$ 77.00	day		$ -		$ -	10	$ 770.00	50	$ 3,850.00		$ -
Rental Vehicle	$ 60.00	day		$ -		$ -	4	$ 240.00	30	$ 1,800.00		$ -
Per Diem	$ 46.00	day		$ -		$ -	10	$ 460.00	50	$ 2,300.00		$ -
Lab Analysis (Soil)	$ 60.00	LS		$ -		$ -		$ -		$ -		$ -
Lab Analysis (Waste)	$ 645.00	LS		$ -		$ -		$ -		$ -		$ -
Data Validation/QA	$ 2,500.00	LS		$ -		$ -		$ -		$ -		$ -
Fuel	$60.00	tank		$ -		$ -	4	$ 240.00	10	$ 600.00		$ -
Office Trailer/Lab/Medical	$ 1,000.00	month		$ -		$ -		$ -		$ -		$ -
Portable Toilette	$350	month		$ -		$ -		$ -		$ -		$ -
Safety Supplies	$100.00	each		$ -		$ -		$ -	3	$ 300.00		$ -
Documents	$50.00	each	15	$ 750.00	15	$ 750.00		$ -		$ -	30	$ 1,500.00
20-Yard Roll Off Box (Rental)	$300.00	each		$ -		$ -		$ -		$ -		$ -
Soil Excavation	$65.00	yd		$ -		$ -		$ -		$ -		$ -
Non-Haz Material Disposal	$85.00	ton		$ -		$ -		$ -		$ -		$ -
Hazardous Material Disposal	$ 250.00	drum		$ -		$ -		$ -		$ -		$ -
Excavtor	$ 700.00	day		$ -		$ -		$ -		$ -		$ -
Soil Backfill/Restoration	$ 25.00	yd		$ -		$ -		$ -		$ -		$ -
Survey Equipment Rental	$ 200.00	Day		$ -		$ -		$ -		$ -		$ -
Sifter Rental	$ 500.00	day		$ -		$ -		$ -		$ -		$ -
Water Removal Materials	$ 4,000.00	LS		$ -		$ -		$ -		$ -		$ -
Sampling Supplies/Decon/Medical	$ 100.00	LS		$ -		$ -		$ -		$ -		$ -
Brush Clearing Equipment	$ 2,000.00	LS		$ -		$ -		$ -		$ -		$ -
Backhoe + Certified Operator	$ 155.00	hour		$ -		$ -		$ -		$ -		$ -
Other Direct Costs Subtotal				$ 750.00		$ 750.00		$ 5,710.00		$ 12,850.00		$ 1,500.00
G&A on Other Direct Costs Subtotal	22.10%			$ 165.75		$ 165.75		$ 1,261.91		$ 2,839.85		$ 331.50
Profit on ODC	10.00%			$ 75.00		$ 75.00		$ 571.00		$ 1,285.00		$ 150.00
Total ODC+Profit+G&A				$ 990.75		$ 990.75		$ 7,542.91		$ 16,974.85		$ 1,981.50
Total				$ 16,190.75		$ 18,150.75		$ 66,902.91		$ 64,374.85		$ 48,181.50

	Task 3.0: Implementation of Work Plan		Task 3.1: Vegetation Clearing, Wetland Protection, and Erosion		Task 3.2: Excavation of Test Pits (Trenches)		Task 3.3 Medical, Testing, Disposal, and Confirmation		Task 3.4: Analysis, Examination, and Disposal of IDW		Task 3.5: Data Management / Data Validation		Task 3.6: Surveying and Mapping		**Task 4.0:Investigaiton Report**		Totals	
	Quantity	Unit Total	Quantity	Unit Total	Quantity	Unit Total	Quantity	Unit Total	Quantity	Unit Total	Quantity	Unit Total	Quantity	Unit Total	Quantity	Unit Total	Quantity	Unit Total
Direct Labor																		
Project Manager	24	$ 2,880.00	8	$ 960.00	64	$ 7,680.00		$ -	4	$ 480.00		$ -	8	$ 960.00	32	$ 3,840.00	260	$ 31,200.00
Health and Safety Manager	40	$ 4,600.00		$ -	160	$ 18,400.00		$ -		$ -		$ -		$ -		$ -	272	$ 31,280.00
Technical Manager/Project Engineer	80	$ 9,600.00	32	$ 3,840.00	200	$ 24,000.00		$ -	16	$ 1,920.00	8	$ 960.00	24	$ 2,880.00	500	$ 60,000.00	1380	$ 165,600.00
Chemist		$ -		$ -		$ -	500	$ 50,000.00	8	$ 800.00	24	$ 2,400.00		$ -	120	$ 12,000.00	724	$ 72,400.00
UXO Technician II		$ -		$ -	1200	$ 114,000.00		$ -		$ -		$ -		$ -		$ -	1200	$ 114,000.00
UXO/CWA On-Site Supervisor		$ -		$ -	300	$ 34,500.00		$ -		$ -		$ -		$ -		$ -	300	$ 34,500.00
Risk Assessor/Medical Officer		$ -		$ -		$ -	500	$ 70,000.00		$ -		$ -		$ -	160	$ 22,400.00	700	$ 98,000.00
GIS Specialist		$ -		$ -	200	$ 20,000.00		$ -		$ -		$ -	200	$ 20,000.00	80	$ 8,000.00	560	$ 56,000.00
Project Administrator	24	$ 1,680.00		$ -		$ -		$ -		$ -		$ -		$ -	80	$ 5,600.00	136	$ 9,520.00
Engineer/Geologist/Scientist	40	$ 4,000.00	80	$ 8,000.00	200	$ 20,000.00	500	$ 50,000.00		$ -		$ -		$ -	320	$ 32,000.00	1660	$ 166,000.00
Technician		$ -	240	$ 18,000.00		$ -		$ -	16	$ 1,200.00		$ -	24	$ 1,800.00		$ -	400	$ 30,000.00
Surveyor		$ -		$ -		$ -		$ -		$ -		$ -	160	$ 9,600.00		$ -	200	$ 12,000.00
Clerical	24	$ 1,104.00		$ -	150	$ 6,900.00		$ -		$ -	4	$ 184.00		$ -	160	$ 7,360.00	638	$ 29,348.00
		$ -		$ -		$ -		$ -		$ -		$ -		$ -		$ -	1	$ -
		$ -		$ -		$ -		$ -		$ -		$ -		$ -		$ -	0	$ -
Direct Labor Total		$ 23,864.00	480	$ 30,800.00	2474	$ 245,480.00	1500	$ 170,000.00	44	$ 4,400.00	36	$ 3,544.00	416	$ 35,240.00	1452	$ 151,200.00	8319	$ 849,848.00
Total Direct Labor (Profit Included)		$ 23,864.00		$ 30,800.00		$ 245,480.00		$ 170,000.00		$ 4,400.00		$ 3,544.00		$ 35,240.00		$ 151,200.00		$ 849,848.00
Other Direct Costs																		
Airfare		$ -	4	$ 4,000.00	11	$ 11,000.00	6	$ 6,000.00		$ -		$ -	2	$ 2,000.00		$ -	31	$ 31,000.00
Lodging		$ -	40	$ 3,080.00	220	$ 16,940.00	150	$ 11,550.00		$ -		$ -	40	$ 3,080.00		$ -	510	$ 39,270.00
Rental Vehicle		$ -	6	$ 360.00	120	$ 7,200.00	50	$ 3,000.00		$ -		$ -	20	$ 1,200.00		$ -	230	$ 13,800.00
Per Diem		$ -	40	$ 1,840.00	220	$ 10,120.00	150	$ 6,900.00		$ -		$ -	40	$ 1,840.00		$ -	510	$ 23,460.00
Lab Analysis (Soil)		$ -		$ -		$ -	420	$ 25,200.00	168	$ 10,080.00		$ -		$ -		$ -	588	$ 35,280.00
Lab Analysis (Waste)		$ -		$ -		$ -	4	$ 3,020.00	25	$ 16,125.00		$ -	12	$ 7,740.00		$ -	41	$ 26,445.00
Data Validation/QA		$ -		$ -		$ -		$ -		$ -	3	$ 7,500.00		$ -		$ -	3	$ 7,500.00
Fuel		$ -	24	$ 1,440.00	60	$ 3,600.00	60	$ 3,600.00		$ -		$ -	20	$ 1,200.00		$ -	178	$ 10,680.00
Office Trailer/Lab/Medical	2	$ 2,000.00		$ -		$ -	2	$ 2,000.00		$ -		$ -		$ -		$ -	4	$ 4,000.00
Portable Toilette		$ -		$ -		$ -	25	$ 8,750.00		$ -		$ -		$ -		$ -	25	$ 8,750.00
Safety Supplies		$ -	8	$ 800.00	11	$ 1,100.00	6	$ 600.00		$ -		$ -	20	$ 2,000.00		$ -	48	$ 4,800.00
Documents		$ -		$ -		$ -	2	$ 100.00		$ -		$ -		$ -	60	$ 3,000.00	122	$ 6,100.00
20-Yard Roll Off Box (Rental)		$ -		$ -	20	$ 6,000.00		$ -		$ -		$ -		$ -		$ -	20	$ 6,000.00
Soil Excavation		$ -		$ -	117	$ 7,605.00		$ -		$ -		$ -		$ -		$ -	117	$ 7,605.00
Non-Haz Material Disposal		$ -		$ -		$ -		$ -	50	$ 4,250.00		$ -		$ -		$ -	50	$ 4,250.00
Hazardous Material Disposal		$ -		$ -		$ -	1	$ 250.00	50	$ 12,500.00		$ -		$ -		$ -	51	$ 12,750.00
Excavtor	25	$ 17,500.00		$ -		$ -	1	$ 700.00		$ -		$ -		$ -		$ -	26	$ 18,200.00
Soil Backfill/Restoration		$ -		$ -	117	$ 2,925.00		$ -		$ -		$ -		$ -		$ -	117	$ 2,925.00
Survey Equipment Rental		$ -		$ -		$ -		$ -		$ -		$ -	50	$ 10,000.00		$ -	50	$ 10,000.00
Sifter Rental	25	$ 12,500.00		$ -		$ -		$ -		$ -		$ -		$ -		$ -	25	$ 12,500.00
Water Removal Materials		$ -		$ -		$ -		$ -		$ -		$ -		$ -		$ -	0	$ -
Sampling Supplies/Decon/Medical		$ -		$ -		$ -	4	$ 400.00		$ -		$ -		$ -		$ -	4	$ 400.00
Brush Clearing Equipment		$ -	3	$ 6,000.00		$ -	5	$ 10,000.00		$ -		$ -		$ -		$ -	8	$ 16,000.00
Backhoe + Certified Operator		$ -		$ -	200	$ 31,000.00		$ -		$ -		$ -		$ -		$ -	200	$ 31,000.00
																	0	
																	0	
																	0	
																	0	
																	0	
Other Direct Costs Subtotal		$ 32,000.00		$ 17,520.00		$ 97,490.00		$ 82,070.00		$ 42,955.00		$ 7,500.00		$ 29,060.00		$ 3,000.00	0	$ 332,715.00
G&A on Other Direct Costs Subtotal		$ 7,072.00		$ 3,871.92		$ 21,545.29		$ 18,137.47		$ 9,493.06		$ 1,657.50		$ 6,422.26		$ 663.00	0	$ 73,530.02
Profit on ODC		$ 3,200.00		$ 1,752.00		$ 9,749.00		$ 8,207.00		$ 4,295.50		$ 750.00		$ 2,906.00		$ 300.00	0	$ 33,271.50
Total ODC+Profit+G&A		$ 42,272.00		$ 23,143.92		$ 128,784.29		$ 108,414.47		$ 56,743.56		$ 9,907.50		$ 38,388.26		$ 3,963.00	0	$ 439,516.52
Total		$ 66,136.00		$ 53,943.92		$ 374,264.29		$ 278,414.47		$ 61,143.56		$ 13,451.50		$ 73,628.26		$ 155,163.00		$ 1,289,945.76

1.0	**$**	**16,190.75**
1.1	**$**	**18,150.75**
1.2	**$**	**66,902.91**
1.3	**$**	**64,374.85**
2.0	**$**	**48,181.50**
3.0	**$**	**66,136.00**
3.1	**$**	**53,943.92**
3.2	**$**	**374,264.29**
3.3	**$**	**278,414.47**
3.4	**$**	**61,143.56**
3.5	**$**	**13,451.50**
3.6	**$**	**73,628.26**
4.0	**$**	**155,163.00**
Total =	**$**	**1,289,945.76**
TOTAL	**$**	**1,289,945.76**

Assumptions: ***Intrusive Investigation - Trenching and Removal/Destruction***

1) Assume the brush clearing will require eight 10-hour days of field work. Three technicians and one field engineer/geologist/scientist.

2) Assume the trenching will require 20 10-hour days of field work for a six-person crew of CWM-certified technicians to dig trenches with excavator.
Dirt will be sifted, placed on tarp, all items tested, and then either removed to be decontaminated, and or put back in place or disposed off-site.

3) Assume collection of one sample of stockpiled soils from each trench for Mustard Agent. Assume standard QA samples required as per test kits.
Task 3.4 assume 25 items are found that need to be assessed

4) Assume 168 trenches, each measure 20 ft by 15 ft wide by 3 ft (900 cubic feet) x 168 = 151,200 cu feet = 5600 cu yd. Assume 1.5 tons per cubic yard, 1.5 x 5600 = 8400 tons.

5) Task 1.2 includes one (1) Kick-Off meeting at the RVAAP facility, (32) monthly progress reports, (32) records of conversations, (64) bi-weekly progress updates, (32) meeting minutes documentation, and one (1) RAB meeting.

6) This estimate is for contractor costs only. Does not include costs for Huntsville for preparation of contingency plans and CWM field support. Estimate these costs to be approximately $50K.

7) Assume wetland delineation will require three (3) weeks in the field for an engineer/geologist and a technician, and one (1) week for a surveyor/GPS.

8)

Area	Yards		trenchs are 20 X 15 X 3 -		900 ft3
1998	2,703				
2006	3,294		divided by 27		35

Alternative 4 - Phase II - Mustard Agent/MEC Removal/ Treatment/Decontamination/Destruction/Disposal/ Closure

	Unit Price	Unit	Task 1.0: Project Management Plan (PMP) Included in Phase I/ Separate Phase II Quality Control Plan (QCP)		Task 1.1: Site Safety and Health Plan (SSHP)		Task 1.2: Project Execution/Client Correspondence		Task 2.0: Preparation of Work Plan and Support Documents		Task 3.0: Implementation of Work Plan	
			Quantity	Unit Total	Quantity	Unit Total	Quantity	Unit Total	Quantity	Unit Total	Quantity	Unit Total
Direct Labor												
Project Manager	$ 120.00	hour	8	$ 960.00	16	$ 1,920.00	24	$ 2,880.00	24	$ 2,880.00	24	$ 2,880.00
Health and Safety Manager	$ 115.00	hour		$ -	40	$ 4,600.00	16	$ 1,840.00		$ -	40	$ 4,600.00
Technical Manager/Project Engineer	$ 120.00	hour	16	$ 1,920.00	40	$ 4,800.00	200	$ 24,000.00	120	$ 14,400.00	80	$ 9,600.00
Chemist	$ 100.00	hour		$ -		$ -	16	$ 1,600.00	40	$ 4,000.00		$ -
UXO Technician II	$ 95.00	hour		$ -		$ -		$ -		$ -		$ -
UXO/CWA On-Site Supervisor	$ 115.00	hour		$ -		$ -		$ -		$ -		$ -
Risk Assessor/Medical Officer	$ 140.00	hour		$ -		$ -		$ -	40	$ 5,600.00		$ -
GIS Specialist	$ 100.00	hour		$ -		$ -	16	$ 1,600.00	40	$ 4,000.00		$ -
Project Administrator	$ 70.00	hour	12	$ 840.00		$ -		$ -	8	$ 560.00	24	$ 1,680.00
Engineer/Geologist/Scientist	$ 100.00	hour	40	$ 4,000.00	40	$ 4,000.00	200	$ 20,000.00	120	$ 12,000.00	40	$ 4,000.00
Technician	$ 75.00	hour		$ -		$ -		$ -		$ -		$ -
Surveyor	$ 60.00	hour		$ -		$ -		$ -		$ -		$ -
Clerical	$ 46.00	hour	24	$ 1,104.00	40	$ 1,840.00	120	$ 5,520.00	60	$ 2,760.00	24	$ 1,104.00
				$ -		$ -		$ -	1	$ -		$ -
				$ -		$ -		$ -		$ -		$ -
Direct Labor Total			100	$ 8,824.00	176	$ 17,160.00	592	$ 57,440.00	453	$ 46,200.00		$ 23,864.00
Total Direct Labor (Profit Included)				$ 8,824.00		$ 17,160.00		$ 57,440.00		$ 46,200.00		$ 23,864.00
Other Direct Costs												
Airfare	$ 1,000.00	rnd trp		$ -		$ -	4	$ 4,000.00		$ -		$ -
Lodging	$ 77.00	day		$ -		$ -	10	$ 770.00		$ -		$ -
Rental Vehicle	$ 60.00	day		$ -		$ -	4	$ 240.00		$ -		$ -
Per Diem	$ 46.00	day		$ -		$ -	10	$ 460.00		$ -		$ -
Lab Analysis (Soil)	$ 60.00	LS		$ -		$ -		$ -		$ -		$ -
Lab Analysis (Waste)	$ 645.00	LS		$ -		$ -		$ -		$ -		$ -
Data Validation/QA	$ 2,500.00	LS		$ -		$ -		$ -		$ -		$ -
Fuel	$60.00	tank		$ -		$ -	4	$ 240.00		$ -		$ -
Office Trailer/Lab/Medical	$ 1,000.00	month		$ -		$ -		$ -		$ -	2	$ 2,000.00
Portable Toilette	$350	month		$ -		$ -		$ -		$ -		$ -
Safety Supplies	$100.00	each		$ -		$ -		$ -		$ -		$ -
Documents	$50.00	each	15	$ 750.00	15	$ 750.00		$ -	30	$ 1,500.00		$ -
20-Yard Roll Off Box (Rental)	$300.00	each		$ -		$ -		$ -		$ -		$ -
Soil Excavation	$65.00	yd		$ -		$ -		$ -		$ -		$ -
Non-Haz Material Disposal	$85.00	ton		$ -		$ -		$ -		$ -		$ -
Hazardous Material Disposal/Destruction	$ 250.00	drum/item		$ -		$ -		$ -		$ -		$ -
Excavtor	$ 700.00	day		$ -		$ -		$ -		$ -	25	$ 17,500.00
Soil Backfill/Restoration	$ 25.00	yd		$ -		$ -		$ -		$ -		$ -
Survey Equipment Rental	$ 200.00	Day		$ -		$ -		$ -		$ -		$ -
Sifter Rental	$ 500.00	day		$ -		$ -		$ -		$ -	25	$ 12,500.00
Water Removal Materials	$ 4,000.00	LS		$ -		$ -		$ -		$ -		$ -
Sampling Supplies/Decon/Medical	$ 100.00	LS		$ -		$ -		$ -		$ -		$ -
Brush Clearing Equipment	$ 2,000.00	LS		$ -		$ -		$ -		$ -		$ -
Backhoe + Certified Operator	$ 155.00	hour		$ -		$ -		$ -		$ -		$ -
Other Direct Costs Subtotal				$ 750.00		$ 750.00		$ 5,710.00		$ 1,500.00		$ 32,000.00
G&A on Other Direct Costs Subtotal	22.10%			$ 165.75		$ 165.75		$ 1,261.91		$ 331.50		$ 7,072.00
Profit on ODC	10.00%			$ 75.00		$ 75.00		$ 571.00		$ 150.00		$ 3,200.00
Total ODC+Profit+G&A				$ 990.75		$ 990.75		$ 7,542.91		$ 1,981.50		$ 42,272.00
Total				$ 9,814.75		$ 18,150.75		$ 64,982.91		$ 48,181.50		$ 66,136.00

	Task 3.1: Vegetation Clearing		Task 3.2: Excavation of Anomalies		Task 3.3 Medical, Testing, Disposal, and Confirmation		Task 3.4: Analysis, Examination, and Disposal of IDW		Task 3.5: Data Management / Data Validation		Task 3.6: Surveying and Identification		Task 4.0: Closure Completions Report		Totals	
	Quantity	Unit Total	Quantity	Unit Total	Quantity	Unit Total	Quantity	Unit Total	Quantity	Unit Total	Quantity	Unit Total	Quantity	Unit Total	Quantity	Unit Total
Direct Labor																
Project Manager	8	$ 960.00	64	$ 7,680.00		$ -	4	$ 480.00		$ -	8	$ 960.00	32	$ 3,840.00	212	$ 25,440.00
Health and Safety Manager		$ -	160	$ 18,400.00		$ -		$ -		$ -		$ -		$ -	256	$ 29,440.00
Technical Manager/Project Engineer	32	$ 3,840.00	200	$ 24,000.00		$ -	16	$ 1,920.00	8	$ 960.00	200	$ 24,000.00	240	$ 28,800.00	1152	$ 138,240.00
Chemist		$ -		$ -	400	$ 40,000.00	8	$ 800.00	24	$ 2,400.00		$ -	80	$ 8,000.00	568	$ 56,800.00
UXO Technician II		$ -	1200	$ 114,000.00		$ -		$ -		$ -		$ -		$ -	1200	$ 114,000.00
UXO/CWA On-Site Supervisor		$ -	300	$ 34,500.00		$ -		$ -		$ -		$ -		$ -	300	$ 34,500.00
Risk Assessor/Medical Officer		$ -		$ -	400	$ 56,000.00		$ -		$ -		$ -	120	$ 16,800.00	560	$ 78,400.00
GIS Specialist		$ -	40	$ 4,000.00		$ -		$ -		$ -	200	$ 20,000.00	40	$ 4,000.00	336	$ 33,600.00
Project Administrator		$ -		$ -		$ -		$ -		$ -		$ -	24	$ 1,680.00	68	$ 4,760.00
Engineer/Geologist/Scientist	80	$ 8,000.00	200	$ 20,000.00	400	$ 40,000.00		$ -		$ -		$ -	200	$ 20,000.00	1320	$ 132,000.00
Technician	240	$ 18,000.00		$ -		$ -	16	$ 1,200.00		$ -	24	$ 1,800.00		$ -	280	$ 21,000.00
Surveyor		$ -		$ -		$ -		$ -		$ -	160	$ 9,600.00		$ -	160	$ 9,600.00
Clerical		$ -	32	$ 1,472.00		$ -		$ -	4	$ 184.00		$ -	80	$ 3,680.00	384	$ 17,664.00
		$ -		$ -		$ -		$ -		$ -		$ -		$ -	1	$ -
		$ -		$ -		$ -		$ -		$ -		$ -		$ -	0	$ -
Direct Labor Total	480	$ 30,800.00	2196	$ 224,052.00	1200	$ 136,000.00	44	$ 4,400.00	36	$ 3,544.00	592	$ 56,360.00	816	$ 86,800.00	6685	$ 695,444.00
Total Direct Labor (Profit Included)		$ 30,800.00		$ 224,052.00		$ 136,000.00		$ 4,400.00		$ 3,544.00		$ 56,360.00		$ 86,800.00		$ 695,444.00
Other Direct Costs																
Airfare	4	$ 4,000.00	11	$ 11,000.00	6	$ 6,000.00		$ -		$ -	2	$ 2,000.00		$ -	27	$ 27,000.00
Lodging	40	$ 3,080.00	220	$ 16,940.00	120	$ 9,240.00		$ -		$ -	10	$ 770.00		$ -	400	$ 30,800.00
Rental Vehicle	6	$ 360.00	120	$ 7,200.00	40	$ 2,400.00		$ -		$ -	5	$ 300.00		$ -	175	$ 10,500.00
Per Diem	40	$ 1,840.00	220	$ 10,120.00	120	$ 5,520.00		$ -		$ -	10	$ 460.00		$ -	400	$ 18,400.00
Lab Analysis (Soil)		$ -		$ -	600	$ 36,000.00	25	$ 1,500.00		$ -		$ -		$ -	625	$ 37,500.00
Lab Analysis (Waste)		$ -		$ -	5	$ 3,020.00	25	$ 16,125.00		$ -		$ -		$ -	30	$ 19,350.00
Data Validation/QA		$ -		$ -	20	$ 50,000.00		$ -	3	$ 7,500.00		$ -	4	$ 10,000.00	27	$ 67,500.00
Fuel	24	$ 1,440.00	60	$ 3,600.00	60	$ 3,600.00		$ -		$ -	20	$ 1,200.00		$ -	168	$ 10,080.00
Office Trailer/Lab/Medical		$ -		$ -	2	$ 2,000.00		$ -		$ -		$ -		$ -	4	$ 4,000.00
Portable Toilette		$ -		$ -	20	$ 7,000.00		$ -		$ -		$ -		$ -	20	$ 7,000.00
Safety Supplies	8	$ 800.00	11	$ 1,100.00	25	$ 2,500.00	20	$ 2,000.00		$ -	20	$ 2,000.00		$ -	84	$ 8,400.00
Documents		$ -		$ -	2	$ 100.00	10	$ 500.00		$ -		$ -	30	$ 1,500.00	102	$ 5,100.00
20-Yard Roll Off Box (Rental)		$ -		$ -		$ -		$ -		$ -		$ -		$ -	0	$ -
Soil Excavation		$ -		$ -		$ -		$ -		$ -		$ -		$ -	0	$ -
Non-Haz Material Disposal		$ -		$ -		$ -	12	$ 1,020.00		$ -		$ -		$ -	12	$ 1,020.00
Hazardous Material Disposal/Destruction		$ -		$ -	600	$ 150,000.00	12	$ 3,000.00		$ -		$ -		$ -	612	$ 153,000.00
Excavtor		$ -		$ -		$ -		$ -		$ -		$ -		$ -	25	$ 17,500.00
Soil Backfill/Restoration		$ -		$ -		$ -		$ -		$ -		$ -		$ -	0	$ -
Survey Equipment Rental		$ -	50	$ 10,000.00		$ -		$ -		$ -	20	$ 4,000.00		$ -	70	$ 14,000.00
Sifter Rental		$ -		$ -		$ -		$ -		$ -		$ -		$ -	25	$ 12,500.00
Water Removal Materials		$ -		$ -		$ -		$ -		$ -		$ -		$ -	0	$ -
Sampling Supplies/Decon/Medical		$ -	50	$ 5,000.00	4	$ 400.00		$ -		$ -		$ -		$ -	54	$ 5,400.00
Brush Clearing Equipment	3	$ 6,000.00		$ -	5	$ 10,000.00		$ -		$ -		$ -		$ -	8	$ 16,000.00
Backhoe + Certified Operator		$ -		$ -		$ -		$ -		$ -		$ -		$ -	0	$ -
															0	
															0	
															0	
															0	
															0	
Other Direct Costs Subtotal		$ 17,520.00		$ 64,960.00		$ 287,780.00		$ 24,145.00		$ 7,500.00		$ 10,730.00		$ 11,500.00	0	$ 465,050.00
G&A on Other Direct Costs Subtotal		$ 3,871.92		$ 14,356.16		$ 63,599.38		$ 5,336.05		$ 1,657.50		$ 2,371.33		$ 2,541.50	0	$ 102,776.05
Profit on ODC		$ 1,752.00		$ 6,496.00		$ 28,778.00		$ 2,414.50		$ 750.00		$ 1,073.00		$ 1,150.00	0	$ 46,505.00
Total ODC+Profit+G&A		$ 23,143.92		$ 85,812.16		$ 380,157.38		$ 31,895.55		$ 9,907.50		$ 14,174.33		$ 15,191.50	0	$ 614,331.05
Total		$ 53,943.92		$ 309,864.16		$ 516,157.38		$ 36,295.55		$ 13,451.50		$ 70,534.33		$ 101,991.50		$ 1,309,504.25

1.0	**$**	**9,814.75**
1.1	**$**	**18,150.75**
1.2	**$**	**64,982.91**
	$	**-**
2.0	**$**	**48,181.50**
3.0	**$**	**66,136.00**
3.1	**$**	**53,943.92**
3.2	**$**	**309,864.16**
3.3	**$**	**516,157.38**
3.4	**$**	**36,295.55**
3.5	**$**	**13,451.50**
3.6	**$**	**70,534.33**
4.0	**$**	**101,991.50**
Total =	**$**	**1,309,504.25**
TOTAL	**$**	**1,309,504.25**

Assumptions: ***Intrusive Investigation - Digging Anaomalies, Testing for Mustard Agent and MEC, Removal/Destruction***

1) Assume the brush clearing will require 20 10-hour days of field work. Three technicians and one field engineer/geologist/scientist.

2) Assume the digging require 20 10-hour days of field work for a six-person crew of CWM-certified technicians to dig out anomalies.

3) Assume collection of one sample of soils from each anomalie for Mustard Agent. Assume standard QA samples required as per test kits. Task 3.4 assume 600 items are found that need to be assessed

4) Assume 1000 anomalies, 600 must be treated and tested.

5) Task 1.2 includes one (1) Kick-Off meeting at the RVAAP facility in cluded with Phase I, (32) monthly progress reports, (32) records of conversations, (64) bi-weekly progress updates, (32) meeting minutes documentation, and one (1) RAB meeting.

6) This estimate is for contractor costs only. Does not include costs for Army required personnel and CWM field support. Estimate these costs to be approximately $50K.

7) Assume UXO equipment cost not included.

8) Task 3.3
Assumed 2 CWM chemists - 2 medical in onsite medical lab - 2 CMW experts in decontamination area
included 50 hours each person to setup facilities in Phase I.

9) Destruction UXO - MEC

10) Additional Army Experts required - assume ~$150,000 not included but required.
- U.S. Army Edgewood Chemical Biological Center = (ECBC)
- U.S. Army CBRNE Analytical and Remediation Activity = (CARA)
- Chemical, Biological, Radiological, Nuclear and Explosives = (CBRNE).

EXAMPLE LABORATORY ANALYSIS

Analyte	Fixed Unit Price	Number of Tests	Total Cost
Surface Soil/Sediment			
MI Sample Prep	60		$ -
TAL Metals	130	5	$ 650.00
Mercury	30		$ -
Hexavalent Chromium	60		$ -
Propellants	350	5	$ 1,750.00
Explosives	80	5	$ 400.00
SVOCs	250	5	$ 1,250.00
VOCs	80	5	$ 400.00
Pesticides	80	5	$ 400.00
PCBs	80	5	$ 400.00
		Total Surface Soil =	**$ 5,250.00**
Sulfur Mustard Agent (dichlorodiethyl sulfide) *	525	5	$ 2,625.00
TCLP - Prep	40	1	$ 40.00
TCLP -SVOCs	163	1	$ 163.00
TCLP - VOCs	80	1	$ 80.00
TCLP - 8 Metals	77	1	$ 77.00
pH	11	1	$ 11.00
Flashpoint	24	1	$ 24.00
		Total Waste Characterization =	**$ 3,020.00**

* TestAmerica is capable of performing the laboratory analysis for Sulfur Mustard Agent. It consists of a Method 8321A analysis for Thiodiglycol, and a Method 8270C analysis for Chemical Warfare Degrates 1,4-Dithiane & 1,4-Oxathiane.

Test Kits - $60 per test

Mustard Detection Unit - rental or purchase

APPENDIX D: Excerpts from Various Army Regulations and the Contingency Plan Regarding Safety Measures and Protective Requirements

Department of the Army ***TRADOC Pamphlet 385-1**
Headquarters, United States Army
Training and Doctrine Command
Fort Eustis, Virginia 23604-5700

6 January 2012

Safety

THE TRADOC MODEL SAFETY PROGRAM AND SELF-ASSESSMENT GUIDE

FOR THE COMMANDER:

OFFICIAL:

JOHN E. STERLING, JR.
Lieutenant General, U.S. Army
Deputy Commanding General/
Chief of Staff

CHARLES E. HARRIS III
Colonel, GS
Deputy Chief of Staff, G-6

History. This publication is a rapid action revision. The portions affected by this administrative revision are listed in the summary of change.

Summary. This pamphlet serves as the basis for doctrine development and organizing, implementing, resourcing, and assessing safety and occupational programs within the U.S. Army Training and Doctrine Command (TRADOC).

Applicability. This pamphlet applies to all TRADOC organizations, activities, centers and schools.

Proponent and exception authority. The proponent of this pamphlet is the TRADOC Deputy Commanding General/Chief of Staff. The proponent has the authority to approve exceptions or waivers to this pamphlet that are consistent with controlling law and regulations. The proponent may delegate this authority in writing, to a division chief with the proponent agency or its direct reporting unit or field-operating agency, in the grade of colonel or the civilian equivalent. To request an exception or waiver to this pamphlet, send a written request to usarmy.jble.tradoc.mbx.tradoc-g1-4-safety-office@mail.mil prior to initiating deviation.

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*This pamphlet supersedes TRADOC Pamphlet 385-1, 17 March 2009.

Identify specific conflict(s) with pamphlet and provide justification for the request and alternate measures. Include an assessment of the associated risk with the request.

Suggested improvements. Users are invited to send comments and suggested improvements on DA Form 2028 (Recommended Changes to Publication and Blank Forms) directly to Commander, TRADOC (ATCS-S), 950 Jefferson Ave, Fort Eustis, VA 23604-5754 or usarmy.jble.tradoc.mbx.tradoc-g1-4-safety-office@mail.mil. Suggested improvements may also be submitted using DA Form 1045 (Army Ideas for Excellence Program (AIEP) Proposal).

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Summary of Change

TRADOC Pamphlet 385-1
The TRADOC Model Safety Program and Self-assessment Guide

This revision, dated – 6 January 2012

o Updates procedures and standards to be in compliance with Army Regulation 385-10.

o Updates procedures and standards to be in compliance with 29 Code of Federal Regulation 1910.

o Updates procedures and standards to be in compliance with 29 Code of Federal Regulation 1926.

Contents

Figure List

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Chapter 1
Introduction

1-1. Purpose

a. This publication provides commanders and safety managers a model for a safety and occupational health program, defines standards, and addresses those basic safety program elements necessary for implementation of effective safety and accident prevention programs as outlined in Army Regulation (AR) 385-10 and U.S. Army Training and Doctrine Command (TRADOC) Regulation 385-2. Commanders may tailor this publication to meet their needs and local conditions to accomplish the TRADOC mission.

b. The self-assessment guide provides commanders and safety managers a standardized method to assess the scope and effectiveness of a comprehensive safety and occupational health program. The self-assessment guide consists of several checklists that provide a systematic method to assess safety program implementation. Additionally, because no checklist is all inclusive, safety professionals must utilize applicable safety laws, statutes, codes, and regulations to assist the command and leaders in implementing an effective and compliant safety program.

1-2. References
Required and related publications are listed in appendix A.

1-3. Explanation of abbreviations and terms
Abbreviations and special terms used in this pamphlet are explained in the glossary.

Chapter 2
Safety Program Overview

2-1. Standard
The TRADOC Model Safety Program is based on the legal and regulatory requirements of the Occupational Safety and Health Act of 1970, Department of Defense Instruction (DODI) 6055.1, AR 385-10, applicable laws, statues, and codes as implemented by TRADOC Regulation 385-2. Public law, executive orders, DODIs, and Army regulations direct actions to furnish employees with places and conditions of employment that are free from recognized hazards causing, or likely to cause, death or serious physical harm; and apply composite risk management (CRM) strategies to eliminate accidents, death, and occupational illnesses. Commanders at all levels should provide employees with places and conditions of employment that are free from recognized hazards likely to cause death or serious physical harm, and establish procedures to ensure employees are not subjected to restraint, interference, coercion, discrimination, or reprisal for filing a report of an unsafe or unhealthful working condition. An effective program is:

a. Comprehensive in application, built around and addresses all core functions and enduring missions of the Army and TRADOC.

b. Adequately resourced, staffed, and funded to support the Army and TRADOC mission. Ensure leaders, supervisors, managers, and individuals are empowered with the requisite training, authority, information, and resources to execute their duties safely. Focus safety on all areas of risk by employing sound CRM practices.

c. Universal in scope, providing effective support to current operations, yet remaining sufficiently flexible to support future operations. Not a static program, the safety program is tailored to the existing operational environment and updated as required by accident experience and lessons learned.

2-2. Safety program success
The ability to implement, manage, and measure an effective safety program, and the ultimate success of the model program depend on three enduring threads of continuity:

a. Ownership. Personal involvement of commanders, leaders, and supervisors at each level of command/organization sets the focus and direction of safety program and accident prevention efforts. It empowers Soldiers and workers with the authority to implement the safety mission.

b. Oversight. A qualified safety manager (as defined in AR 385-10 and the Office of Personnel Management standards), with direct and unimpeded access to the commander, is essential. This ensures commanders maintain a situational awareness of the effectiveness of CRM implementation and safety program effectiveness, and reinforces the credibility of the safety manager in dealing with other staff elements.

c. Standards. The safety program document sets the standard for each individual safety program and sub-elements of that program. A written safety program document clearly defines the commander’s intent, fixes responsibility and accountability, and formally defines requirements for acceptable performance.

Chapter 3
Safety Program Elements

3-1. Composite risk management (CRM)

a. CRM is the Army’s primary decisionmaking process for identifying hazards and controlling risks across the full spectrum of Army missions, functions, operations, and activities. A CRM based safety program puts into place a systematic, disciplined, management process that focuses on priorities so that the mission is accomplished without unnecessary risk. CRM:

(1) Fosters initiative and further freedom of action by defining risk parameters within which an operation must remain, rather than imposing unnecessary restrictions or limitations on leaders.

(2) Creates an operational climate that promotes mission accomplishment with minimal risk.

(3) Is dependent upon two critical elements for effectiveness:

(a) First, leaders must understand the decisionmaking process of CRM.

(b) Second, there must be a system in place to effectively deal with changes in mission or activity risk levels due to changes in circumstances or conditions.

b. Commanders/commandants must ensure CRM is institutionalized in all school products, training courses, and combat training center programs. Service school graduates must be trained and proficient in assessing and managing risk in both training and operational environments. A CRM structure and control system must also be in place to ensure on the ground leadership presence at the appropriate level for all high and moderate risk training. Leaders must also clearly define risk decision authority to include the role/responsibility in the approval process for executing high and moderate risk training, ensure the conduct of initial and periodic on the ground review or “lane proofing” of all recurring training activities, provide clear guidance on where risk decision authority lies, and where possible, get risk decisions ahead of time where risk is known and understood. Risk decision authority must be clearly understood and enacted. The primary tenets of effective CRM are that commanders accept no risk unless the potential benefit outweighs the potential loss and that risk decisions are made at the appropriate level. Appropriate risk decision authority (residual risk) in accordance with TRADOC Regulation 385-2 follows:

(1) Extremely high risk: Senior commander of general officer grade.

(2) High risk: Colonel or equivalent grade, as designated by the senior commander.

(3) Moderate risk: Lieutenant colonel or equivalent grade, and command sergeants major serving as noncommissioned officer (NCO) academy or command sergeants major academy commandants, as designated by the senior commander.

(4) Low risk: As designated by the senior commander.

c. Commanders should establish and publish a CRM standard that incorporates this guidance and designates risk decision authority consistent with TRADOC criteria. Risk decisions are based on the residual risk of an activity, after application of appropriate control measures. They are briefed one level up the chain of command from the decisionmaker.

3-2. Inspections, assessments, and evaluations

Safety assessments and evaluations are important tools in effectively identifying hazards and controlling risk and provide a safe and healthful workplace. Safety assessments may be the result of an unusual occurrence or an out of the ordinary planned activity. In all cases, inspections, assessments, and evaluations are oriented toward the identification of hazards or measuring the effectiveness of accident prevention efforts, not the effectiveness of the command or leadership. An aggressive safety and occupational health inspection program ensures that all workplaces are inspected on an annual basis. See paragraph 4-1b for implementation and use of inspections.

3-3. Hazard abatement

Law and regulation direct that hazards be eliminated on a worst first basis. To ensure that the worst hazards are corrected first, coordinate the listing of all safety and occupational related hazards with the Garrison Safety Office for integration into a single garrison hazards abatement log maintained by the garrison safety manager. Hazards may be identified by a variety of means, such as inspections, accidents, routine maintenance and repair operation, or requests (work orders/job orders, customer reports, etc.) for repair or replacement of material or facilities. To ensure all hazards are correctly assessed and included in the garrison hazard abatement log, ensure the garrison safety manager reviews and validates all work orders, job orders, or requisitions that have a safety or occupational health connection. Once a violation or hazard is identified, the safety manager or a qualified safety professional must ensure it is risk assessed in terms of hazards severity and accident probability. This assessment is expressed in terms of a risk assessment code (RAC) which identifies the relative seriousness of the hazard. Prepare a garrison abatement plan for each RAC 1 or 2 hazard when the correction exceeds 30 days.

3-4. Accident reporting, investigation, and analysis

Accident investigations and careful analysis of accident information provides the safety manager with the means to identify potential sources of future accidents and to develop and implement countermeasures. Ensure the command accident prevention program also supports the Garrison Civilian Personnel Office’s effort to reduce injuries and occupational illnesses. In addition to the accident reports Department of the Army (DA) Pam 385-40 requires near-miss information is important in identifying hazards before they can result in serious damage or injury. Trained additional duty safety officers (ADSO) or collateral duty safety officers (CDSOs), and first-line supervisors are the best sources for this information. Other important sources of accident information are military police blotter reports, hospital admission and discharge sheets, sick call slips, and estimated cost of damage reports from the General Services Administration and unit motor pools. When collected, organized, and analyzed, this information may yield valuable data on potential problems or hazards, education/training shortfalls, motivation or leadership issues, procedural or standard inadequacies, or other potential problem areas. These potential problems, hazards, or shortfalls may often go unnoticed or undetected, because individual units and organizations view them as isolated instances. A successful accident prevention program will be one in which accident data and statistics are used strictly for accident prevention purposes, not to attempt to document command or leadership effectiveness.

3-5. Education, training, and safety awareness
The prevention of accidents and the associated mission impact and loss of resources is the responsibility of every member of the Army team. Law and regulation require training for all Army personnel, Soldiers and civilians, commensurate with their duties and responsibilities. The most effective accident prevention program recognizes this and sustains an extensive, ongoing program of safety training to educate, motivate, and raise safety awareness. Commanders, leaders, and supervisors at all levels, as well as individual Soldiers and civilian employees, are important in the accident prevention process. The effectiveness of their contributions, however, depends on their knowledge and understanding of safety and CRM and their responsibility in the Army Safety Program.

3-6. Branch safety/CRM integration
Integration of safety and CRM into Army doctrine, organizations, training, materiel, leadership and education, personnel, and facilities is inherent in the worldwide branch safety mission. Unlike safety managers within other Army commands, TRADOC safety managers have worldwide branch safety mission responsibility. In addition to the safety and CRM integration mission, branch safety managers monitor the operations, training, equipment, and tactics, techniques, and procedures within their specific branch. For this reason, TRADOC standards dictate that the qualified command safety and occupational health manager is rated by, and reports directly to the senior commander, school commandant, or respective chief of staff.

3-7. Additional/Collateral duty safety program
The trained ADSO/CDSO is essential to the safety manager’s ability to reach all levels of command, gather accident prevention information, identify hazards, and meet legal and regulatory requirements. Additional/collateral duty safety personnel may conduct inspections of low risk workplaces, but only when they are trained to identify hazards and recommend appropriate abatement action. A good safety program provides training in addition to the online ADSO/CDSO course, so that trained safety professionals are free to devote their time and energy to dealing with the more serious safety issues that require extensive technical expertise. ADSO/CDSOs collect accident reports for their activities or units. They are the local commander’s safety representative and an important source of information at the grass root level in gauging the effectiveness of the commander’s safety program.

3-8. Safety and Occupational Health Advisory Council (SOHAC)
An active SOHAC, chaired by the commander/commandant/chief of staff, meeting regularly, and composed of military and civilian management and operating personnel membership, is necessary for the effective interchange of safety and occupational health information. Participation of the commander/commandant/chief of staff demonstrates command support and sets the tone for the safety/accident prevention program. Command visibility and active participation in the safety council sends a powerful message to subordinate commanders and staff on the importance of safety.

3-9. Emergency action plans
Preplanned, coordinated, and regularly tested emergency action, disaster preparedness, and pre-accident plans are proven methods to minimize loss of life and property damage due to natural or man-made disasters. Commanders/commandants should coordinate and integrate their needs into garrison emergency action, disaster preparedness, and pre-accident plans as appropriate to their mission. Safety managers should develop, coordinate, publish, and test pre-accident plans for both ground and aviation accidents and assist the garrison in development, coordination, and maintenance of emergency action and disaster preparedness plans.

3-10. Initial military training (IMT)
The safety and well-being of Soldiers during their IMT is critical to the success of the TRADOC training mission. Soldiers arriving at Army reception battalions come from many differing backgrounds and in differing levels of physical condition. Similarly, cadets and newly-appointed officers also exhibit some of that diversity. Consequently, some may be at a greater risk of injury/illness. Safety directors with an IMT mission should develop and implement an aggressive accident prevention strategy to provide these Soldiers a training environment that facilitates their transition from civilian to military life.

3-11. Motor vehicle accident prevention
An enduring threat and a serious problem to TRADOC and the Army is the tragic loss of Soldiers and civilian workers in vehicle accidents. Privately owned vehicle (POV) accidents continue as the single leading cause of accidental death for our Soldiers, civilians, and their Family members. This needless loss of life demands actions. Commands with aggressive motor vehicle accident prevention strategies and programs enjoy greater success at reducing the incidence of motor vehicles and POV accidents than those commands that do not. All successful motor vehicle and POV accident prevention programs start with active command involvement. Other program elements common to an effective POV prevention programs include driver/rider training initiatives, a functioning POV task force, motorcycle mentorship, and the involvement of the first-line leaders. Leaders must make every effort to use other available tools to combat the rising incidence of vehicular accidents.

Chapter 4
Self-Assessment Guide

4-1. Implementation and use

a. Safety assessments and evaluations are important tools to effectively identify hazards and control risk. Orient inspections, assessments, and evaluations on identification of hazards or assessment of the effectiveness of accident prevention efforts, not the effectiveness of the command or leadership.

b. An aggressive safety and occupational health inspection program ensures that all workplaces are inspected on an annual basis. Facilities or operations involving special hazards may be inspected more frequently. Qualified safety and occupational health professionals should conduct inspections and provide written reports of violations to the head of the activity or the commander of the unit/organization inspected. The self-assessment guide and associated checklists in appendix B provide commanders and safety managers an effective tool to document the scope and effectiveness of their safety and accident prevention efforts.

4-2. Standards/documentation

Documentation of program elements serves as an indication of program effectiveness. Documentation such as local policies, regulations, or standing operating procedures (SOPs); however, do not in themselves ensure program implementation. Ensure documentation is relevant, current, and in accordance with the appropriate standards. Make sure users are familiar with their existence and content; and the standards are applied to the relevant events or operations.

4-3. Application

The self-assessment guide (see appendix B) and conditioning/obstacle course criteria (see appendix C) consist of a series of checklists that provide a systematic, standardized means to evaluate/assess the compliance of program elements with directives, legal standards, and regulations. Each provides the user the appropriate reference for the requirement, as well as a recommended documentation to assess implementation. The self-assessment guide is not all inclusive of every safety requirement required by public law, statute, and regulation. Therefore, research applicable public law, statute, and regulation that pertain to your command and situation.

Appendix A
References

Section I
Required Publications

AR 25-400-2
The Army Records Information Management System (ARIMS)

AR 40-5
Preventive Medicine

AR 95-1
Flight Regulations

AR 350-1
Army Training and Leader Development

AR 385-10
The Army Safety Program

AR 385-63
Range Safety

AR 420-1
Army Facilities Management

AR 500-3
U.S. Army Continuity of Operations Program Policy and Planning

AR 600-55
The Army Driver and Operator Standardization Program (Selection, Training, Testing, and Licensing)

DA Pam 385-10
Army Safety Program

DA Pam 385-16
System Safety Management Guide
DA Pam 385-24
The Army Radiation Safety Program

DA Pam 385-30
Mishap Risk Management

DA Pam 385-40
Army Accident Investigation and Reporting

DA Pam 385-61
Toxic Chemical Agent Safety Standards

DA Pam 385-63
Range Safety

DA Pam 385-64
Ammunition and Explosives Safety Standards

DA Pam 385-65
Explosive and Chemical Site Plan Development and Submission

DA Pam 385-90

Army Aviation Accident Prevention

DA Pam 420-10
Space Management Guide

Department of Defense Directive 5000.1
The Defense Acquisition Team

Department of Defense Directive 6055.9E
Department of Defense (DOD) Explosives Safety Management and DOD Explosives Safety Board

DODI 6055.1
DOD Safety and Occupational Health (SOH) Program

DODI 6055.04
DOD Traffic Safety Program

FM 3-25.150
Combatives

FM 5-19
Composite Risk Management

FM 6-0
Mission Command: Command and Control of Army Forces

FM 21-10
Field Hygiene and Sanitation

TB MED 530
Food Service Sanitation

Title 29 Code of Federal Regulations (CFR) 1200

Title 23 CFR 1230
Uniform Procedures for State Highway Safety Programs

Title 29 CFR 1910
Occupational Safety and Health Standards

Title 29 CFR 1926
Construction Standards

Title 29 CFR 1960
Basic Program Elements for Federal Employees Occupational Safety and Health Administration

TRADOC Regulation 350-6
Enlisted Initial Entry Training Policies and Administration

TRADOC Regulation 350-16
Drill Sergeant Program

TRADOC Regulation 350-29
Prevention of Heat and Cold Casualties

TRADOC Regulation 350-70
Systems Approach to Training Management, Process, and Procedures

TRADOC Regulation 385-2
U.S. Army Training and Doctrine Command Safety Program

TC 3-22.20
Army Physical Readiness Training

TC 21-24
Rappelling

"Operational and Training Facilities" Corps of Engineers Drawing Number DEF 028-13-95

National Fire Protection Association 72

Section II
Related Publications

AR 15-6
Procedures for Investigating Officers and Boards of Officers

AR 50-6
Chemical Surety

AR 70-1
Army Acquisition Policy

AR 75-1
Malfunctions Involving Ammunition and Explosives

AR 200-1
Environmental Protection and Enhancement

AR 215-1
Military Morale, Welfare, and Recreation Programs and Nonappropriated Fund Instrumentalities

AR 335-15
Management Information Control System

AR 350-90
The Army Sustainable Range Program

AR 600-8-22
Military Awards

AR 672-20
Incentive Awards

AR 690-950
Career Management

AR 700-141
Hazardous Materials Information Resource System

AR 870-20
Army Museums, Historical Artifacts, and Art

DA Pam 385-40
Army Accident Investigation and Reporting

DODI 4500.9-R, part II
Defense Transportation Regulation (Cargo Movement)

DODI 6050.05
DOD Hazard Communication Program

DODI 6055.06
DOD Fire and Emergency Services Program

DODI 6055.07
Accident Investigation, Reporting and Recordkeeping

DODI 6055.08
Occupational Ionizing Radiation Protection Program

DODI 6055.09-M
DOD Ammunition and Explosives Safety Manual

DODI 6055.11
Protecting Personnel from Electromagnetic Fields

DODI 6055.12
Hearing Conservation Program

DODI 6055.15
DOD Laser Protection Program

FM 3-0
Operations

FM 10-67-1
Concepts and Equipment of Petroleum Operations

TB MED 575
Swimming Pools and Bathing Facilities

TC 5-210
Military Float Bridging Equipment

TC 3-22.20
Army Physical Readiness Training

TC 21-21
Water Survival Training

TC 21-305
Training Program for Wheeled Vehicle Accident Avoidance

Title 10 CFR 19
Notices, Instructions, and Reports to Workers: Inspection and Investigations

Title 10 CFR 20
Standards for Protection Against Radiation

Title 29 CFR 1926.59
Hazard Communication

Title 33 CFR 183
Boats and Associated Equipment

Section III
Prescribed Form

This section contains no entries.

Section IV
Referenced Forms

DA Form 1045
Army Ideas for Excellence Program (AIEP) Proposal

DA Form 2028
Recommended Changes to Publication and Blank Forms

DA Form 2609
Historical Property Catalog

DA Form 2696
Operational Hazard Reports

DA Form 4754
Violation Inventory Log

DA Form 4755
Report of Alleged Unsafe or Unhealthful Working Conditions

DA Form 5752-R
Rope Log (Usage and History)

DA Form 7306
Worksheet for Telephonic Notification of Ground Accident

Occupational Safety and Health Administration Form 300
Work-Related Injuries and Illnesses

Standard Form 91
Motor Vehicle Accident Report

Appendix B
Self-Assessment Guide

B-1. Program management
Program management is a core element of the TRADOC safety program. Program management requirements apply to all TRADOC operations and activities in accordance with AR 385-10, and applicable laws, statutes, codes, and regulations. The self-assessment checklist for program management appears in table B-1.

Table B-1 Program management

	Program Management	YES	NO	Remarks
1	Has commander/commandant established a SOH to protect personnel, equipment, and facilities that is emphasized, resourced, and ensures a vital organization-wide safety program that includes:			
	(1) General safety requirements (Required)			
	(2) Strategic Planning, Army Safety Program Structure, Safety Program Evaluation, Councils, and Committees (Required)			
	(3) Accident investigation and reporting (Required)			
	(4) Contracting safety (Required)			
	(5) Explosives/Range safety management (Mission dictated)			
	(6) Public, family, off-duty recreation and seasonal safety (Required)			
	(7) Radiation safety management (Mission dictated)			
	(8) Safety awards program (Required)			
	(9) System safety management (Mission dictated)			
	(10) Training requirements (Required)			
	(11) Motor vehicle accident prevention (Required)			
	(12) Force Mobilization (Mission dictated)			
	(13) Tactical safety (Mission dictated)			
	(14) Safe cargo operations (Required)			
	(15) Aviation safety management (Mission dictated)			
	(16) Occupational safety and health program (Required)			
	(17) Workplace inspections (Required)			
	(18) Industrial Operational Safety (Required)			

	Program Management continued	YES	NO	Remarks
	(19) Emergency Planning and Response (Required)			
	(20) Biological Defense Safety (Mission dictated)			
	(21) Chemical Agent Safety Management (Mission dictated)			
	(22) Marine activities (Required)			
	(23) Medical Safety (Mission dictated)			
	(24) Facility Reuse and Closure (Required)			
	Standard: AR 385-10, paragraph 1-4m(9), Table 1-1			
	Documentation: Safety regulation, SOPs, memorandums, and training records.			
2	Does the commander/commandant have a single source safety and occupational health regulation/program document that prescribes policy, responsibilities, and key safety and occupational health principles?			
	Standard: AR 385-10, paragraph 1-1, 1-5a-d, 1-6, 1-9.			
	Documentation: Command safety regulation, SOP, memorandums, and training records.			
3	Has the commander/commandant established strategic goals, metrics and plans required to achieve those goals that are addressed as a section in the Safety and Occupational Health (SOH) regulation/program document, with annual organizational accident prevention goals and objectives that incorporates TRADOC's annual goals and objectives?			
	Standard: AR 385-10, paragraph 2-1; DA Pam 385-10, paragraph 2-1.			
	Documentation: Goals and strategic plan on hand and implemented.			

	Program management continued	**YES**	**NO**	**Remarks**
4	Is the command safety office/organization funded and fully resourced to execute all responsibilities and functions designated in respective safety regulation to assure safety program effectiveness?			
	Standard: AR 385-10, paragraph 2-6c.			
	Documentation: Budget/Table of distribution & allowances (TDA)			
5	Is the command structured and staffed to administer a safety and occupational health program through the chain of command that is based upon the organization's mission, goals, and objectives as well as statutory requirements?			
	Standard: AR 385-10, paragraphs 2-5a and 2-6a, 2-6b and DA Pam 385-10, paragraph 3-3.			
	Documentation: (TDA)			
6	Does the safety manager develop policy and procedures for the integration of safety and occupational health, CRM, and accident prevention activities of the command?			
	Standard: DA Pam 385-10, paragraph 3-2c(4).			
	Documentation: Policies, SOP, and regulation.			
7	Has commander/commandant co-located mission and garrison safety resources into a single safety organization reporting to the senior commander?			
	Standard: TRADOC Regulation 385-2, paragraph 1-4e(3).			
	Documentation: Regulation, SOP, policy, organizational diagram, and TDA.			

	Program management continued	**YES**	**NO**	**Remarks**
8	Is the safety manager a member of the commander's/ commandant's special staff reporting directly to the commander or the chief of staff?			
	Standard: AR 385-10, paragraph 2-7e.			
	Documentation: Organizational chart/rating chart.			
9	Does the safety director/manager meet the U.S. Office of Personnel Management (OPM) standards for the positions of Occupational Safety and Health, GS 0018/0803?			
	Standard: AR 385-10, paragraph 2-7e.			
	Documentation: Review safety manager/director's job description.			
10	Is the safety and occupational health office staffed with professional safety personnel meeting the requirements for these positions established by OPM?			
	Standard: AR 385-10, paragraph 2-7f, TRADOC Regulation 385-2, paragraph 1-4f(4).			
	Documentation: Review position descriptions.			
11	Are safety professionals receiving adequate training to perform their duties in accordance with 29 CFR 1960?			
	Standard: AR 385-10, paragraph 10-4, 29 CFR 1960.			
	Documentation: Individual development plans and training records.			
12	Does the safety manager assist all elements of the command in the implementation of the strategic safety plan?			
	Standard: DA Pam 385-10, paragraph 3-2c(2).			
	Documentation: Published strategic safety plan.			

	Program management continued	YES	NO	Remarks
13	Are command procedures published to implement effective public, family, sports, and off-duty recreation safety programs; identify responsibilities for all subordinate organizations and installations?			
	Standard: AR 385-10, chapter 6; DA Pam 385-10, chapter 5.			
	Documentation: Safety documentation (i.e., regulation, standard memorandum, etc.)			
14	Has the commander/commandant established, resourced, and implemented a safety program for water recreational activities to include boating (lifeguards present)?			
	Standard: AR 385-10, paragraphs 6-6 and 6-7; TRADOC Regulation 385-2, paragraph 9-2a(4).			
	Documentation: Regulation, SOPs, lesson plans, and attendance records.			
15	Does the commander/commandant develop and implement procedures to ensure Soldiers have applied CRM to their leave, pass, temporary duty, or permanent change of station travel plans, which involve driving out of the local area, as determined by the commander.			
	Standard: AR 385-10, paragraphs 6-3a; 6-3a(1).			
	Documentation: Copy of Travel Risk Planning System (TRiPS), risk assessments, counseling or regulation, policy memorandums, and SOP.			

	Program management continued	YES	NO	Remarks
16	Does the commander/commandant develop and administer promotional programs and procedures to increase awareness of the specific hazards associated with the change of seasons and celebration of holidays?			
	Standard: AR 385-10, paragraph 6-4.			
	Documentation: Promotional items on hand, safety memorandums, advertisements; i.e., safety shows, training documentation.			
17	Does the safety office review command sponsored safety requirements for sporting events?			
	Standard: AR 385-10, paragraph 6-11.			
	Documentation: Sporting safety information documents. Submission of safety requirements to installation safety.			
18	Has a SOHAC or Soldier and Army Civilian Employee Safety Committee been established that meets at least semiannually?			
	Standard: AR 385-10, paragraph 2-24, TRADOC Regulation 385-2, paragraph 1-8.			
	Documentation: Signed minutes and attendance roster from council.			

	Program management (continued)	**YES**	**NO**	**Remarks**
19	Do subordinate units not staffed with safety professionals appoint additional/collateral duty safety personnel by written orders?			
	Standard: AR 385-10, paragraph 2-7g.			
	Documentation: Audit, inspections, evaluation reports, or copies of current additional duty orders.			
20	Does safety office provide additional training to additional duty safety officers ADSOs and CDSOs?			
	Standard: AR 385-10, paragraph 10-8(b).			
	Documentation: Lessons plans, attendance rosters, certificate of completion of training.			
21	Does the command ensure that ADSOs/CDSOs are: Appointed by commander on written orders. Are commissioned officers at battalion and higher unit levels in the rank of staff sergeant or higher at the company level with 1 year or more retainability in the unit at appointed? Report directly to commander safety related matters. Coordinate activities with safety office.			
	Standard: AR 385-10, paragraph 2-7g.			
	Documentation: Review ADSO/CDSO roster and orders.			
22	Has the commander/commandant established accountability for safety and occupational health through the performance evaluation system and performance counseling sessions?			
	Standard: AR 385-10, paragraph 1-5c(5).			
	Documentation: Policy, memorandums, regulation, SOPs.			

	Program management (continued)	YES	NO	Remarks
23	Is the safety office represented on the Emergency Planning Team/Crisis Action Team/Continuity of Operations Program?			
	Standard: DA Pam 385-10, paragraph 10-4a; AR 500-3.			
	Documentation: Attendance roster and minutes from Emergency Planning Team meetings.			
24	Have formal agreements been developed with tenant or other organizations as necessary?			
	Standard: AR 385-10, paragraph 2-5a(3); TRADOC Regulation 385-2, paragraph 1-6a.			
	Documentation: Memorandum of agreement.			
25	Have battalion commanders registered in the web-based Army Readiness Assessment Program within 90 days of assuming command?			
	Standard: TRADOC Regulation 385-2, paragraph 1-4(f)(15).			
	Documentation: TRADOC Army Readiness Assessment Program Report, tracking database, documentation of completion.			
26	Have battalion commanders conducted a follow-up Army Readiness Assessment Program assessment at mid-tour or 12 months in command, to evaluate unit progress against initial results?			
	Standard: TRADOC Regulation 385-2, paragraph 1-4(f)(15).			
	Documentation: TRADOC Army Readiness Assessment Program Report, tracking database, documentation of completion.			

	Program management (continued)	**YES**	**NO**	**Remarks**
27	Is safety integrated into the contracting process? Are contracts in accordance with the requirements and reviewed by safety office?			
	Standard: AR 385-10, chapter 4.			
	Documentation: Copies of contracts.			
28	Does contracting officer representative monitor contractor(s) safety and training program?			
	Standard: AR 385-10, paragraph 4-4			
	Documentation: Written record of meetings with contracting officer representative and contractors.			
29	Mobilization (as required) have leaders at all levels established a command climate that promotes safety and health during pre and post mobilization/integration?			
	Standard: AR 385-10, chapter 12.			
	Documentation: Command policy.			
30	Are cargo operations conducted safely IAW public law, statutes, and regulation?			
	Reference: AR 385-10, chapter 14.			
	Documentation: SOP, risk assessments on hand.			

	Program Management (continued)	**YES**	**NO**	**Remarks**
31	Does safety director ensure the implementation of industrial safety requirements?			
	Reference: AR 385-10, DA Pam 385-10, TRADOC Regulation 385-2, paragraph 13-3.			
	Documentation: Safety inspection of operation on file.			
32	Installation safety director ensures public, family, off-duty recreation, and seasonal safety programs are implemented.			
	Reference: AR 385-10, TRADOC Regulation 385-2, paragraph 13-5.			
	Documentation: Written public, family, off-duty, recreational, and seasonal safety policy, SOP, regulation on hand.			
33	Does safety director with an individual mobilization mission oversee and monitor mobilization safety program IAW applicable regulations?			
	Reference: TRADOC Regulation 385-2, paragraph 13-6.			
	Documentation: Individual mobilization training support package (TSP), SOP, regulation, or policy on hand.			

B-2. Education and training
Commanders and/or supervisors shall ensure that required safety education and training is scheduled, conducted, and documented that includes but not limited to: personal protective equipment; general safety requirements particular to the operation; CRM mitigation techniques and controls; special safety requirements; lessons learned from previous operations; procedures for reporting and responding to accidents; identification of all known and perceived accidents. See table B-2 for the self-assessment checklist for education and training.

Table B-2 Education and training

		YES	NO	Remarks
1	Are leaders provided specialized training to enable them to execute their safety and occupational health and CRM leadership responsibilities properly?			
	Standard: AR 385-10, paragraph 10-5.			
	Documentation: Training requirements, lesson plans, and attendance rosters.			
2	Have leaders and managers integrated CRM into all Army processes and operations?			
	Standard: AR 385-10, paragraph 10-3(a) TRADOC Composite Risk Management Integration Plan.			
	Documentation: Review SOPs, policies, regulation, lesson plans, and operation orders.			
3	Does the safety office monitor the command to ensure all Army personnel are provided CRM training in areas needed for a safe and efficient execution of their tasks?			
	Standard: AR 385-10, paragraph 10-2.			
	Documentation: Inspection reports that document CRM training for instructors, cadre, training developers, combat developers, and drill sergeants, etc.			

	Education and training (continued)	YES	NO	Remarks
4	Does safety office conduct evaluations to ensure that personnel receive adequate training to perform their duties in accordance with 29 CFR 1960?			
	Standard: 29 CFR 1960; AR 385-10, paragraph 10-4.			
	Documentation: Inspections and reports.			
5	Have commanders and other personnel required to complete the online Commander's Safety Course have documentation on hand?			
	Standard: AR 385-10, paragraph 10-6.			
	Documentation: Training records.			
6	Does command have a written Hazard Communication Program that is implemented and maintained at each level of activity and are workers receiving hazard communication training?			
	Standard: AR 385-10, paragraph 16-2d(2); DA Pam 385-10, paragraph 14-2.			
	Documentation: Written program, training records, lesson plans, and attendance rosters.			
7	Does commander/commandant representative evaluate subordinate commands to ensure safety policies and procedures are established to ensure employees are provided appropriate job training?			
	Standard: 29 CFR 1960; AR 385-10, paragraph 10-4.			
	Documentation: Lesson plans, attendance roster, and certificates of completion.			

	Education and training (continued)	**YES**	**NO**	**Remarks**
8	Does the command require supervisors to ensure employees have sufficient training, licensure, qualification, and experience prior to assignment to a particular job or activity?			
	Standard: AR 385-10, paragraph 18-7.			
	Documentation: Policy, SOP, and Organization Inspection Program checklist.			

B-3. Safety awards and promotion
Safety awards and promotion are an effective part of a safety program that enhance Army operations and improve safety and CRM awareness through recognition and promotion of individual and organizational accident prevention methods and successes. See table B-3 for the self-assessment checklist for promotion and awards.

Table B-3 Safety awards and promotions

		YES	NO	Remarks
1	Does the command publish holiday, seasonal, and special hazard safety alerts, messages, and bulletins to raise safety awareness during periods of increased risk, or alert the commander of special seasonal hazards?			
	Standard: AR 385-10, paragraph 6-4.			
	Documentation: Copy of safety messages, safety alerts, etc.			
2	Does the safety office budget, procure and issue promotional items?			
	Standard: AR 385-10 paragraph 10-9; TRADOC Regulation 385-2, paragraph 5-7.			
	Documentation: SOP, policy letters, and inventory of items on hand.			
3	Does commander have an active safety awards program?			
	Standard: AR 385-10, chapter 8; TRADOC Regulation 385-2, paragraph 5-2b(1).			
	Documentation: Program documentation, copies of awards.			
4	Do commanders at all levels promote and implement the Safety Awards Program?			
	Standard: AR 385-10, chapter 8; TRADOC Regulation 385-2, paragraph 5-3.			

	Documentation: Safety and occupational health council, staff meetings, e-mail, local papers, flyers, posters, etc.			

	Safety awards and promotions (continued)	**YES**	**NO**	**Remarks**
5	Does the safety office distribute educational and marketing information on the Army’s Safety Awards Program?			
	Standard: AR 385-10, paragraph 8-7; TRADOC Regulation 385-2, paragraph 5-7.			
	Documentation: Promotion and educational material.			
6	Does the safety office have an active unit safety certification program?			
	Standard: AR 385-10, paragraph 8-6.			
	Documentation: Unit safety certificates.			

B-4. Workplace safety, inspections, hazard analysis, and countermeasures development
Inspections measure adequacy and/or determine effectiveness of controls in achieving workplace safety. In TRADOC training areas, classrooms, and ranges may be the place of work. Safety managers collect, review, and analyze data from various sources to identify trends, systemic deficiencies, or profiles for use in establishing program initiatives and priorities. Safety managers develop countermeasures to correct deficiencies and/or eliminate or reduce hazards. The self-assessment checklist for workplace safety, inspections, hazard analysis, and countermeasures development is found at table B-4.

Table B-4 Workplace safety, inspections, hazards analysis, and countermeasures development

		YES	NO	Remarks
1	Has the safety director ensured that job hazard analysis has been conducted and level of risk identified for all workplaces that include industrial operations, safe cargo operations, training areas, and other applicable operations?			
	Standard: AR 385-10; chapters 1, 3-5, 7, 10, 13-18, 21, 22; DA Pam 385-10, paragraphs 8-2, 8-3, 8-5; DA Pam 385-30, paragraph 2-12.			
	Documentation: Written or electronic list indicating buildings, facilities, and operations with level of risks assigned.			
2	Are civilian and military operations conducted in accordance with requirements such as safe cargo, marine activities, radiation, and industrial operations, etc in order to provide a safe and healthful workplace?			
	Standard: AR 385-10, chapters 1, 3-5, 7, 10, 13-18, 21, and 22; DA Pam 385-10.			
	Documentation: Regulation, SOPs, TSPs, memorandum.			
3	Has commander/commandant developed and implemented a safety and occupational health inspection program audit that ensures each subordinate organization is evaluated at least every 12 to 18 months?			
	Standard: AR 385-10, paragraph 2-11.			

	Documentation: Inspection schedules and reports.			
	Workplace safety, inspections, hazards analysis, and countermeasures development (continued)	**YES**	**NO**	**Remarks**
4	Are barracks inspected at least annually by a qualified safety and health professional or competent specially trained personnel? Are dining facilities inspected at least semiannually by safety, fire department, and preventive medicine?			
	Standard: AR 385-10, paragraph 17-6a, g; AR 40-5, paragraph 1-7d(2); DA Pam 40-11, 5-20; TRADOC Regulation 350-6 L-2 a and b.			
	Documentation: Copies of inspection reports.			
5	Are qualified safety and occupational health professionals or specially trained competent personnel conducting the inspections?			
	Standard: AR 385-10, paragraph 17-6a.			
	Documentation: Training records.			
6	Is the safety office using performance indicators and matrices in executing their inspection program?			
	Standard: AR 385-10, paragraph 2-11c.			
	Documentation: Inspection reports and performance indicators.			
7	Does the safety office validate all RAC 1 or RAC 2 work orders/projects?			
	Standard: DA Pam 385-10, paragraph 8-5.			
	Documentation: Review hazard abatement plan and safety inspection reports.			

	Workplace safety, inspections, hazards analysis, and countermeasures development (continued)	**YES**	**NO**	**Remarks**
8	Does the safety office have a system established and implemented to ensure corrective action is completed in a timely manner?			
	Standard: DA Pam 385-10, chapter 8.			
	Documentation: Copies of response indicating corrective action and verification.			
9	Is there a program or policy for reporting unsafe or unhealthful conditions?			
	Standard: AR 385-10, paragraph 17-9.			
	Documentation: Copies of DA Form 4755 (Report of Alleged Unsafe or Unhealthful Working Conditions).			
10	Does the commander/commandant have a policy in place requiring supervisors to develop an accident prevention and response plan for each activity under their direct control and administration?			
	Standard: AR 385-10, paragraph 18-6.			
	Documentation: SOP, policy, and regulations.			
11	Are facility fire alarms and smoke detectors installed, serviceable, and tested periodically?			
	Standard: National Fire Protection Association 72 – National Fire Alarm Code, and 29 CFR 1910.164 (b)(2), (c)(2).			
	Documentation: Inspect and test equipment.			

	Workplace safety, inspections, hazards analysis, and countermeasures development (continued)	**YES**	**NO**	**Remarks**
12	Are identified (safety or health-related) deficiencies corrected in a timely manner?			
	Standard: DA Pam 385-10, paragraphs 8-2, 8-5.			
	Documentation: Date of identification versus date of correction.			
13	Is personal protective equipment provided, used, and maintained in a sanitary and reliable condition?			
	Standard: DA Pam 385-10, paragraph 8-2, table C-3; 29 CFR 1910.132-138; 1910.147.			
	Documentation: Maintenance documentation available on personal protective equipment.			

B-5. Accident investigation, reporting, and analysis
Collection and analysis of accident/incident information is critical to the accident prevention process and takes place at several levels of command. The safety office is the command/activity focal point for review of accident investigations, collection and analysis of accident/incident information, and the development of timely and effective countermeasures. The self-assessment checklist at table B-5 is provided to assist in this effort.

Table B-5 Accident investigation, reporting, and analysis

		YES	**NO**	**Remarks**
1	Has the commander/commandant developed and established standards and procedures to implement the accident investigation program within their command?			
	Standard: AR 385-10, paragraph 1-4m(14).			
	Documentation: Command safety documentation (i.e., regulation, standard memorandum, etc.)			
2	Does commander/commandant develop metrics for rate of accident occurrence, severity and cost for recording and review with the commander as part of the commander's regular oversight process?			
	Standard: AR 385-10, paragraph 2-10.			
	Documentation: Accident trends and analysis.			
3	Does the commander/commandant review accident trends and analysis with subordinate commanders, directors, and managers and discuss resolutions to causation factors?			
	Standard: AR 385-10, paragraph 2-24.			
	Documentation: Copy of trends and analysis and minutes to command safety council.			

	Accident investigation, reporting, and analysis (continued)	**YES**	**NO**	**Remarks**
4	Has commander/commandant developed local training for accident reporting, investigation requirements, and analysis?			
	Standard: 29 CFR 1960; AR 385-10, paragraph 1-4m(6), 10-4.			
	Documentation: Training programs.			
5	Are all accidents reported, investigated, and analyzed?			
	Standard: AR 385-10, paragraph 3-2; TRADOC Regulation 385-2, 2-1(a).			
	Documentation: Check accident feeder reports against files.			
6	Is the safety office a member of the Federal Employees' Compensation Act working group?			
	Standard: TRADOC Regulation 385-2, paragraph 2-1b.			
	Documentation: Check meeting roster.			
7	Are fatality review boards and fatality after accident reviews completed?			
	Standard: TRADOC Regulation 385-2, paragraph 2-6b.			
	Documentation: Check submission dates of fatality after accident reviews.			

	Accident investigation, reporting, and analysis (continued)	**YES**	**NO**	**Remarks**
8	Does the safety office have a system for receiving feeder reports?			
	Standard: TRADOC Regulation 385-2, paragraph 2-7(a).			
	Documentation: Copy of feeder reports from military police blotters, traffic accident reports, serious incident reports, estimated cost of damage reports, admission and disposition sheets, Standard Form 91(s) Motor Vehicle Accident Report), staff judge advocate claims data, marine casualty reports, casualty reports, and emergency operation center reports.			
9	Does the safety office identify trends and problem areas to develop injury prevention countermeasures by disseminating command accident data?			
	Standard: TRADOC Regulation 385-2, paragraph 2-7b(3).			
	Documentation: Reports, briefs, or meeting minutes addressing accident analysis and trends.			
10	Does the safety office maintain Occupational Safety and Health Administration (OSHA) Form 300 (Work-Related Injuries and Illnesses) and post a copy of the OSHA Form 300-A?			
	Standard: 29 CFR 1904.7(b)(3); AR 385-10, paragraph 3-8b(3)(b); TRADOC Regulation 385-2, paragraph 2-7c.			
	Documentation: Copy of OSHA Form 300 or equivalent and copy of OSHA Form 300-A.			

	Accident investigation, reporting, and analysis (continued)	YES	NO	Remarks
11	Are all accidents/incidents in support of TRADOC's mission immediately reported on DA Form 7305-R (Worksheet for Telephonic Notification of Aviation Accident/Incident) or DA Form 7306-R (Worksheet for Telephonic Notification of Ground Accident) through appropriate channels to the TRADOC Safety Office?			
	Standard: TRADOC Regulation 385-2, paragraph 2-2(b).			
	Documentation: Reports on hand.			
12	Are all Class A and B on-duty accidents investigated by an accident investigation board?			
	Standard: AR 385-10, paragraph 3-14a; TRADOC Regulation 385-2, paragraph 2-5.			
	Documentation: Written accident investigation board results.			
13	Are accident findings and recommendations from the U.S. Army Combat Readiness Center/Safety Center (USACR/SC) concerning branch issues and systems resolved in a timely manner?			
	Standard: DA Pam 385-40, paragraph 4-3.			
	Documentation: Documentation of corrective action taken.			
14	Does the safety director provide the TRADOC Exposure Report on a quarterly basis to the TRADOC Safety Office? The completed report, reflecting the previous quarter's accident data, is due to the TRADOC Safety Office by 15 Jan, 15 Apr, 15 Jul, and 15 Oct.			
	Standard: TRADOC Regulation 385-2, paragraph 2-7(d).			
	Documentation: Documentation of completed TRADOC Exposure Reports.			

B-6. Branch and proponency
Integration of safety and CRM into doctrine, organizations, training, materiel, leadership, education, personnel, and facilities is inherent in the worldwide branch mission.

a. Per TRADOC standard, designate the qualified command safety and occupational health manager as the branch safety manager. The branch safety manager should work for, be rated by, and report directly to the commander, school commandant, or the respective chief of staff.

b. Combine TRADOC mission and branch safety assets into a mission/branch safety office and fund and staff in accordance with the appropriate manpower standards.

c. The safety office covers the full spectrum of occupational safety and health, systems safety, schoolhouse support, CRM integration, and worldwide branch safety proponency. The self-assessment checklist for branch safety is provided at table B-6.

Table B-6 Branch and proponency

		YES	NO	Remarks
1	Are accident findings and recommendations from the USACR/SC concerning branch issues and systems resolved in a timely manner?			
	Standard: DA Pam 385-40, paragraph 4-3.			
	Documentation: Documentation of corrective action taken.			
2	Is CRM integrated into school products, operations, branch systems/materiel and reviewed by the designated SOH officer and/or systems safety engineer?			
	Standard: TRADOC Regulation 385-2, paragraph 1-5.			
	Documentation: School products (for example, technical manuals, field manuals, TSPs, lesson plans, policy, and doctrine).			
3	Do the safety and occupational health specialist and/or systems safety engineer maintain a hazard tracking system to identify and track proponent system hazards?			
	Standard: TRADOC Regulation 385-2, paragraph 4-2b.			
	Documentation: Written or electronic lists of reported systems hazards.			

	Branch and Proponency (continued)	YES	NO	Remarks
4	Are all hazards controlled by procedures or training addressed in the training manual and technical manuals for those systems?			
	Standard: AR 385-10, paragraph 1-4p(3).			
	Documentation: Lesson plans, program of instructions, and technical manuals.			
5	Are instructors, cadre, training developers, combat developers and drill sergeants trained in the application of the CRM process? How was this training accomplished?			
	Standard: AR 385-10, chapter 10; TRADOC Regulation 350-70.			
	Documentation: Attendance rosters, certificates of completion.			
6	Is CRM applied to all training and approved at the appropriate level, and is a current copy of the risk assessment worksheet maintained at the training site?			
	Standard: AR 385-10, paragraph 10-1; TRADOC Regulation 350-6, paragraph 3-27.			
	Documentation: Observe training, review deliberate, and daily risk assessments.			
7	Have the requirements of DA Pam 385-30 been applied to the hazard assessment, prioritization, and correction processes?			
	Standard: AR 385-10, paragraph 17-4.			
	Documentation: Copy of hazard assessment and RAC assignments.			

	Branch and Proponency (continued)	YES	NO	Remarks
8	Does the school monitor the development of branch specific material and develop a position on materiel developer's system safety risk assessment for proponent materiel systems and materiel changes?			
	Standard: AR 385-10, paragraph 9-2; DA Pam 385-16, paragraph 2-6; TRADOC Regulation 385-2, paragraph 4-2b(1).			
	Documentation: Memorandum stating position.			
9	Is CRM techniques applied to eliminate or control hazards associated with proponent products/systems/materiel?			
	Standard: TRADOC Regulation 385-2, paragraph 1-5.			
	Documentation: Policy, technical manuals, field manuals, memorandums, and safety of use messages.			
10	Have school documents and training products such as TSPs, lesson plans, field manuals, technical manuals, reviewed by the designated safety and occupational health official.			
	Standard: TRADOC Regulation 385-2, paragraph 1-5f(1). TRADOC Regulation 350-6, paragraph 3-27a(2).			
	Documentation: Documents signed by safety and occupational health official.			
11	Are instructors, cadre, drill sergeants, supervisors, training developers trained in the application of the CRM process? How was this training accomplished?			
	Standard: TRADOC Regulation 385-2, paragraph 1-5.			
	Documentation: Attendance rosters, certificates of completion, and lesson plans.			

	Branch and Proponency (continued)	YES	NO	Remarks
12	Is CRM integrated into all technical and leader development training within the branch?			
	Standard: TRADOC Regulation 385-2, paragraph 1-5e.			
	Documentation: TSP, lesson plans, and training schedules.			
13	Is CRM conducted for all training and approved at the appropriate level, and is a current copy of the risk assessment worksheet maintained at the training site?			
	Standard: TRADOC Regulation 385-2, paragraph 1-5d(4).			
	Documentation: Observe training, review deliberate, and daily risk assessments.			
14	Are RACs assigned to each lesson plan and TSPs?			
	Standard: TRADOC Regulation 385-2, paragraph 1-5c.			
	Documentation: Risk assessment codes are assigned to lesson plans, TSPs.			

B-7. Initial Military Training(IMT)/military training, operations and tactical safety

a. The safety of the IMT Soldier is critical to the success of the TRADOC mission to provide the Army with military occupational specialty qualified Soldiers. Initial entry Soldiers are subject to stress and risk in the IMT environment because the living conditions, physical demands, and training tasks are unfamiliar and the Soldier is untried.

b. Close, consistent oversight and supervision by qualified drill sergeants, platoon sergeant, instructors, and cadre; responsive medical support; and living and training facilities free from known hazards are inherent requirements of the safety structure in place to protect the IMT Soldier. An effective mission-oriented safety program, together with regular, standardized evaluations of the IMT environment, effective training programs, and enforcement of training standards ensures a successful soldierization program that sets high standards, provides positive role models, and reinforces essential Soldier skills.

c. The safety and the use of CRM is paramount to the training Soldier due to the high-risk training events that may be in encountered in advance or specialty schools such as drill sergeant, airborne, and ranger. The use of CRM is a vital component to safely train Soldiers while ensuring that training is realistic.

d. The risk level associated with all military training within Army and TRADOC schools are based upon a predetermined number of qualified instructors, when the ratio of students to instructors changes, the risk assessment must be relooked to ensure that the level of risk for the training remains within acceptable limits. Use table B-6 as a guideline for self-assessment in these areas.

Table B-7 IMT/military training, operations and tactical safety

		YES	**NO**	**Remarks**
1	Does the safety office maintain a list of high-risk training? Do safety office personnel review training products for CRM integration?			
	Standard: TRADOC Regulation 385-2, paragraph 1-4h(5).			
	Documentation: School products (i.e., technical manuals, field manuals, TSPs, lesson plans, policy, doctrine, etc.). List of all high-risk training events/risk assessments for all high-risk training.			

	IMT/military training, operations and tactical safety (continued)	**YES**	**NO**	**Remarks**
2	Are there sufficient instructors/assistant instructors present to conduct training in accordance with the requirements of the subject TSPs?			
	Standard: TRADOC Regulation 350-6, paragraph 3-4(a).			
	Documentation: Copy of TSP and lesson plans.			
3	When the number of instructors and/or assistant instructors drops below the number specified in the TSP, is the risk assessment updated and approved at the appropriate level?			
	Standard: TRADOC Regulation 350-6, paragraph 3-4.			
	Documentation: Updated risk assessment.			
4	Are drill sergeant ratios maintained in accordance with TRADOC standards?			
	Standard: TRADOC Regulation 350-16, paragraph 2-14.			
	Documentation: Copies of company status report.			
5	Are drill sergeants assigned additional duties that divert them from their primary mission of training Soldiers?			
	Standard: TRADOC Regulation 350-16, paragraph 2-9a.			
	Documentation: Copies of additional duty appointment orders and or duty rosters for drill sergeant.			
6	Is a minimum of one certified combat lifesaver (CLS) drill sergeant or cadre member and one CLS aid bag present during training per platoon?			
	Standard: TRADOC Regulation 350-6, paragraph 3-32.			
	Documentation: Drill sergeant/cadre training records,			

	spot check CLS bags.			
	IMT/military training, operations and tactical safety (continued)	**YES**	**NO**	**Remarks**
7	Are CLSs equipped with the appropriate supplies available to provide the necessary first aid and emergency medical care?			
	Standard: TRADOC Regulation 350-6, paragraph 3-32.			
	Documentation: Spot check CLS bags.			
8	Does the commander/commandant address medical support requirements in the planning, preparation, and execution of all training activities?			
	Standard: TRADOC Regulation 350-6, Appendix H.			
	Documentation: Written plan, policy, regulation (the goal for Medical Support to Training is for injured personnel to be at an emergency medical support facility within 1 hour).			
9	Has the commander/commandant assessed and certified the adequacy of their medical support to training at least annually to ensure the capability of ground and air medical evacuation?			
	Documentation: CRM worksheet, memorandum.			
	Standard: TRADOC Regulation 350-6, paragraph 3-31c; TRADOC Regulation 385-2, paragraph 11-4b(3).			
10	Has the commander/commandant rehearsed their medical support plan (casualty response, evacuation, and treatment) for high-risk training at least semiannually, with focus on responding to a training catastrophe?			
	Standard: TRADOC Regulation 350-6, paragraph 3-31c; TRADOC Regulation 385-2, paragraph 11-4b(3).			
	Documentation: Copies of exercise after action reports.			

	IMT/military training, operations and tactical safety (continued)	YES	NO	Remarks
11	Are instructors and cadre qualified in the proper operation and training on the rappel tower, obstacle, confidence, bayonet, and pugil courses?			
	Standard: TRADOC Regulation 350-6, paragraph 3-1e.			
	Documentation: Copy of instructor certification.			
12	Are physical training structures inspected for structural integrity and maintained to standard?			
	Standard: Training Circular 21-24.			
	Documentation: Copy of structural inspection and visual spot check.			
13	Is CRM integrated into all technical and leader development training and operations throughout the professional military and civilian education programs?			
	Standard: AR 350-1, table G-2; TRADOC Regulation 385-2, paragraph 1-5.			
	Documentation: TSP, lesson plans, training schedules, etc.			
14	Is CRM applied to all training and approved at the appropriate level, and is a current copy of the risk assessment worksheet maintained at the training site?			
	Standard: TRADOC Regulation 350-6, paragraph 3-27; TRADOC Regulation 385-2, paragraph 1-5.			
	Documentation: Observe training, review deliberate, and daily risk assessments.			

	IMT/military training operations and tactical safety (continued)	**YES**	**NO**	**Remarks**
15	Does the risk assessment maintained at the training site reflect current conditions?			
	Standard: TRADOC Regulation 385-2, paragraph 1-5; TRADOC Regulation 350-70, chapter I-2.			
	Documentation: Copy of current risk assessment.			
16	Is there a lesson plan/TSP at ranges and training areas?			
	Standard: TRADOC Regulation 350-70.			
	Documentation: Copy of the lesson plan/TSP.			
17	Is there adequate billeting floor space per trainee (72 net square feet per Basic Combat Training (BCT)/One Station Unit Training Soldier (OSUT); 90 net square feet per Advance Individual Training (AIT) Soldier is the desired goal, unless the Advance Individual Training is located at an Army Training Center)?			
	Standard: TRADOC Regulation 350-6, paragraph 3-36a(4)a-e.			
	Documentation: Floor plans, visual inspection, etc.			
18	Has commander ensured that military personnel involved in training in or around water are swim tested and non-swimmers are identified?			
	Standard: TRADOC Regulation 385-2, paragraph 9-2a(1).			
	Documentation: Swim test results and SOP .			

	IMT/military training operations and tactical safety (continued)	YES	NO	Remarks
19	Does safety director provide staff oversight of the water program to include monitoring appropriate cadre/staff to ensure all instructors involved in teaching or overseeing training or operations in or around water receive training in water operations and hazards before teaching students?			
	Standard: AR 385-10, 13-8; DA Pam 385-10 chapter 12; TRADOC Regulation 385-2, paragraph 9-2 b(1)(2).			
	Documentation: Regulation, SOPs, audits, training schedules, and attendance rosters.			
20	Do commanders in the grade of O-6 and above approve deviations from SOP/TSP, and lesson plans for tactical water operations?			
	Standard: AR 385-10, paragraph 13-8.			
	Documentation: SOP, TSP, policy for deviation.			
21	Has commander/commandant established directives addressing specific safety procedures/requirements for all tactical water training or operations prior to conducting water operation?			
	Standard: AR 385-10 paragraphs 13-8, 22-1; TRADOC Regulation 385-2, paragraph 9-2a(3).			
	Documentation: Regulation, SOP, and memorandums.			
22	Are the following environmental hazard assessed using CRM process and appropriate methods taken to minimize risk? High altitude; disease vectors; contaminated food and water; poor air quality; heat; cold.			
	Standard: AR 385-10, paragraph 13-9.			
	Documentation: Regulation, SOP, memorandum, risk assessment.			

	IMT/military training operations and tactical safety (continued)	YES	NO	Remarks
23	Does commander enforce discipline in bivouac areas to minimize accidents and provide procedures for: Site selection; camouflage; field sanitation; generators; field mess operations; storage of flammables; fire extinguishers; grounding of equipment; restriction/control of motor vehicles?			
	Standard: AR 385-10, paragraph 13-10.			
	Documentation: TSP, SOP, regulation, risk assessment worksheet.			
24	Does commander ensure that all combative training is conducted by certified instructors of the appropriate level and adhere to the CRM process and instructional framework?			
	Standard: AR 350-1, paragraph 1-25d.			
	Documentation: TSP, lesson plan, SOP, instructors' certifications.			
25	Is the required protective equipment available, serviceable, and in the appropriate sizes to fit training Soldier?			
	Standard: TRADOC Regulation 350-6, Appendix K-6.			
	Documentation: Visually inspect protective equipment to ensure it is available in sizes appropriate to the needs of the training.			
26	Are only space heaters authorized by the U.S. Army Soldier Systems Center in use?			
	Standard: TRADOC Regulation 385-2, paragraph 11-3.			
	Documentation: Regulation SOP, memorandum, and observation.			

	IMT/military training operations and tactical safety (continued)	YES	NO	Remarks
27	Are traffic and column guards provided with serviceable reflective vests or belts?			
	Standard: TRADOC Regulation 385-2, paragraph 8-9.			
	Documentation: Observation.			
28	Is vehicle access to running routes controlled during physical training hours?			
	Standard: TRADOC Regulation 385-2, paragraph 8-7b.			
	Documentation: Observation.			
29	Do commanders/commandants have a severe weather/lightning protection plan prepared on hand for each field training site and/or range?			
	Standard: TRADOC Regulation 385-2, paragraph 11-6.			
	Documentation: Written plan on hand.			

B-8. Systems safety
System safety applies engineering and management principles, criteria, and techniques to achieve acceptable mishap risk, within the constraints of operational effectiveness, time, and cost, throughout all phases of the life cycle of systems or facilities. Commanders implement system safety engineering and management policies consistent with their missions. Apply and tailor system safety to all Army systems and facilities and integrate system safety into other manpower and personnel integration concerns. A systems safety checklist is provided at table B-8.

Table B-8 Systems Safety

		YES	NO	Remarks
1	Has the commander implemented a system safety engineering and management policy consistent with the proponent mission?			
	Standard: AR 385-10, paragraph 9-2; DA Pam 385-16 paragraphs 1-4, 5-1, 5-3 and 5-4; TRADOC Regulation 385-2, paragraph 4-2.			
	Documentation: Copy of system safety engineering and management policy and knowledge of policy at directorate and unit level.			
2.	Does the system safety engineer on the table of distribution and allowances meet the OPM standards for safety engineer GS-0803 series?			
	Standard: DA Pam 385-10, paragraph 3-2a(2), table 3-1.			
	Documentation: Review systems safety engineer job description.			
3	Is systems safety represented in all phases of combat developments?			
	Standard: AR 385-10, paragraph 9-8; DA Pam 385-16, paragraph 1-4a; TRADOC Regulation 385-2, paragraph 4-2b.			
	Documentation: Material requirement documents. Evidence of coordination with proponent Directorate of Combat Development.			

	Systems Safety (continued)	**YES**	**NO**	**Remarks**
4	Does safety office ensure safety of use message, ground precautionary messages, safety of flight, and aviation safety action messages to include safety releases, confirmations, and assessments are disseminated?			
	Standard: DA Pam 385-16.			
	Documentation: Copies of message are at unit level, combat developers, and/or proponent school for action.			
5	Does the safety office have a process to ensure a safety release is disseminated to the user prior to pretest troop training for local tests, experiments, appraisals, and demonstrations involving troops and Soldier support equipment?			
	Standard: TRADOC Regulation 385-2, paragraph 4-3d(2).			
	Documentation: Copy of safety release, SOP, written procedures, and policies.			
6	Are processes established to review and ensure that all residual hazards controlled by procedures or training are addressed in the training products and associated publications for those systems?			
	Standard: AR 385-10, paragraph 1-4p(3), 9-2a, 9-2j; DA Pam 385-16.			
	Documentation: Residual hazards addressed in program of instructions, lesson plans, and field manuals. Review or validation on hand.			
7	Does school/proponent/system safety review all modifications of mission profiles and capability documents for safety impact and are the results reported to the combat developer?			
	Standard: DA Pam 385-16.			

	Documentation: Policy on review of mission profile modifications and capability documents.			
	Systems safety (continued)	**YES**	**NO**	**Remarks**
8	Upon discovering an unsafe condition with a piece of Army equipment does the unit/school/branch, notify the proponent command of the system and the TRADOC Safety Systems Engineer?			
	Standard: DA Pam 385-16.			
	Documentation: Copy of notification to proponent. Systems engineer or representative has documentation.			
9	Does unit/school/proponent identify, through the accident reporting system, inadequacies contributing to an accident and analyze these inadequacies to ensure that safety compromising trends are identified?			
	Standard: DA Pam 385-16.			
	Documentation: Accident report equipment analysis, Safety of Use Message, Ground Precautionary Messages, etc.			
10	Does the commander/commandant ensure that equipment safety risks are accepted at a level of management authority commensurate with the risk in accordance with AR 70-1 and DA Pam 385-30?			
	Standard: AR 70-1, paragraph 1-5; AR 385-10, paragraph 9-2(i); DA Pam 385-30, paragraph 4-11g; TRADOC Regulation 385-2, paragraph 4-3.			
	Documentation: System Safety Risk Assessment for all risks exceeding the criteria for “low” risk.			
11	Are preliminary hazard lists developed to identify specific hazards during the concept phase for development of systems?			
	Standard: DA Pam 385-16.			

	Documentation: Copy of preliminary hazard lists for new systems under development.				

	Systems safety (continued)	**YES**	**NO**	**Remarks**
12	Do safety office personnel participate in Systems Safety Working Groups, if applicable?			
	Standard: TRADOC Regulation 385-1, paragraph 4-2; DA Pam 385-16.			
	Documentation: Written or electronic lists of reported systems hazards and attendance of systems safety working group.			

B-9. Range, explosive, and ammunition safety
The degree of success of the ammunition surveillance and explosives safety programs depends upon management visibility, organizational structure, and quality assurance specialist, ammunition surveillance (QASAS) personnel staffing to mitigate a hazardous situation. The ultimate goal is to ensure ammunition and explosives are safe and serviceable for storage, transportation, and use by Soldiers.

a. Commanders should ensure that the QASAS/explosives safety functions are staffed with sufficient qualified personnel to support the mission and to provide for daily ammunition surveillance and explosives safety operations as required by Army standards.

b. Commanders should ensure that QASAS personnel and safety specialists are provided required refresher training to keep up to date with the latest weapon and ammunition technology.

c. An effective range safety program will:

(1) Enhance safe, realistic, live-fire training.

(2) Prevents fratricide in live-fire training.

(3) Protect civilian and military populations who live and work in the vicinity of live-fire training ranges.

(4) Protect the environment from the effects of live-fire training.

d. Commanders will develop range safety regulations and/or SOPs, integrating appropriate CRM processes and procedures.

e. Qualified safety specialists should inspect all explosives and training complexes on a semiannual basis. High-risk training operations should be inspected more often as the risk dictates.

f. Report and investigate all incidents or accidents involving Arms, Ammunition and Explosives with firing units.

g. Commander should use the self-assessment checklist in table B-9 to ensure their program meets all applicable guidance.

Table B-9 Range, explosive, and ammunition safety

		YES	NO	Remarks
1	Has the commander/commandant established a Range Safety Program?			
	Standard: AR 385-63, paragraph 1-4p.			
	Documentation: Range safety program documents.			
2	Has the commander/commandant established an Explosive Safety Management Program?			
	Standard: AR 385-10, paragraph 5-1 and DA Pam 385-64, paragraph 1-5b.			
	Documentation: Explosive safety program documents.			
3	Has the commander/commandant established a Memorandum of Agreement (MOA) or policy that outlines the Explosive Safety Management Program requirements and responsibilities of both garrison and mission?			
	Standard: AR 385-10, paragraph 5-1 and DA Pam 385-64, paragraph 1-5c(1).			
	Documentation: Explosive safety program policy and MOA documents.			
4	Has the commander/commandant ensured the explosive/range safety staff is appropriate for the unit's mission and are they properly trained and qualified?			
	Standard: AR 385-10, paragraph 5-1 and DA Pam 385-64, paragraphs 1-5b, 1-5c.			
	Documentation: Unit Table of Distribution and Allowance and Assignment rosters, Training Records.			
5	Has the commander forwarded a copy of range deviations, Certificates of Risk Acceptance, and Certificates of Compelling Reason to HQ TRADOC Safety?			
	Standard: TRADOC Regulation 385-2, paragraph 6-3b.			

	Documentation: Range deviation log.			

	Range, explosive, and ammunition safety (continued)	**YES**	**NO**	**Remarks**
6	Are range deviations, Certificates of Risk Acceptance, and Certificate of Compelling Reasons current, complete, and approved at the appropriate level?			
	Standard: AR 385-63, paragraph 3-2; DA Pam 385-63, paragraph 1-5; DA Pam 385-64, paragraph 1-13, TRADOC Regulation 385-2, paragraph 6-3a.			
	Documentation: Copy of all range deviations, Certificates of Risk Acceptance and Certificate of Compelling Reasons.			
7	Does the safety office review all new TRADOC range/explosive facilities construction and are they coordinated thru garrison safety for site planning and to ensure that the installation master plan is annotated with Explosive Safety Management Program requirements?			
	Standard: AR 385-10, paragraph 5-5, DA Pam 386-64, paragraphs 1-6b(8), (12), (14), and 1-11, TRADOC Regulation 385-2, paragraph 6-2b(8),(9).			
	Documentation: Range safety SOP, copy of range waivers, and proof of safety office review of new range/explosive facilities construction.			
8	Are properly approved explosive safety site plans available and up-to-date for storage facilities?			
	Standard: DA Pam 385-64, chapter 4.			
	Documentation: Validate installation explosive safety site plans for accuracy.			
9	Is a process in place that ensures that the CRM process is applied to all training/operations prior to occupying range complex or explosive facilities?			
	Standard: AR 385-63, paragraph 2-7, AR 385-10, paragraph 5-3.			

	Documentation: Standard, SOP, or risk assessment.			

	Range, explosive, and ammunition safety (continued)	**YES**	**NO**	**Remarks**
10	Are commanders complying with installation special use airspace requirements for live-fire training?			
	Standard: AR 385-63.			
	Documentation: Range regulations/SOP.			
11	Are new baffled firing ranges approved by the appropriate command?			
	Standard: AR 385-63, paragraph 2-2c.			
	Documentation: Approval letter.			
12	Does the commander/commandant have a process for approving “burst offset” firing techniques?			
	Standard: DA Pam 385-63, paragraph 5-2b.			
	Documentation: Approval process for “burst offset” firing techniques.			
13	Has commander/commandant established procedures for the approval of nonstandard ammunition before purchase?			
	Standard: AR 385-63, paragraph 2-3.			
	Documentation: Nonstandard ammunition approval process.			
14	Are ammunition and explosives stored in licensed locations and quantity/distance limits maintained?			
	Standard: AR 385-10, paragraph 5-7; DA Pam 385-64, chapter 5.			
	Documentation: Review installation Standard Army Ammunition System-Modification explosives safety			

		YES	NO	Remarks
	report.			
	Range, explosive, and ammunition safety (continued)	**YES**	**NO**	**Remarks**
15	Are ammunition and explosives storage facilities inspected annually?			
	Standard: AR 385-10, paragraph 5-7; DA Pam 385-64, paragraph 1-9.			
	Documentation: Review inspection reports by QASAS and safety for findings and recommendations.			
16	Were lightning protection system and bonding for explosive facilities visually inspected and electrically tested IAW DA Pam 385-64, appendix D?			
	Standard: DA Pam 385-64, paragraphs 17-27, 17-28, and 17-29.			
	Documentation: Review lightning protection system inspection records and electrical test results.			
17	Are the correct storage fire/chemical symbols displayed?			
	Standard: DA Pam 385-64, paragraphs 6-14 and 6-16.			
	Documentation: Visually check storage sites/facilities to verify correct signage.			
18	Are SOPs developed, current, and used for all arms, ammunition and explosives operations?			
	Standard: DA Pam 385-64, paragraph 2-4.			
	Documentation: Review of SOP to ensure workers have information necessary to perform their task safely and that required procedures are identified.			
19	Have personnel working with or transporting arms, ammunitions and explosives received required training?			
	Standard: AR 385-10, chapter 10-10b; DA Pam 385-64, paragraph 1-8, and 20-2.			

	Documentation: Review training rosters.			

B-10. Radiation safety

a. The TRADOC Radiation Protection Program safeguards personnel from unnecessary exposure to ionizing and non-ionizing radiation through:

(1) Control of radiation sources.

(2) Personnel training.

(3) Surveys and monitoring.

(4) Documentation of radiation emissions.

(5) Medical examinations and bioassays.

b. Commanders should ensure there is positive control of potential health hazards resulting from the procurement, possession, storage, transportation, use, and disposal of radioactive materials or equipment capable of producing potentially hazardous ionizing or non-ionizing radiation. The checklist at table B-10 is provided to assist in this effort.

Table B-10 Radiation safety

		YES	**NO**	**Remarks**
1	Does the commander/commandant have a radiation safety program?			
	Standard: AR 385-10, paragraph 1-4m(9), 7-2a.			
	Documentation: Radiation safety SOP.			
2	Does the commander/commandant designate, in writing, a radiation staff safety officer?			
	Standard: AR 385-10, paragraph 1-4m(5).			
	Documentation: Radiation staff safety officer appointment memorandum.			

	Radiation Safety (continued)	**YES**	**NO**	**Remarks**
3	Has the commander forwarded a copy of radiation deviations to HQ TRADOC?			
	Standard: AR 385-10, paragraph 1-4m(9); DA Pam 385-24, paragraph 1-4i(5)(b).			
	Documentation: Central registration of deviations.			
4	Has the commander/commandant established written policies and procedures for radioactive commodities as necessary to ensure compliance with radiation safety requirements in applicable technical publications?			
	Standard: AR 385-10, paragraph 7-2a.			
	Documentation: Radioactive commodities policy and procedures.			
5	Does the commander/commandant ensure compliance with conditions of Army Materiel Command (AMC)-held radioactive commodity Nuclear Regulatory Commission (NRC) licenses and Army Radiation Authorizations (ARA) to include ensuring all personnel using radioactive material are aware of applicable regulations and conditions as appropriate?			
	Standard: AR 385-10, paragraph 7-2b.			
	Documentation: SOPs for AMC-held radioactive commodities.			
6	Does the command have approved applications for new, renewals, or amendments to ARA?			
	Standard: AR 385-10, paragraph 7-6, DA Pam 385-24 paragraphs 1-4i(1) and 1-4i(3).			
	Documentation: Copy of ARAs/amendments.			

	Radiation safety (continued)	YES	NO	Remarks
7	Does the commander/commandant ensure that all the NRC licenses, ARAs, and Army Radiation Permits for radioactive materials and machine produced ionizing radiation equipment are available?			
	Standard: AR 385-10, paragraph 7-5a.			
	Documentation: Copy of license, authorizations, permits.			
8	Is the commander/commandant in compliance with appropriate NRC licenses and ARA requirements?			
	Standard: AR 385-10, paragraphs 7-2b, 7-6b; DA Pam 385-24, paragraphs 1-4j(6), 1-4i(1).			
	Documentation: Copy of current NRC/ARA license.			
9	Has the commander/commandant established written policies and procedures to assure compliance with applicable Federal, DOD, and Army radiation safety regulations and directives?			
	Standard: AR 385-10, paragraph 7-2.			
	Documentation: Policies and procedures for radiation safety (emergency reaction plans as necessary and procedures for investigating and reporting radiation accidents, incidents, and overexposures).			

	Radiation safety (continued)	YES	NO	Remarks
10	Does the commander/commandant assure that an internal (for example, the Radiation Safety Officer (RSO) or local acting Inspector General) or external agent (for example, the Surgeon General or an RSO from another command) or agency audits the radiation safety program annually?			
	Standard: DA Pam 385-24, paragraphs 1-4j(6), 1-4i(5)(d); 1-4k(2)(c).			
	Documentation: Audit report.			
11	Has the commander/commandant established an installation Radiation Safety Committee? (as per NRC license requirements or as need dictates, the Radiation Safety Committee provide information on issues to command and are audited by command)			
	Standard: AR 385-10, paragraph 2-23c(1).			
	Documentation: Installation Radiation Safety Committee meeting minutes.			
12	Does the commander/commandant maintain an inventory of radiation sources as higher headquarters directs and in accordance with requirements of NRC licenses, Army reactor permits, Army radiation authority, and technical publications?			
	Standard: AR 385-10, paragraph 7-5g.			
	Documentation: Inventory of radiation sources.			

	Radiation safety (continued)	YES	NO	Remarks
13	Has the commander/commandant established and employed procedures to assure that captured, purchased, borrowed, or otherwise obtained foreign equipment and materiel are surveyed for radioactive material and that appropriate actions are taken following discovery of any radioactive material in those items?			
	Standard: AR 385-10, paragraphs 1-4m, 7-5i.			
	Documentation: SOP for foreign equipment and materials.			
14	Has the commander/commandant established and employed procedures to ensure that there is a Light Amplification by Stimulated Emission of Radiation (LASER) Safety Program established and a designated LASER Safety Officer in writing?			
	Standard: DA Pam 385-24, paragraphs 1-4k(1), 1-4k(2).			
	Documentation: LASER Safety Policy.			
15	Does the commander/commandant maintain an inventory of Class 3b and Class 4 LASER as higher headquarters directs and in accordance with requirements?			
	Standard: DA Pam 385-24, paragraph 3-1h.			
	Documentation: Policies and procedures for non-ionizing radiation safety.			
16	Does the commander/commandant ensure LASER accidents are reported to the Tri-service hotline and the United States Army Public Health Command (Provisional) and follow accident reporting procedures?			
	Standard: DA Pam 385-24, paragraph 5-3a; DA Pam 385-40, paragraph 5-4c(2)(b).			
	Documentation: Policies and procedures for non-ionizing radiation safety.			

	Radiation safety (continued)	**YES**	**NO**	**Remarks**
17	Does the commander/commandant report excess “military-exempt” LASERs to the Defense Reutilization and Marketing Service for utilization screening within DOD?			
	Standard: DA Pam 385-24, paragraph 1-4i(6).			
	Documentation: Excess military-exempt LASER SOP.			
18	Has the commander/commandant established and employed procedures to ensure that there is a Radiofrequency Radiation (RFR) Safety Program established and have designated a RFR Safety Officer in writing?			
	Standard: DA Pam 385-24, paragraphs 1-4k(1) and 1-4k(2).			
	Documentation: RFR safety policy and procedures.			
19	Does the commander/commandant ensure RFR accidents are reported to United States Army Public Health Command (Provisional) and follow accident reporting procedures?			
	Standard: DA Pam 385-24, paragraph 6-1a(3)(b); DA Pam 385-40, paragraph 5-4c(2)(a).			
	Documentation: RFR safety policy and procedures.			
20	Are radiation handlers/users trained in safe working conditions and operating procedures in accordance with applicable regulations and directives?			
	Standard: AR 385-10, paragraph 10-10a.			
	Documentation: Lesson plans, training roster, and schedule of classes.			

	Radiation safety (continued)	YES	No	Remarks
21	Do radiation safety officers receive required radiation protection training? Has training been completed before RSO/LASER Safety Officer/RFR Safety Officer assumes the Radiation Safety Program responsibilities? Is refresher training occurring annually/and retraining after significant regulatory change or every 5 years?			
	Standard: AR 385-10, paragraph 10-10; DA Pam 385-24, paragraph 1.			
	Documentation: Certificate of completion of refresher training; lesson plans/program of instructions/TSPs and schedule of classes.			

B-11. Aviation safety

a. Aviation operations are an important part of TRADOC operations. Aviation safety is a major subprogram of the Army Safety and Occupational Health Program and provides increased combat power and efficiencies for the commander. Aviation is an inherently dangerous business with many facets of mission risk. This makes safety at all levels of utmost importance. Aviation Safety Program requirements apply to all Army operations and personnel participating in aviation activities and to all who operate and/or maintain Army aircraft (manned or unmanned). TRADOC organizations conducting/supporting aviation operations will have an active and effective aviation safety program with fully engaged leadership.

b. Table B-11 applies to all TRADOC aviation units (both manned and unmanned) and TRADOC units with aviation assets assigned.

Table B-11 Aviation safety

		YES	NO	Remarks
1	Is there a school trained aviation safety officer (ASO) assigned to the TDA, Table of Organization and Equipment, Modified Table of Organization and Equipment; authorized full-time position?			
	Standard: DA Pam 385-90, paragraph 1-4j(2).			
	Documentation: Copy of TDA.			
2	Is there a safety-trained NCO or qualified individual appointed by the unit commander, in writing, to assist the safety manager in aviation units?			
	Standard: DA Pam 385-90, paragraph 1-4j (3)(d).			
	Documentation: A certificate of completion from a sanctioned Safety Course and appointment orders for the safety NCO or alternate to the ASO.			

	Aviation safety (continued)	YES	NO	Remarks
3	Has an appropriately trained additional duty aviation safety officer been appointed in aviation organizations without authorized ASO positions, and in non-aviation organizations, not staffed with full-time safety personnel to perform safety and accident prevention functions for the commander?			
	Standard: DA Pam 385-90, paragraph 1-4j(3)(c); AR 385-10, paragraph 2-6d/2-7g; DA Pam 385-10, paragraph 3-3f.			
	Documentation: Check appointment orders and ADSO course completion certificate (within 90 days of appointment).			
4	At brigade level and below, does the ASO work directly for and is rated by the commander?			
	Standard: DA Pam 385-90, paragraph 1-4j (3); AR 385-10, paragraph 2-7g.			
	Documentation: Unit rating scheme.			
5	Has the commander established a written safety philosophy that incorporates goals, objectives, and priorities? Is it in the quarterly training guidance?			
	Standard: DA Pam 385-90, paragraph 2-3; DA Pam 385-90, paragraph 1-4j(5); AR 385-10, paragraph 15-2a(2).			
	Documentation: Check the commander's safety philosophy for completeness.			
6	Does the ASO maintain current unit safety functional files and are procedures for safety files and administration established in the SOP?			
	Standard: AR 25-400-2, paragraph 1-7, https://www.arims.army.mil/; AR 385-10, paragraph 16-2, DA Pam 385-90 paragraph 2-10f.			

	Documentation: Functional files and SOP.			
	Aviation safety (continued)	**YES**	**NO**	**Remarks**
7	Does the safety manager maintain a current library of safety regulations, accident prevention directives, and instructional materials?			
	Standard: DA Pam 385-90, paragraph 1-4m(6)(h) and Appendix A.			
	Documentation: Check access to current regulations in printed or electronic format. Recommending printed copies of the minimum daily core regulations (385 series).			
8	Does the ASO maintain safety bulletin boards with: (1) The names of the Commander, ASO, and Aviation Safety NCO (2) The names of command support and safety-related program managers (3) The most recent Commander's Safety Council and Executive Safety Council, as applicable); (4) The unit and next higher Commanders' Safety Philosophies; (5) Blank DA Forms 2696, Operational Hazard Report (OHR); (6) Blank DA Forms 4755s?			
	Standard: DA Pam 385-90, paragraphs 1-4m(5), 2-4f.			
	Documentation: Check all safety bulletin boards with current minutes posted.			
9	Has the safety manager established written procedures for the awards program, to include procedures for impact awards?			
	Standard: AR 385-10, paragraph 8-5; DA Pam 385-90, paragraph 1-4 (m)(6)(q); DA Pam 385-10, paragraph 1-6.			
	Documentation: Verify all applicable safety awards programs are functioning. Policy and evidence of issue during the evaluation period (unit, individual, impact, flight, and safe drivers). Ensure the program is funded down to the unit level. Review the SOP to find if this area is covered. If this area is not recognized, ask the ASO.			

	Aviation safety (continued)	YES	NO	Remarks
10	Does the safety manager maintain historical documentation of awards presented to the unit and individuals?			
	Standard: AR 25-400-2, paragraph 1-7 and record number 385-10gg2.			
	Documentation: Check for historical records of awards being presented to the unit and individuals and maintained on file for 2 years.			
11	Does the command have a crew endurance program included in the standard operating procedures? Is the crew endurance policy being adhered to?			
	Standard: AR 25-400-2, paragraph 1-7a, b, https://www.arims.army.mil/; DA Pam 385-90 paragraph 2-10f.			
	Documentation: SOP or policy letters and risk assessment worksheets.			
12	Does the ASO ensure CRM worksheets are completed and reviewed for all training/operations?			
	Standard: TRADOC Regulation 385-2, paragraph1-5d(4).			
	Documentation: Spot check current operations and inspect historical records.			
13	Does the commander clearly specify in writing, safety duties for staff officers, subordinate commanders, leaders, and individuals?			
	Standard: DA Pam 385-90, paragraph 1-4j(13); AR 385-10, paragraph 1-5.			
	Documentation: SOP or policy letters.			

	Aviation safety (continued)	YES	NO	Remarks
14	Are command-approved risk-control options integrated into the SOP as task performance standards and are all appropriate subjects addressed in the unit SOP?			
	Standard: DA Pam 385-90, paragraph 2-12.			
	Documentation: Review the SOP for inclusion of all applicable subjects and risk control options.			
15	Are procedures established to ensure the unit receives applicable aviation/non-aviation safety messages for assigned aircraft, ground vehicles, air vehicles, related systems, components, or repair parts?			
	Standard: AR 750-6, paragraphs 2-3 through 2-7.			
	Documentation: Check for written procedures establishing responsibility for obtaining safety action messages assigned aircraft, air vehicles, related systems, components, or repair parts. If nothing is found, ask the ASO about current procedures.			
16	Does the ASO rehearse, review, and document the adequacy of the unit pre-accident plan?			
	Standard: DA Pam 385-90, paragraph 1-4m(6)(e).			
	Documentation: Review the unit/airfield SOP, pre-accident plan, record of plan preparation, as well as the rehearsal and review records kept on file.			
17	Does the pre-accident plan specify procedures to be followed in the event of aviation and ground accidents?			
	Standard: DA Pam 385-90, paragraph 2-9b(4); FM 3-04.300, paragraph 11-15 and Appendix E-11/ E-12.			
	Documentation: Review the pre-accident plan for procedures to be followed in the event of an accident.			

	Aviation safety (continued)	**YES**	**NO**	**Remarks**
18	Are the responsibilities of aviators involved in accidents established in the SOP?			
	Standard: DA Pam 385-90, paragraph 2-12p.			
	Documentation: Review the SOP to find if this area is covered. If this area is not covered, ask the ASO about current procedures established in the organization.			
19	Are procedures established to integrate risk management into all unit aviation and ground mission planning and execution activities?			
	Standard: AR 385-10, paragraph 15-1b.			
	Documentation: Review the SOP to find if this area is covered. If this area is not recognized ask the ASO about current procedures established in the organization.			
20	Are radiological protection programs established in writing when the commander has determined that a radiological hazard or LASER exist in the unit?			
	Standard: DA Pam 385-90, paragraph 3-6.			
	Documentation: Review the SOP to find if this area is covered. IF THE COMMANDER RECOGNIZES THE NEED FOR SUCH A PROGRAM ask the ASO about current procedures established in the organization.			
21	Has the organization established procedures for handling ammunition, explosives, and/or weapons?			
	Standard: DA Pam 385-90, paragraph 3-10.			
	Documentation: IF THE UNIT PERFORMS THIS FUNCTION, review the SOP to find if this area is covered. If this area is not recognized, ask the ASO about current.			

	Aviation safety (continued)	YES	NO	Remarks
22	Is command level authority of risk acceptance specified in the SOP?			
	Standard: DA Pam 385-90, paragraph 1-4j (6)c.			
	Documentation: Check SOP for risk acceptance level.			
23	Are command safety council meeting conducted quarterly and the minutes maintained on file for 2 years?			
	Standard: DA Pam 385-90, paragraph 1-4j(14) and 2-4f; AR 25-400-2, Army Records Information Management System (ARIMS), https://www.arims.army.mil Record number 385-10d.			
	Documentation: Check records for council minutes.			
24	Are Abbreviated Accident Reports submitted for all applicable aviation and ground mishaps?			
	Standard: DA Pam 385-40.			
	Documentation: Review all submitted reports using Record Management Information System and spot check suspense dates with USACR/SC.			
25	Are file copies maintained of Army Aviation Accident Reports (AAAR) and Army Ground Accident Reports (AGAR) submitted by the organization?			
	Standard: AR 25-400-2, paragraph 1-7.			
	Documentation: Verify file copies are maintained by the army standards.			
26	Does the ASO review aircraft accident reports and operational hazard report (OHR) to help implement corrections?			
	Standard: DA Pam 385-90, paragraphs 1-4m(6)(d); 2-7c.			
	Documentation: Review the accidents and hazard logs to			

	verify the ASO's actions.			
	Aviation safety (continued)	**YES**	**NO**	**Remarks**
27	Is follow-up action documented on operational hazard reports to include the responsible commander's signature and are completed reports maintained on file for 2 years?			
	Standard: DA Pam 385-90, paragraphs 2-7b(f), 2-7c(6).			
	Documentation: Check submitted OHRs. Ensure the suspense's have been met and the commander has signed the completed OHR within 10 working days; files are maintained for 2 years.			
28	Are required aviation accident prevention survey procedures covered in the SOP and all functional areas inspected annually?			
	Standard: AR 385-10, paragraph 15-3; DA Pam 385-90, paragraphs 1-4j and 2-11.			
	Documentation: Check for documentation of annual accident prevention surveys. All applicable functional areas must be surveyed and hazards tracked for the unit to receive credit for a complete survey.			
29	Are copies of previous safety surveys maintained on file for 5 years?			
	Standard: AR 25-400-2, paragraph 1-7; www.arims.army.mil; and 385-10i.			
	Documentation: Review files in the organization indicating the completion of the surveys (5 years worth for all organizations).			

	Aviation safety (continued)	YES	NO	Remarks
30	Are functional or sub areas surveyed within 60 days of a new program manager being appointed?			
	Standard: DA Pam 385-90, paragraph 1-4j(16).			
	Documentation: Review the survey files and compare them to appointment orders. (5 years worth for all organizations).			
31	Does the foreign object damage officer/ NCO delegate specific areas and ensure monthly inspections of all unit areas?			
	Standard: DA Pam 385-90, paragraph 2-8d(2).			
	Documentation: Check the unit's foreign object damage area delegation and survey records.			
32	Are fire risk management surveys reviewed for hazardous conditions to be included in the organizations hazard tracking system?			
	Standard: DA Pam 385-10, paragraph 4-3j; DA Pam 385-90, paragraph 3-9.			
	Documentation: Check Fire Risk Management surveys (AR 420-1, paragraph 25-27) are completed IAW Fire Chief's program, copies maintained by unit, and appropriate hazards added to the hazard log.			
33	Does the ASO monitor unit aviation maintenance programs and address uncorrected hazards on the hazard tracking system?			
	Standard: DA Pam 385-10, paragraph 4-3j; DA Pam 385-90, paragraph 3-9.			
	Documentation: Check to see if the ASO reviews shop inspections/ other reports and puts uncorrected hazards on the hazard log.			

	Aviation safety (continued)	YES	NO	Remarks
34	Does the safety manager monitor the Aviation Life Support Equipment program to ensure all deficiencies that are not corrected by Aviation Life Support Equipment personnel are tracked on the unit's hazard tracking system?			
	Standard: DA Pam 385-90, paragraph 3-11.			
	Documentation: Check surveys and council minutes for Aviation Life Support Equipment evaluations.			
35	Does the ASO review accident/incident reports and investigations, equipment improvement reports (EIRs), product quality deficiency reports (PQDRs), and safety action messages for uncorrected hazards to be included on the units' hazard tracking system?			
	Standard: DA Pam 385-90, paragraph 1-4m(6)(d).			
	Documentation: Review Army Aviation Accident Reports, Army Ground Accident Reports, DA Form 285s, DA Form 4755s, OHRs, product quality deficiency reports, equipment improvement reports, and all other sources that may be good sources of unreported hazards.			
36	Has the organization implemented a file or log of hazards and maintained them for 5 years or until no longer needed?			
	Standard: DA Pam 385-10, paragraph D-4(g); DA Pam 385-90, paragraph 2-10(f); AR 25-400-2; www.arims.army.mil.			
	Documentation: Check organization's files for a hazard tracking system that meets requirements.			
37	Is the hazard identification, analysis, and countermeasures implementation and control program requirements established within the unit SOP?			
	Standard: AR 385-10, paragraph 18-5.			
	Documentation: Review the SOP to find if this area is			

	covered. If this area is not recognized inquire of the ASO.			

	Aviation safety (continued)	**YES**	**NO**	**Remarks**
38	Are all uncorrected hazards detected during accident prevention surveys entered on the hazard tracking system, DA Form 4754 or equivalent? Is a hazard abatement plan completed for RAC 1 & 2 hazards when corrective action exceeds 30 days?			
	Standard: DA Pam 385-10, appendix D, D-4(g); DA Pam 385-90, paragraph 2-10(f) TRADOC Regulation 385-2, paragraph 3-3.			
	Documentation: Check hazards to determine if the uncorrected hazards were entered into the hazard log and an abatement plan was completed on RAC 1 & 2 hazards when correction exceeds 30 days.			
39	Are current hazards (including Aviation Accident Prevention Survey findings) reviewed at the Command Safety Council and are follow-up actions taken to correct noted deficiencies?			
	Standard: DA Pam 385-10, paragraph D-4(g); DA Pam 385-90, paragraphs 2-4a and 2-10(f).			
	Documentation: Check the hazard log and ensure most deficiencies are being logged. Check the suspense system to ensure it is current. Validate review with council minutes.			
40	Are minutes of the Command Safety Council meetings published with action officers and suspense dates assigned to action items?			
	Standard: DA Pam 385-90, paragraph 2-4f.			
	Documentation: Review the council minutes noting the assignment of action, action officers and suspense dates for open items.			

	Aviation safety (continued)	**YES**	**NO**	**Remarks**
41	Are the Command/Enlisted Safety Councils established with appropriate membership and do they meet at least quarterly?			
	Standard: DA Pam 385-90, paragraphs 1-4j(13) and 2-4b.			
	Documentation: Review the orders or SOP and check minutes.			
42	Are safety council meeting minutes signed by the commander and distributed, to include posting to the safety bulletin board and forwarding to the next higher headquarters?			
	Standard: DA Pam 385-90, paragraph 2-4f.			
	Documentation: Check the distribution list on the minutes or cover memo, e-mail forwarding, and the signature block.			
43	Does the safety manager organize the Command Safety Council?			
	Standard: DA Pam 385-90, paragraph 2-4c.			
	Documentation: Review the council orders and or council minutes to ensure that the ASO is functioning as the council's recorder.			

	Aviation safety (continued)	**YES**	**NO**	**Remarks**
44	Are the procedures for the safety councils established in the SOP?			
	Standard: DA Pam 385-90, paragraph 1-4j(6).			
	Documentation: Review the SOP to find if this area is covered. If this area is not recognized, ask the ASO.			
45	Has the commander established a safety education and training program in writing that ensures safety training is conducted monthly for full-time organizations and quarterly for all others?			
	Standard: AR 385-10, paragraph 15-5; DA Pam 385-90, paragraphs 2-4g and 2-12.			
	Documentation: AR 385-10, paragraph 15-5; DA Pam 385-90, paragraph 2-4g.			

B-12. Motor vehicle accident prevention

a. Most motor vehicle accidents are caused by driver error. Proper selection, training, and supervision can reduce the incidence of these errors. Commanders are ultimately responsible for the implementation of effective motor accident prevention efforts within their commands and should ensure the individuals they select as drivers are well trained, motivated, and supervised. This includes responsibility for operation of POVs by members of their commands. See table B-12 for a motor vehicle accident prevention safety checklist.

b. Commanders should:

(1) Comply with requirements of 23 CFR 1230, DODI 6055.04, AR 385-10, and AR 600-55.

(2) Develop and prescribe local procedures for the safe operation of motor vehicles.

(3) Develop and execute training, education, and motivation programs for motor vehicle operation.

(4) Ensure motor vehicle activities and accident data are collected and analyzed.

Table B-12 Motor vehicle accident prevention

		YES	NO	Remarks
1	Does commander/commandant administer a Motor Vehicle Accident Prevention program?			
	Standard: AR 385-10, paragraph 11-2(a)(3).			
	Documentation: Motor Vehicle Accident Prevention document (i.e., safety regulation, standard memo, etc…).			
2	Does the commander/commandant ensure supervisors are enforcing standards of performance for vehicle operations of Army motor vehicle operations and periodically assessing driver performance?			
	Standard: AR 385-10, paragraphs1-5b and 11-2b.			
	Documentation: Inspection report, training records, and SOPs.			

	Motor vehicle accident prevention (continued)	**YES**	**NO**	**Remarks**
3	Are civilian employees that operate Army motor vehicle receiving online Army Accident Avoidance Training Course?			
	Standard: AR 385-10, paragraph 11-7(a)(5).			
	Documentation: Certificates of completion.			
4	Have commanders established procedures for the safe operation of motor vehicles on and off Army installations and contractor vehicles on post?			
	Standard: AR 385-10 paragraph 11-3a(1)(2).			
	Documentation: Motor Vehicle Accident Prevention document, SOP, and regulation.			
5	Do commanders ensure that motorcycle and moped operators are required to comply with established Army motorcycle safety requirements?			
	Standard: AR 385-10, paragraph 11-9.			
	Documentation: Motor vehicle accident prevention program, appropriate license and personal protective equipment.			
6	Has the commander/commandant established a Motorcycle Mentorship Program?			
	Standard: TRADOC Regulation 385-2, paragraph 1-4e(7).			
	Documentation: Motor Vehicle Accident Prevention document.			

	Motor vehicle accident prevention (continued)	**YES**	**NO**	**Remarks**
7	Is the Army Traffic Safety Training Program fully implemented (Introductory (Advance Individual Training Students complete one hour DVD), Local Area Hazards, Intermediate, Accident Avoidance, and Remedial Driver Training)?			
	Standard: AR 385-10, paragraph 11-7a.(1)(2)(3)(5) and b.			
	Documentation: Attendance roster and lesson plans.			
8	Does the commander convene a POV task force at least semiannually?			
	Standard: TRADOC Regulation 385-2, paragraph 8-11a.			
	Documentation: Minutes from POV task force.			
9	Are motorcycle operators prior to operation of any motorcycle completing a Motorcycle Safety Foundation or Motorcycle Safety Foundation based approved motorcycle rider safety course?			
	Standard: AR 385-10, paragraph 11-9b(1).			
	Documentation: Certificate of completion, lesson plans, and attendance roster.			
10	Do all operators of government or privately owned all terrain vehicles on DOD installations meet established training requirements?			
	Standard: DoDI 6055.4, paragraph E3.2.3.3; AR 385-10, paragraph 11-9b(6); TRADOC Regulation 385-2, paragraph 8-5.			
	Documentation: Attendance rosters, certificates of completion, and lesson plans.			

	Motor vehicle accident prevention (continued)	YES	NO	Remarks
11	Are all TRADOC military members prohibited from using cell phones unless hands free regardless of location?			
	Standard: TRADOC Regulation 385-2, paragraph 8-10.			
	Documentation: Motor Vehicle Accident Prevention Regulation, SOP, and policy.			
12	Has the command implemented a straggler control policy?			
	Standard: TRADOC Regulation 385-2, paragraph 8-8a.			
	Documentation: Regulation, SOP, and policy.			
13	Do all DOD vehicles, including government-owned and contractor-operated vehicles required to pass an annual safety inspection?			
	Standard: AR 385-10 paragraph 11-3c.			
	Documentation: Safety inspections.			
14	Do soldiers complete a TRiPs (POV risk assessment) when going on leave, pass or TDY out of the immediate local area and will be operating a motor vehicle?			
	Standard: AR 385-10 paragraph 11.4a(8).			
	Documentation: Actual TRiPS reports.			
15	Does command have the appropriate traffic safety clothing for traffic guards and Soldiers?			
	Standard: TRADOC Regulation 385-2, paragraph 8-9, table 8-1.			
	Documentation: Regulation, SOP, and policy.			

Table B-13 Identification of Radiation, Inert Munitions and Ammunition Components, Museums/Displays:

1. General: War trophies, museum display items, training aids, and the use of inert ammunition and components for public demonstrations, or office display may represent a significant hazard if these items are not free of all explosive material or chemical fillers.

2. Policy:

a. Ammunition and explosive items will not be rendered inert except by technically qualified personnel IAW established procedures.

b. Ammunition and ammunition components will be identified and certified as inert IAW DA Pam 385-64.

c. Items on museum display must be certified as inert and that certification annotated on the DA Form 2609, Historical Property Catalog, or its electronic equivalent, for that item.

	Identification of Radiation, Inert Munitions and Ammunition Components, Museums/Displays	**YES**	**NO**	**Remarks**
1	Is each item of ammunition or component that is part of a permanent museum display inspected by explosive ordnance disposal personnel or other personnel familiar with explosives?			
	Standard: DA Pam 385-64, Para 3-5d			
	Documentation: DA Form 2609 or its electronic equivalent, for item annotated as inert.			
2	Does the DA From 2609 or its electronic equivalent record the date of inspection and inspecting unit?			
	Standard: DA Pam 385-64, Para 3-5d			
	Documentation: DA Form 2609 or its electronic equivalent, for item annotated			

	Identification of Radiation, Inert Munitions and Ammunition Components, Museums/Displays	**YES**	**NO**	**Remarks**
3	Has the museum curator annotated in the remarks section of the DA Form 2609 that the item was found to be or made inert?			
	Standard: DA Pam 385-64, Para 3-5d			
	Documentation: DA Form 2609 or its electronic equivalent, for item annotated			
4	Has the museum established a Hazard Communication Program?			
	Standard: AR 870-20 paragraph 1-15c			
	Documentation: Copy of written Hazard Communication Program.			
5	Are museum employees trained IAW 29CFR1200?			
	Standard: AR 870-20,, paragraph 1-16c(6)			
	Documentation: Documented training for employees.			
6	Are items in the museum's collection containing radioactive material licensed with the NRC or controlled with an internal Army permit?			
	Standard: AR 870-20, paragraph 1-16d			
	Documentation: Copy of NRC License or Army Radiation Authorization.			
7	Have radiological surveys of artifacts containing radiation or areas in which they are stored conducted per the conditions of the license or permit?			
	Standard: AR 870-20, paragraph 1-16d			
	Documentation: Copy of radiological survey.			

Appendix C
Conditioning/Obstacle Course Criteria

C-1. Conditioning/obstacle course criteria
Conditioning/endurance course inspection and standardization criteria (see figures C-1 through C-31 and tables C-1 through C-26).

IMT Conditioning/Endurance Course Evaluator Information Checklist

Course: ____

Location: ___________________________________ Date of Inspection: ______________

Inspector:
Name: _______________________________Organization: ________________________

POC Name: ___________________________Organization:_________________________

Phone: ____

1. Courses will be evaluated to identify any safety hazards/concerns. Deficiencies found during the inspection will be annotated and corrective actions initiated by the responsible organization.

2. This evaluation will also assist in standardizing courses used at TRADOC activities.

3. Obstacle Category: Conditioning and Endurance.

Note: Surface refers to the area beneath and around obstacles to include travel lanes and at least six feet to the sides of obstacles presenting a fall hazard. Impact absorbing material depth under obstacles is 18 inches for sand, 12 inches of shredded rubber, and 24 inches for saw dust. Sand and sawdust must be tilled or turned at least annually to combat settling and ensure impact absorbance.

4. Standards for conditioning/endurance courses are a combination of those found in Engineer Drawing DEF 028-13-95, Obstacle Course Layout Plan; TC 3-22.20, Army Physical Readiness Training; and TRADOC Regulation 350-6.

Figure C-1. IMT conditioning/endurance course evaluator information checklist

Table C-1
General administrative inspection criteria checklist

	AREA	STANDARD	NO	NO GO
1.	Training requirement	a. Training event is supported by TSP, program of instruction, or lesson plan.		
		b. SOPs are published and on hand at each course.		
2.	Administrative	Condition service logs are maintained on all ropes used for surmounting and suspension.		
3.	Risk management	a. Generic risk assessment worksheet maintained onsite.		
		b. Daily risk assessment worksheet is onsite during training identifying hazards associated with personnel, equipment, and environment.		
4.	Inspections	a. Copy of last safety inspection report conducted by professional safety staff onsite.		
		b. Copy of daily pre-operations inspection maintained at site.		
		c. Existing deficiencies are documented and maintained by the responsible organization.		
		d. Copy of current work orders maintained by responsible organization.		
5.	Accident trends	A list of all injuries sustained on obstacles is maintained by responsible organization and safety office.		
	Remarks:			

Table C-2
General inspection criteria checklist

	AREA	STANDARD	GO	NO GO
1.	Wood timbers	a. There are no signs of rot, warping, severe weathering, or impact damage.		
		b. No protruding nails or splinters that may cause injury when obstacle is negotiated.		
		c. All timbers are connected securely together to prevent movement when put under stress.		
2.	Wall boards	a. All boards are securely attached to structure with proper hardware (bolts and nuts).		
		b. All boards free of protruding nails, splinters, rot, or damage.		
		c. Edges of boards rounded/smooth where used to support individual's weight.		
3.	Hardware	a. All bolts, nuts, and washers in place and of the designated type, size, and placement.		
		b. All anchors are made of three or more galvanized guy wire.		
		c. Take-up galvanized turnbuckles are used at anchor points of each cable to allow adjustment.		
		d. All cable clamps are positioned with U-bolt placed on the dead or short end of cable.		
4.	Fiber ropes	a. All ropes are free of rips, tears, cuts, frays, rot, or unraveled sections.		
		b. All ropes designed for surmounting are 1.5 inches in diameter.		
		c. Ropes are securely mounted to supporting timbers with ends tied and taped.		
		d. Ends of ropes are tied in a knot or wrapped to prevent fraying.		
		e. Condition/service logs are maintained on all ropes used for surmounting and suspension.		
5.	Design	Professional safety staff reviews obstacle construction plans.		

	Remarks:

	AREA	STANDARD	GO	NO GO
6.	Fall protection	a. The surface under conditioning obstacles will be free of any tripping hazard and covered with sand or saw dust.		
		b. Any obstacle requiring negotiation at an elevated level (in excess of 6 feet) will have impact absorbing material beneath it and around it at least 5 feet from the edges.		
		c. Forged steel hooks are used to fasten nets to its supports.		
		d. Nets are weight tested after initial installation and before being used as a fall protection system, whenever relocated, after major repair and every 6 months. The drop-test shall consist of a 400 pound (180 kg) bag of sand 30 or - 2 inches (76 + or - 5 cm) in diameter dropped into the net from the highest walking/working surface at which employees are exposed to fall hazards, but not from less than 42 inches (1.1 m) above that level. When the commander can demonstrate that it is unreasonable to perform the drop-test required by 29 CFR 1926.502 (c)(4)(i), the commander (or a designated competent person) shall certify that the net and net installation is in compliance with 29 CFR 1926.502(c)(4)(i) by preparing a certification record prior to the net being used as a fall protection system. The certification record must include an identification of the net and net installation for which the certification record is being prepared; the date that it was determined that the identified net and net installation were in compliance with 29 CFR 1926.502 (c)(3) and the signature of the person making the determination and certification. The most recent certification record for each net and net installation shall be available at the training site for inspection.		
		e. All nets are suspended below high obstacles (in excess of 10 feet) have padding or small mesh material to prevent limbs from penetrating net		
		f. All padding is in good condition with no tears, holes, or loose material to trip personnel when dismounting.		
		g. All pole-vaulting pads are placed properly at base of designated high obstacles.		
7.	Padding	a. All safety padding attached to timbers is in good condition without signs of damage.		
		b. All pads are securely attached to the timber supports to prevent movement when impacted.		
8.	Base containment box	a. Base containment box is adequate to contain all absorbent material located at base of obstacle.		
		b. Containment box does not display signs of rot, damage, or instability.		
		c. Containment box extends far enough from dismount point of obstacle to prevent creating a tripping hazard.		
		d. Containment box is filled with either 18 inches of sand, 12 inches of shredded rubber, or 24 inches of sawdust.		
9.	Surfaces	All surfaces beneath low obstacles are free of hazards that have the potential to cause injury when crawled upon.		
10.	Condition	a. Designated course is free of tripping hazards.		
		b. Course surface is well maintained to prevent injury in case of falls.		
		c. Course surface is raked and policed prior to each use.		
		d. Course surface is free of large rocks, stones, or concrete materials that may cause injury in the event of a fall.		
11.	Safety	Safety Office staff conducts semi-annual inspections.		

	Remarks:

Table C-2
General inspection criteria checklist, continued

C-2. Obstacle specific design criteria

The following criteria supplement sketches found in TC 3-22.20, and DA Corps of Engineer Drawing DEF 028-13-95, Obstacle Course Layout Plan.

a. Climbing ropes that are 1 1/2 inches wide and either straight or knotted.

b. Walls 7 or 8 feet high.

c. Ground covering should be maintained to prevent excessive erosion and compaction.

d. This criteria applies to the following specific obstacle courses:

(1) Obstacles for jumping (see figure C-2).

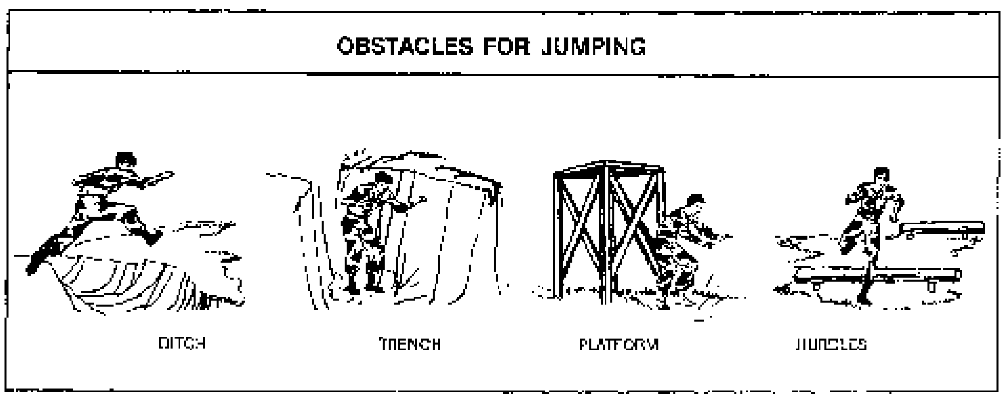


Figure C-2. Obstacles for jumping

(2) Obstacles for dodging (see figure C-3).

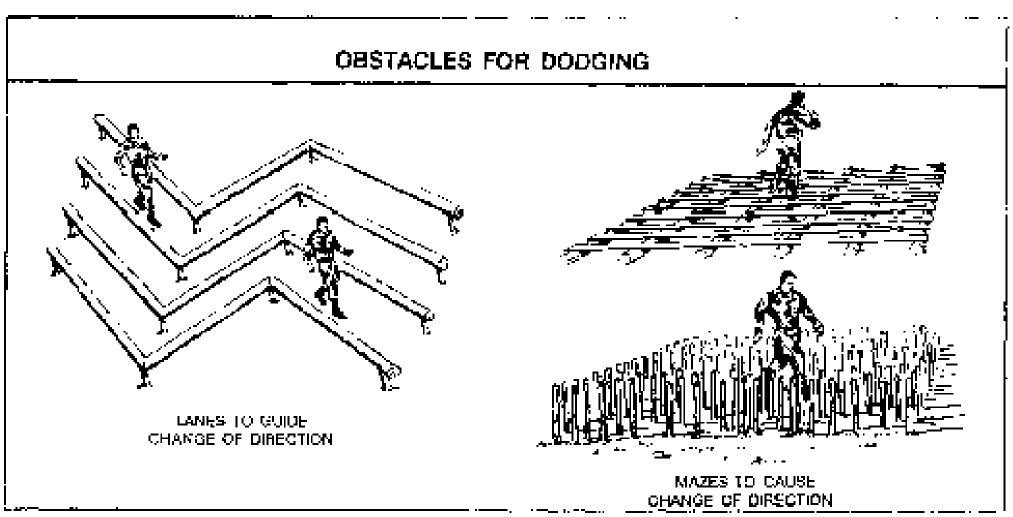


Figure C-3. Obstacles for dodging

(3) Obstacles for climbing and surmounting (see figure C-4).

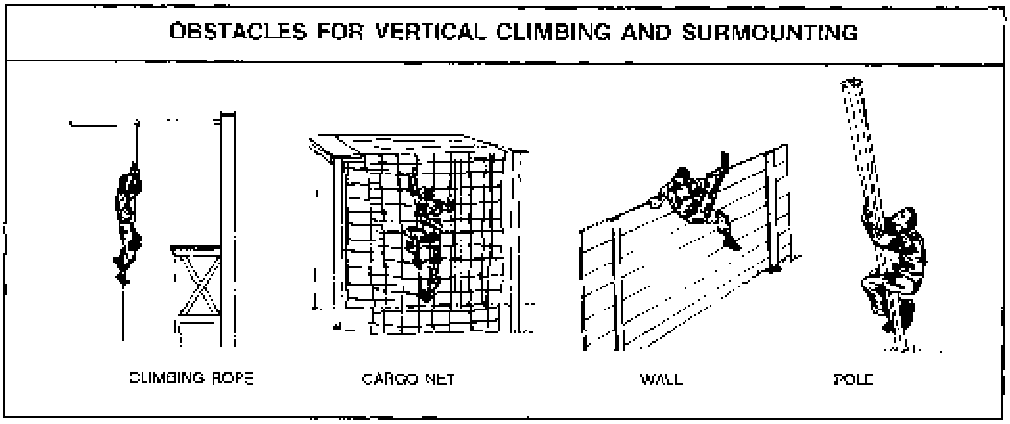


Figure C-4. Obstacles for vertical climbing and surmounting

(4) Horizontal traversing (see figure C-5).

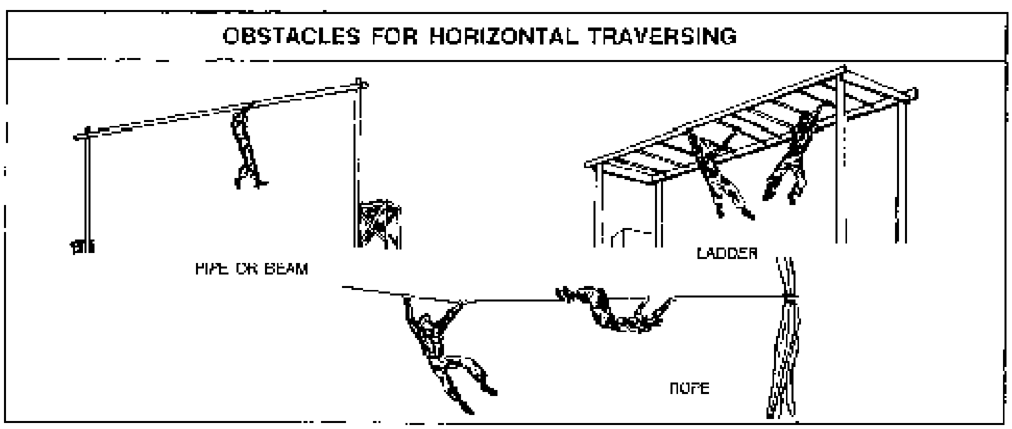


Figure C-5. Obstacles for horizontal traversing

(5) Obstacles for crawling (see figure C-6).

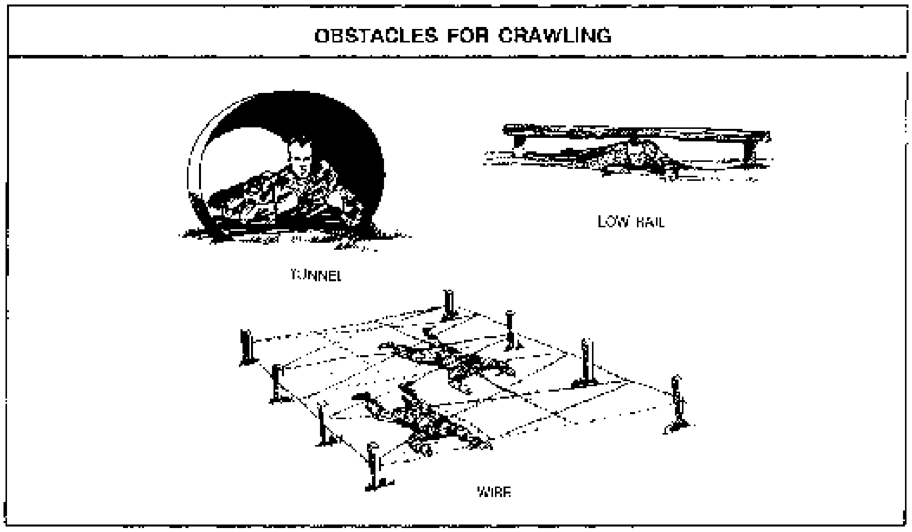


Figure C-6. Obstacles for crawling

(6) Obstacles for vaulting (see figure C-7).

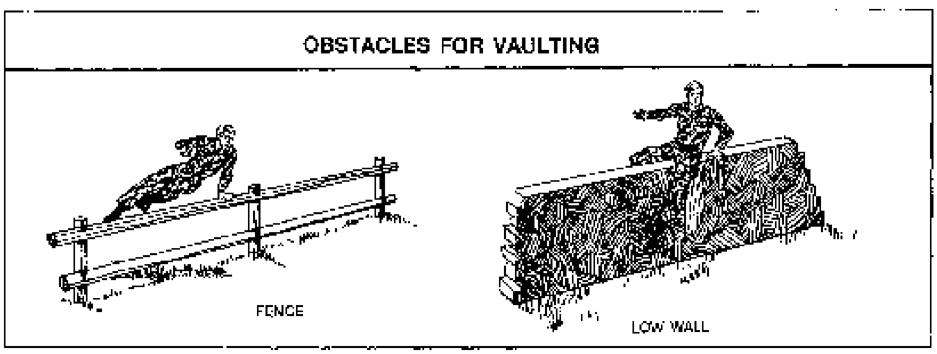


Figure C-7. Obstacle for vaulting

(7) Obstacles for balancing (see figure C-8).

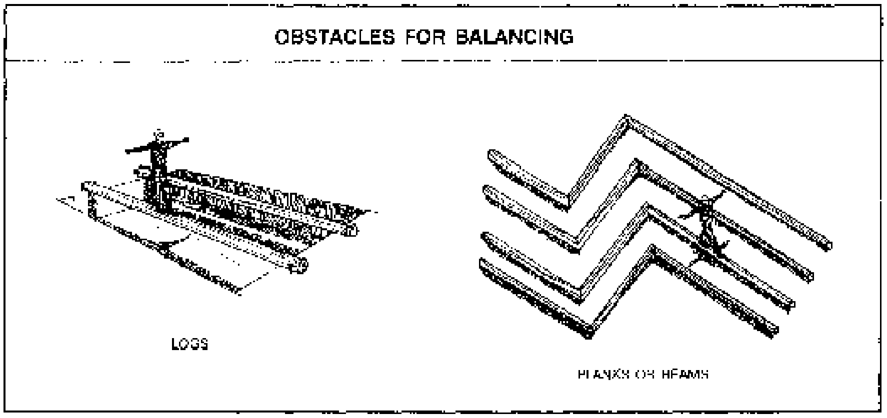


Figure C-8. Obstacle for balancing

C-3. IMT obstacle course checklist

Figure C-9 provides an obstacle course inspection and standardization criteria.

a. See table C-3 for the IMT obstacle course administrative general inspection criteria.

b. See table C-4 for the IMT obstacle course general inspection criteria.

IMT Obstacle Course Evaluator Information

Obstacle Course: ____

Location: ____________________________________ Date of Inspection: ______________

Inspector:
Name: _______________________________ Organization: ________________________

POC:
Name: _______________________________ Organization:_________________________

Phone: ____

1. Courses will be evaluated to identify any safety hazards/concerns. Deficiencies found during the inspection will be annotated and corrective actions initiated by the responsible organization.

2. This evaluation will also assist in standardizing courses used at TRADOC activities.

3. Obstacle categories: standard, nonstandard, and other.

Note: Where indicated on checklist, "fall protection" refers to devices or systems emplaced beneath obstacles and at least six feet to the sides of obstacles presenting a fall hazard, to prevent injury during falls; "fall arrest systems" are devices attached to personnel to limit the distance of falls; and "surface" refers to the area beneath and around obstacles, to include travel lanes. Impact absorbing material depth under obstacles is 18 inches for sand, 12 inches of shredded rubber, and 24 inches for saw dust. Sand and sawdust must be tilled or turned at least annually to combat settling and ensure impact absorbance.

4. Standards for Conditioning/Endurance Courses are a combination of those found in TC 3-22.20; Engineer Drawing DEF 028-13-95, Obstacle Course Layout Plan; and TRADOC Regulation 350-6.

Figure C-9. IMT obstacle course evaluator information

Table C-3
IMT obstacle course administrative general inspection criteria

	AREA	STANDARD	GO	NO GO
1	Training requirement	a. Training event is supported by TSP, program of instruction, or lesson plan.		
		b. SOPs are published and on hand at each course.		
2	Administrative	a. All ropes used for surmounting and suspension have condition service logs available.		
		b. Weight testing logs are maintained for nets.		
3	CRM	a. Generic risk assessment is completed and maintained on training site.		
		b. Daily risk assessment is completed and onsite during training, identifying hazards associated with personnel, equipment, and environment.		
4	Inspections	a. Copy of last professional safety staff's safety inspection report is onsite.		
		b. Copy of daily inspection is maintained at training site.		
		c. A list of all current deficiencies is maintained by the responsible organization.		
		d. Copies of current work orders are maintained by the responsible organization.		
5	Accident trends	A list of all injuries sustained on obstacles is maintained by the responsible organization and safety office.		
	Remarks:			

Table C-4
IMT obstacle course general inspection criteria

	AREA	STANDARD	GO	NO GO
1	Wood timbers	a. There are no signs of rot, warping, severe weathering, or impact damage.		
		b. There are no protruding nails or splinters to cause injury when obstacle is negotiated.		
		c. All timbers are securely connected together without excess separation between joints.		
2	Wall boards	a. All boards are securely attached to structure with proper hardware.		
		b. All boards free of protruding nails, splinters, rot, or damage.		
		c. Edges of boards rounded/smooth where used to support individual's weight.		
3	Hardware	a. All bolts, nuts, and washers are in place and of the designated type/size/placement.		
		b. All anchors are made of 3-strand galvanized guy wire or larger.		
		c. Take-up galvanized turnbuckles are used at anchor points of each cable to allow for adjustment.		
		d. Anchor cables are not used to support obstacles not properly constructed or improperly emplaced in the ground.		
		e. All cable clamps are positioned with U-bolt placed on the dead or short end of cable.		
4	Fiber ropes	a. All ropes are free of rips, tears, cuts, frays, rot, or unraveled sections due to age, excessive wear, or contact with the ground.		
		b. All ropes designed for surmounting are 1.5 inches in diameter.		
		c. Ropes are securely mounted to supporting timbers with ends tied/taped.		
		d. Ends of ropes are tied in a knot or wrapped to prevent fraying.		
		e. Condition/service logs are maintained on all ropes used for surmounting and suspension.		
5	Design	Obstacle adheres to blue print specifications.		
	Remarks:			

Table C-4
IMT obstacle course general inspection criteria, continued

	AREA	STANDARD	GO	NO GO
6	Fall protection	a. All nets meet American National Standards Institute (ANSI) load bearing standard for personnel (ANSI 10.11/OSHA 1926.105) 3.5-inch nylon mesh, 17,500 lb impact resistant.		
		b. All nets designed for fall protection extend 8 feet out from point of potential fall.		
		c. Forged steel hooks are used to fasten nets to its supports.		
		d. Nets are weight tested after initial installation and before being used as a fall protection system, whenever relocated, after major repair and every 6 months. The drop-test shall consist of 400 pound (180 kg) bag of sand 30 + or - 2 inches (76 + or - 5 cm) in diameter dropped into the net from the highest walking/working surface at which employees are exposed to fall hazards, but not from less than 42 inches (1.1 m) above that level. When the commander can demonstrate that it is unreasonable to perform the drop-test required by 29 CFR 1926.502 (c)(4)(i), the commander (or a designated competent person) shall certify that the net and net installation is in compliance with 29 CFR 1926.502(c)(4)(i) by preparing a certification record prior to the net being used as a fall protection system. The certification record must include an identification of the net and net installation for which the certification record is being prepared; the date that it was determined that the identified net and net installation were in compliance with 29 CFR 1926.502 (c)(3) and the signature of the person making the determination and certification. The most recent certification record for each net and net installation shall be available at the training site for inspection.		
		e. All nets are suspended below high obstacles (in excess of 10 feet) have padding or small mesh material to prevent limbs from penetrating net.		
		f. Pole-vaulting pads are in good condition with no tears, holes, or loose material, which can trip personnel when dismounting.		
		g. All pole-vaulting pads are placed properly at base of designated high obstacles.		
7	Padding on timbers	a. All padding on timbers is in good condition without signs of damage.		
		b. Pads are securely attached to the timber supports to prevent movement when impacted.		
8	Base contain-ment box	a. Base containment box is adequate for containment of absorbent material located at base of obstacle.		
		b. Containment box does not display signs of rot, damage, or instability.		
		c. Containment box is large enough to dismount from obstacle without causing injury.		
		d. Containment box is filled with either 18 inches of sand, 12 inches of shredded rubber, or 24 inches of sawdust.		
9	Surfaces	All surfaces beneath low obstacles are free of hazards with the potential to cause injury.		
10	Course condition	a. Designated course is free of tripping hazards.		
		b. Course surface is well maintained to prevent injury in case of falls.		
		c. Course surface is raked and policed prior to each use.		
		d. Course surface is free of large rocks, stones, or concrete materials that may cause injury in the case of a fall.		
11	Safety	Professional safety staff reviews obstacle construction plans and conducts semiannual inspections.		

	Remarks:			

C-4. Obstacle course specific inspection criteria

a. The accompanying checklists and sketches supplement TC 3-22.20 and DA Corps of Engineer Drawings DEF 028-13-95, Obstacle Course Layout Plan, and TRADOC Regulation 350-6. They serve as minimum construction/safety standards for obstacle courses used by IMT facilities.

b. The “jump and land” and “swinger” are not included and will not be used. These obstacles are conducive to lower extremity injuries.

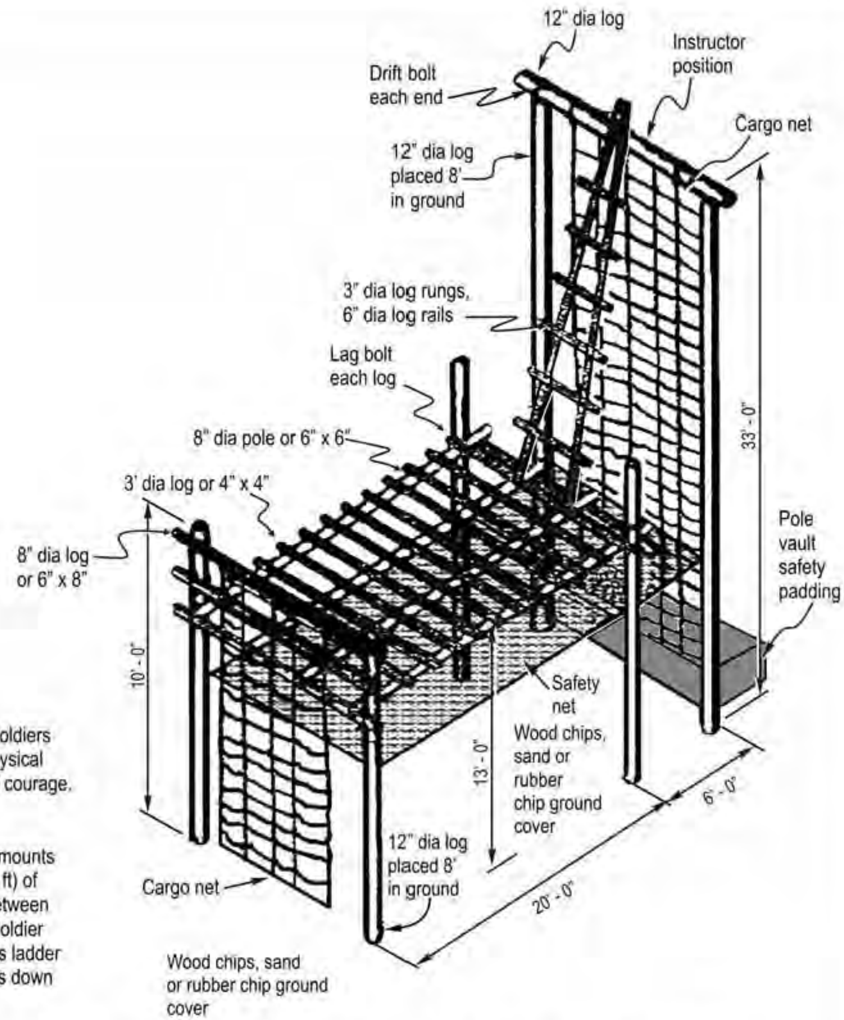
c. Safety equipment (nets, pads, ground covering) should be procured from reliable sources, inspected and tested frequently, and replaced before deterioration/failure.

d. Tables and figures are provided for specific courses.

(1) See table C-5 and figure C-10 for “the tough one.”

Table C-5
The tough one checklist

	AREA	STANDARD	GO	NO GO
1	Wood timbers	a. There are no signs of rot, warping, severe weathering, or impact damage.		
		b. All timbers meet specified dimensions as stated in engineer drawings and TRADOC Regulation 350-6.		
		c. There are no protruding nails or splinters that may cause injury when obstacle is negotiated.		
		d. All timbers are connected securely together without excess separation between joints.		
2	Hardware	All bolts, nuts, and washers are in place and of the designated type, size, and placement.		
3	Design	Professional safety staff reviews obstacle construction plans.		
4	Fall protection	a. All nets meet ANSI load bearing standard for personnel (ANSI 10.11/OSHA 1926.105) 3.5-inch nylon mesh, 17,500 lb impact resistant.		
		b. All nets designed for fall protection extend 8 feet out from point of potential fall.		
		c. Forged steel hooks are used to fasten net to its supports.		
		d. Nets are weight tested after initial installation and before being used as a fall protection system, whenever relocated, after major repair and every 6 months. The drop-test shall consist of 400 pound (180 kg) bag of sand 30 + or - 2 inches (76 + or - 5 cm) in diameter dropped into the net from the highest walking/working surface at which employees are exposed to fall hazards, but not from less than 42 inches (1.1 m) above that level. When the commander can demonstrate that it is unreasonable to perform the drop-test required by 29 CFR 1926.502 (c)(4)(i), the commander (or a designated competent person) shall certify that the net and net installation is in compliance with 29 CFR 1926.502(c)(4)(i) by preparing a certification record prior to the net being used as a fall protection system. The certification record must include an identification of the net and net installation for which the certification record is being prepared; the date that it was determined that the identified net and net installation were in compliance with 29 CFR 1926.502 (c)(3) and the signature of the person making the determination and certification. The most recent certification record for each net and net installation shall be available at the training site for inspection.		
		e. Pole-vaulting pads are in good condition with no tears, holes, or loose material, which can trip personnel when dismounting.		
		f. Pole-vaulting pads are placed properly at base of designated obstacles.		
5	Base containment box	a. Base containment box is adequate for containment of absorbent material located at base of obstacle.		
		b. Containment box does not display signs of rot, damage, or instability.		
		c. Containment box is large enough to dismount from obstacle without causing injury.		
Remarks:				



Purpose of obstacle is to give Soldiers confidence in their mental and physical abilities while cultivating personal courage. This obstacle is not timed.

Execution of obstacle: Soldier mounts and climbs net on lowest end (13 ft) of obstacle. Soldier goes over or between logs at top of rope, net or pole. Soldier moves across log walkway, climbs ladder to the high end (33 ft), then climbs down the cargo net to the ground.

Safety: Instructors conduct inspection and provide orientation and demonstration on apparatus. At a minimum, all ropes and wood surfaces are inspected prior to use for rips, tears or worn/insecure surfaces. Distance between rungs on log ladder should not exceed 36 in. Safety padding sufficient to break a fall should be emplaced at bottom of high (33 ft) cargo net. Instructor should be positioned at the top of the wooden ladder to observe/assist Soldiers over top log at high point and onto cargo net; instructor is to be secured with safety belt or harness to horizontal log to prevent instructor from being pulled off by Soldier negotiating apparatus.

Figure C-10. The tough one

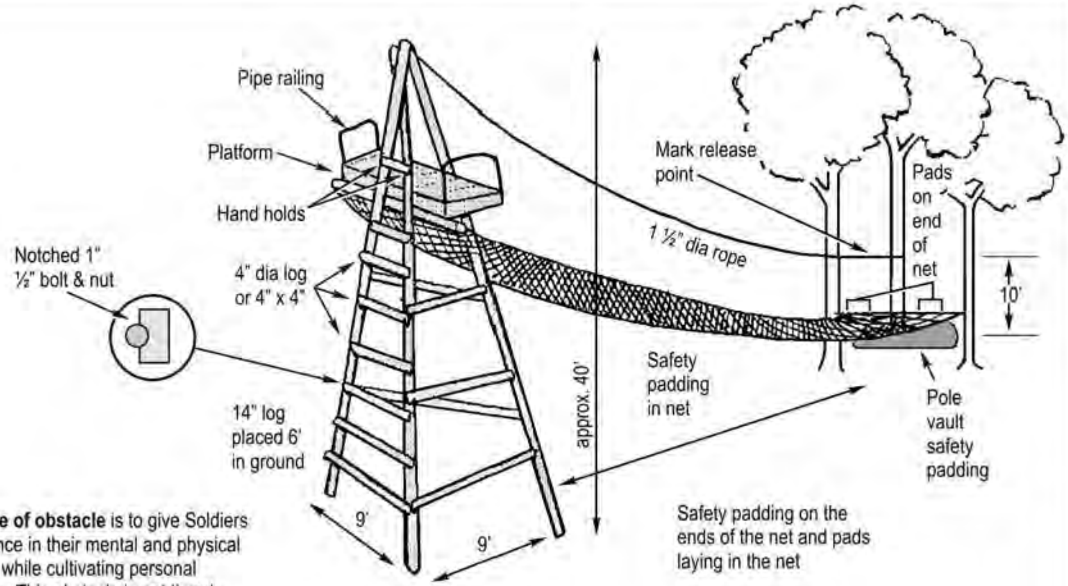
(2) See table C-6 and figure C-11 for the “inverted rope descent/the slide for life.”

Table C-6
Inverted rope descent/the slide for life

	AREA	STANDARD	GO	NO GO
1	Wood Timbers	a. There are no signs of rot, warping, severe weathering, or impact damage.		
		b. All timbers meet specified dimensions as stated in engineer drawings and TRADOC Regulation 350-6.		
		c. There are no protruding nails or splinters that may cause injury when obstacle is negotiated.		
		d. All timbers are connected securely together without excess separation between joints.		
2	Hardware	a. All bolts, nuts, and washers are in place and of the designated type and size.		
		b. All anchors are made of 3-strand galvanized guy wire or larger.		
		c. Take-up galvanized turnbuckles are used at anchor points of each cable to allow for adjustment.		
		d. Anchor cables are not used to support obstacles not properly constructed or improperly emplaced in the ground.		
		e. All cable clamps are positioned with U-bolt placed on the dead or short end of cable.		
3	Fiber ropes	a. All ropes are free of rips, tears, cuts, frays, rot, or unraveled sections due to age, excessive wear, or contact with the ground.		
		b. All ropes designed for surmounting are 1.5 inches in diameter.		
		c. Ropes are securely mounted to supporting timbers with ends tied and taped.		
4	Design	Professional safety staff reviews obstacle construction plans.		

Table C-6
Inverted rope descent/the slide for life, continued

	AREA	STANDARD	YES	NO
5	Fall protection	a. All nets meet ANSI load bearing standard for personnel (ANSI 10.11/OSHA 1926.105) 3.5-inch nylon mesh, 17,500 lb impact resistant.		
		b. All nets designed for fall protection extend 8 feet out from edge of obstacle.		
		c. Forged steel hooks are used to fasten net to its supports.		
		d. Nets are weight tested after initial installation and before being used as a fall protection system, whenever relocated, after major repair and every 6 months. The drop-test shall consist of 400 pound (180 kg) bag of sand 30 + or - 2 inches (76 + or - 5 cm) in diameter dropped into the net from the highest walking/working surface at which employees are exposed to fall hazards, but not from less than 42 inches (1.1 m) above that level. When the commander can demonstrate that it is unreasonable to perform the drop-test required by 29 CFR 1926.502 (c)(4)(i), the commander (or a designated competent person) shall certify that the net and net installation is in compliance with 29 CFR 1926.502(c)(4)(i) by preparing a certification record prior to the net being used as a fall protection system. The certification record must include an identification of the net and net installation for which the certification record is being prepared; the date that it was determined that the identified net and net installation were in compliance with 29 CFR 1926.502 (c)(3) and the signature of the person making the determination and certification. The most recent certification record for each net and net installation shall be available at the training site for inspection.		
		e. All nets suspended below high obstacles (excess of 10 feet) have padding or small mesh material to prevent limbs from penetrating mesh.		
		f. Pole-vaulting pads are in good condition with no tears, holes, or loose material, which can trip personnel when dismounting.		
		g. Pole-vaulting pads are properly placed at base of designated obstacles.		
6	Base contain-ment box	a. Base containment box is adequate for containment of absorbent material located at base of obstacle.		
		b. Containment box does not display signs of rot, damage, or instability.		
		c. Containment box is large enough to dismount from obstacle without causing injury.		
	Remarks:			



Purpose of obstacle is to give Soldiers confidence in their mental and physical abilities while cultivating personal courage. This obstacle is not timed.

Execution of obstacle: Soldier climbs tower, mounts center of platform (instructor available to assist), grasps rope firmly and swing legs upward. Soldier holds rope with legs to distribute weight between legs and arms. Braking the slide with feet and legs, Soldier proceeds down the rope. Soldiers must be warned that they could get rope burns on their hands if improperly executed. This obstacle can be dangerous when the rope is slippery. Soldiers leave the rope at a clearly marked point of release. Only one Soldier at a time is allowed on the rope.

This obstacle requires two instructors – one on the platform and the other on the ground.

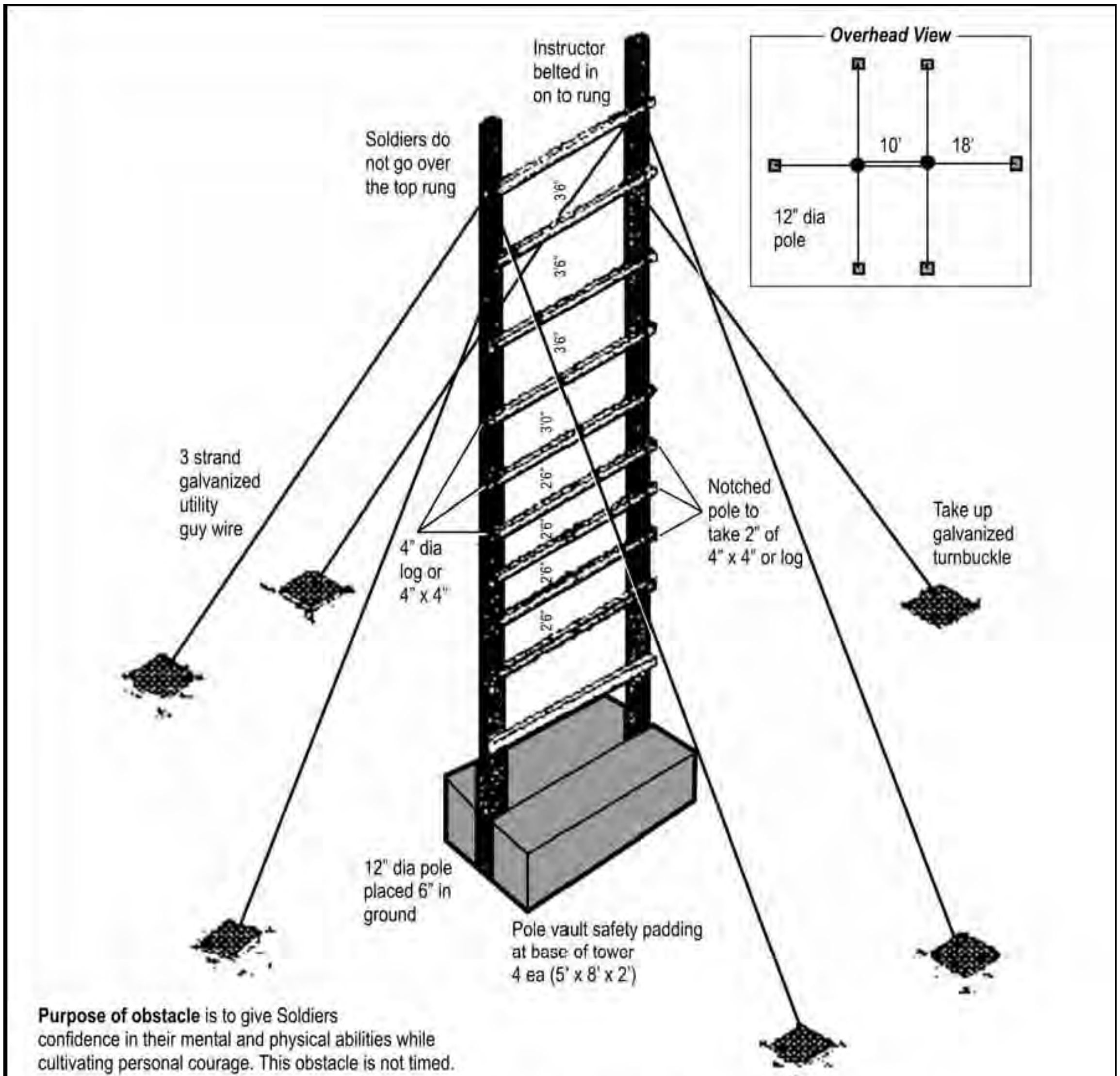
Safety: Instructors conduct inspection and provide orientation and demonstration on apparatus. At a minimum, all ropes, nets and wood surfaces are inspected prior to use for rips, tears or worn/unsecured surfaces. Spacing between the rungs on the log ladder should not exceed 36 inches. Rope will be 1.5 inch diameter with no knots in the vicinity of the mounting point. A safety net is attached so that a Soldier falling from any portion of the rope will land in the net before striking any part of the tower. Padding placed in the net will reduce likelihood of hands/fingers being twisted in the net. Safety padding sufficient to break a fall should be emplaced at the drop off point. Instructor is positioned on the tower platform to assist Soldiers mounting the rope; instructor is to be secured to tower to prevent instructor from being pulled off by Soldier negotiating apparatus. Padding is emplaced at the bottom end of the net (nearest release point) to prevent Soldier from injury on tightened portion of net. This obstacle is dangerous when rope becomes wet/slippery and should not be used. Gloves should not be worn on this apparatus.

Figure C-11. Inverted rope descent/the slide for life

(3) See table C-7 and figure C-12 for the "confidence climb."

Table C-7
Confidence climb checklist

	AREA	STANDARD	GO	NO GO
1	Wood timbers	a. There are no signs of rot, warping, severe weathering, or impact damage.		
		b. All timbers meet specified dimensions as stated in engineer drawings and TRADOC Regulation 350-6.		
		c. There are no protruding nails or splinters that may cause injury when obstacle is negotiated.		
		d. All timbers are securely connected together without excess separation between joints.		
2	Hardware	a. All bolts, nuts, and washers are in place and of the designated type and size.		
		b. All anchors are made of 3-strand galvanized guy wire or larger.		
		c. Take-up galvanized turnbuckles are used at anchor points of each cable to allow for adjustment.		
		d. Anchor cables are not used to support obstacles not properly constructed or improperly emplaced in the ground.		
		e. All cable clamps are positioned with U-bolt placed on the dead or short end of cable.		
3	Design	Professional safety staff reviews obstacle construction plans.		
4	Fall protection	a. Pole-vaulting pads are in good condition with no tears, holes, or loose material, which can trip personnel when dismounting.		
		b. All pole-vaulting pads are properly placed at base of designated obstacles.		
5	Base containment box	a. Base containment box is adequate for containment of absorbent material located at base of obstacle.		
		b. Containment box does not display signs of rot, damage, or instability.		
		c. Containment box is large enough to dismount from obstacle without causing injury.		
Remarks:				



Purpose of obstacle is to give Soldiers confidence in their mental and physical abilities while cultivating personal courage. This obstacle is not timed.

Execution of obstacle: Soldier climbs vertical ladder. Soldier goes up to second rung from top, climbs over, and climbs down other side of ladder. Soldier does not climb over top rung. Only one Soldier at a time is allowed.

Safety: Instructors conduct inspection and provide orientation and demonstration on apparatus. At a minimum, all surfaces and cables are inspected prior to use for breaks, splinters, tears or worn/unsecured surfaces. Safety padding sufficient to break a fall is emplaced at each side on bottom of ladder/tower (inclined ladders are removed to prevent falling soldier from striking cross members). Instructor is positioned on the tower to assist Soldiers climbing to other side; instructor is to be secured to tower to prevent instructor from being pulled off by Soldier negotiating apparatus. This obstacle is dangerous when beams become slippery and should not be used. Gloves should not be worn on this apparatus.

Figure C-12. Confidence climb

(4) See table C-8 and figure C-13 for the "skyscraper."

Table C-8
Skyscraper checklist

	AREA	STANDARD	GO	NO GO
1	Wood timbers	a. There are no signs of rot, warping, severe weathering, or impact damage.		
		b. All timbers meet specified dimensions as stated in engineer drawings.		
		c. There are no protruding nails or splinters that may cause injury when obstacle is negotiated.		
		d. All timbers are securely connected together without excess separation between joints.		
2	Hardware	a. All bolts, nuts, and washers are in place and of the designated type and size.		
		b. All anchors are made of 3-strand galvanized guy wire or larger.		
		c. Take-up galvanized turnbuckles are used at anchor points of each cable to allow for adjustment.		
		d. Anchor cables are not used to support obstacles not properly constructed or improperly emplaced in the ground.		
		e. All cable clamps are positioned with U-bolt placed on the dead or short end of cable.		
3	Design	Professional safety staff reviews obstacle construction plans.		
4	Fall protection	a. All nets meet American National Standards Institute (ANSI) load bearing standard for personnel (ANSI 10.11/OSHA 1926.105) 3.5-inch nylon mesh, 17,500 lb impact resistant.		
		b. All nets designed for fall protection extend 8 feet out from point of potential fall.		
		c. Forged steel hooks are used to fasten net to its supports.		
		d. Nets are weight tested after initial installation and before being used as a fall protection system, whenever relocated, after major repair and every 6 months. The drop-test shall consist of 400 pound (180 kg) bag of sand 30 + or - 2 inches (76 + or - 5 cm) in diameter dropped into the net from the highest walking/working surface at which employees are exposed to fall hazards, but not from less than 42 inches (1.1 m) above that level. When the commander can demonstrate that it is unreasonable to perform the drop-test required by 29 CFR 1926.502 (c)(4)(i), the commander (or a designated competent person) shall certify that the net and net installation is in compliance with 29 CFR 1926.502(c)(4)(i) by preparing a certification record prior to the net being used as a fall protection system. The certification record must include an identification of the net and net installation for which the certification record is being prepared; the date that it was determined that the identified net and net installation were in compliance with 29 CFR 1926.502 (c)(3) and the signature of the person making the determination and certification. The most recent certification record for each net and net installation shall be available at the training site for inspection		
		e. All nets suspended below high obstacles (excess of 10 feet) have padding to prevent limbs from penetrating net.		
		f. Pole-vaulting pads are in good condition with no tears, holes, or loose material, which can trip personnel when dismounting.		
		g. Pole-vaulting pads are properly placed at base of designated obstacles.		

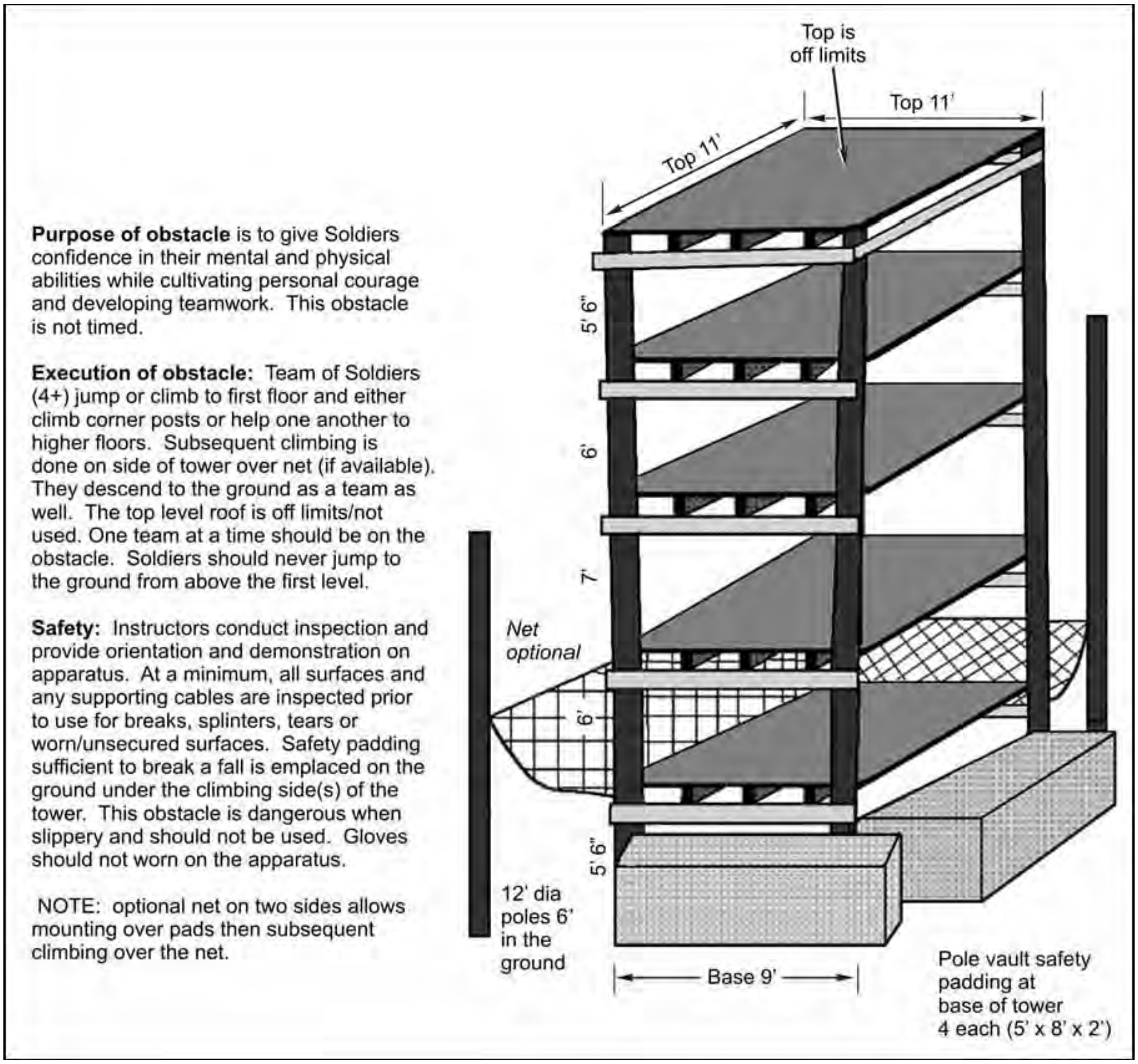


Figure C-13. Skyscraper

(5) See table C-9 and figure C-14 for the "belly robber."

Table C-9
Belly Robber checklist

	AREA	STANDARD	GO	NO GO
1.	Wood timbers	a. There are no signs of rot, warping, severe weathering, or impact damage.		
		b. All timbers meet specified dimensions as stated in engineer drawings.		
		c. There are no protruding nails or splinters that may cause injury when obstacle is negotiated.		
		d. All timbers are securely connected together without excess separation between joints.		
		e. All timbers are free of chemical coatings or substances that affect Soldier's ability to negotiate obstacle.		
2	Hardware	All bolts, nuts, and washers are in place and of the designated type and size.		
3	Design	Professional safety staff reviews obstacle construction plans.		
Remarks:				

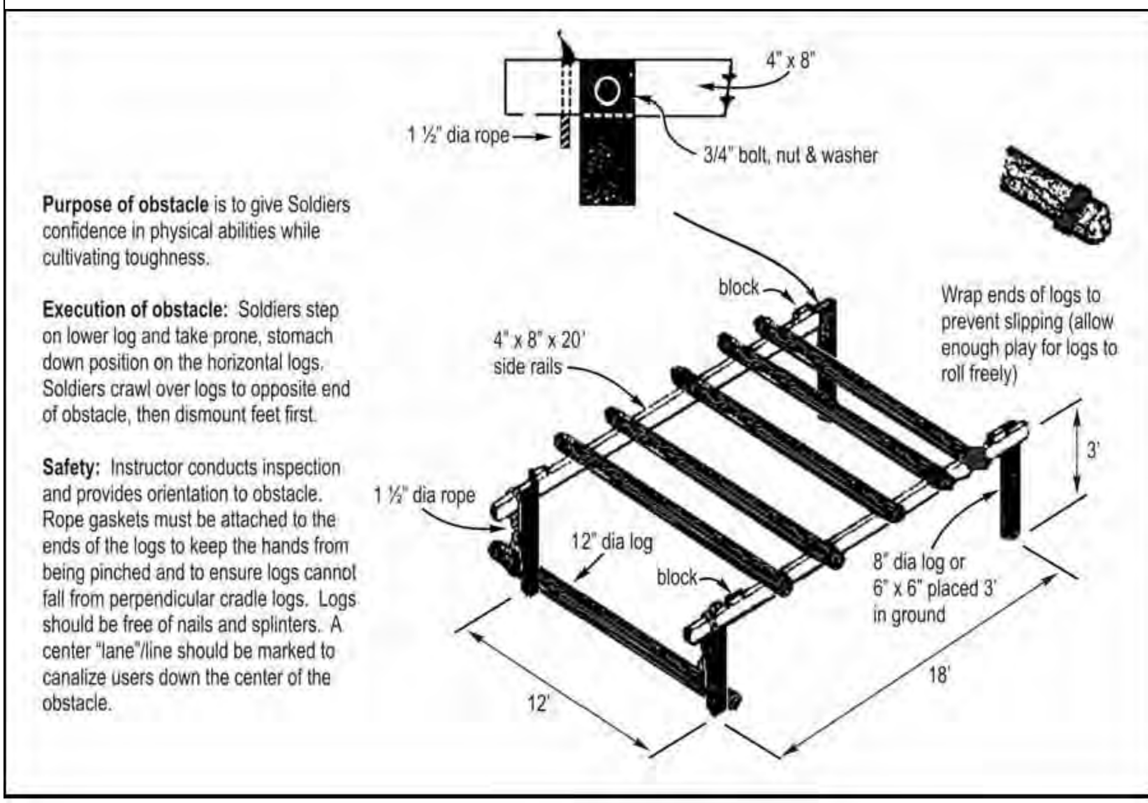


Figure C-14. Belly robber

(6) See table C-10 and figure C-15 for "the Tarzan."

Table C-10
The Tarzan checklist

	AREA	STANDARD	GO	NO GO
1	Wood timbers	a. There are no signs of rot, warping, severe weathering, or impact damage.		
		b. All timbers meet specified dimensions as stated in engineer drawings and TRADOC Regulation 350-6.		
		c. There are no protruding nails or splinters that may cause injury when obstacle is negotiated.		
		d. All timbers are securely connected together without excess separation between joints.		
		e. Rungs on horizontal ladder are modified to support Gender Integrated Training (diameter is reduced to accommodate smaller hand sizes).		
2	Hardware	All bolts, nuts, and washers are in place and of the designated type and size.		
3	Design	Professional safety staff reviews obstacle construction plans.		
Remarks:				

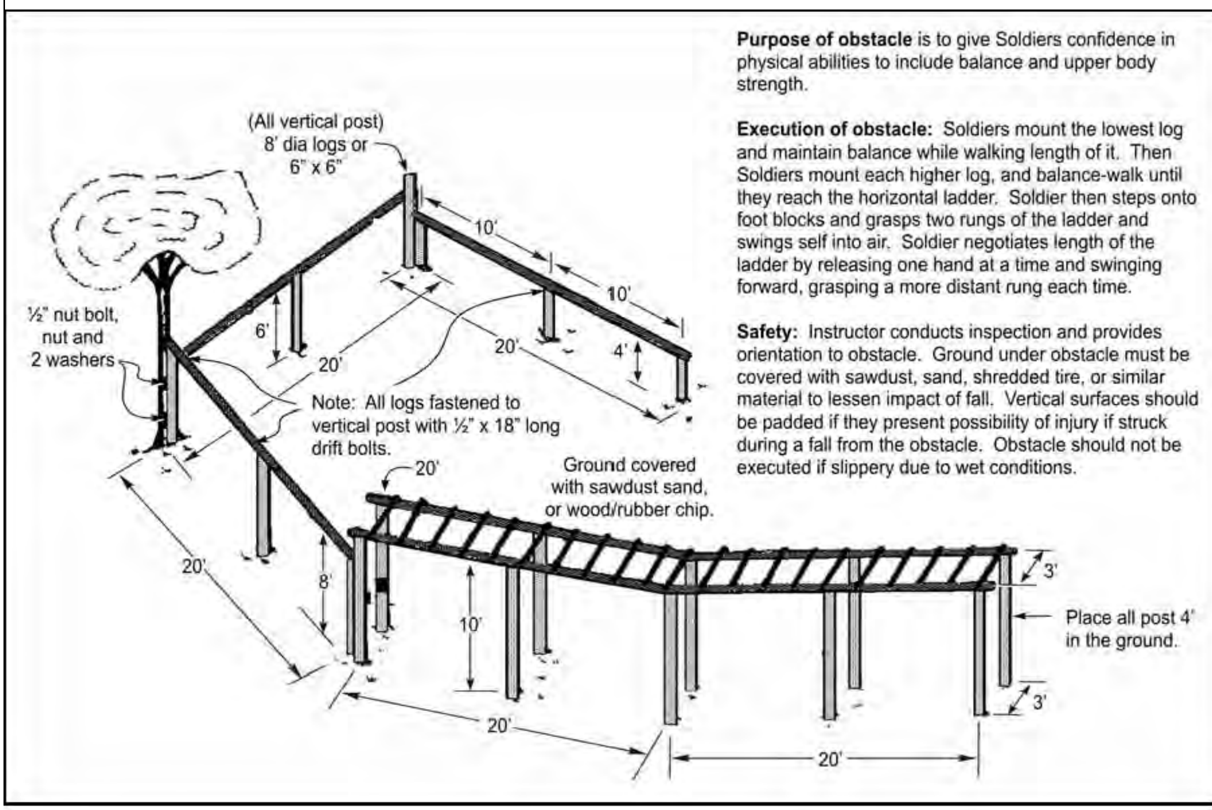


Figure C-15. The tarzan

(7) See Table C-11 and Figure C-16 for the "Low belly over."

Table C-11
Low belly over checklist

	AREA	STANDARD	GO	NO GO
1	Wood timbers	a. No signs of rot, warping, severe weathering, or impact damage.		
		b. All timbers meet specified dimensions as stated in engineer drawings.		
		c. There are no protruding nails or splinters that may cause injury when obstacle is negotiated.		
		d. All timbers are securely connected together without excess separation between joints.		
		e. All timbers are free of chemical coatings or substances that affect Soldier's ability to negotiate obstacle.		
2	Hardware	All bolts, nuts, washers are in place and of the designated type/ size.		
3	Fiber ropes	All ropes are free of rips, tears, cuts, frays, rot, or unraveled sections due to age, excessive wear, or contact with the ground.		
4	Design	Professional safety staff reviews obstacle construction plans.		
5	Padding on timbers	a. All padding on timbers is in good condition no signs of damage.		
		b. Pads are securely attached to the timber supports to prevent movement when impacted.		
Remarks:				

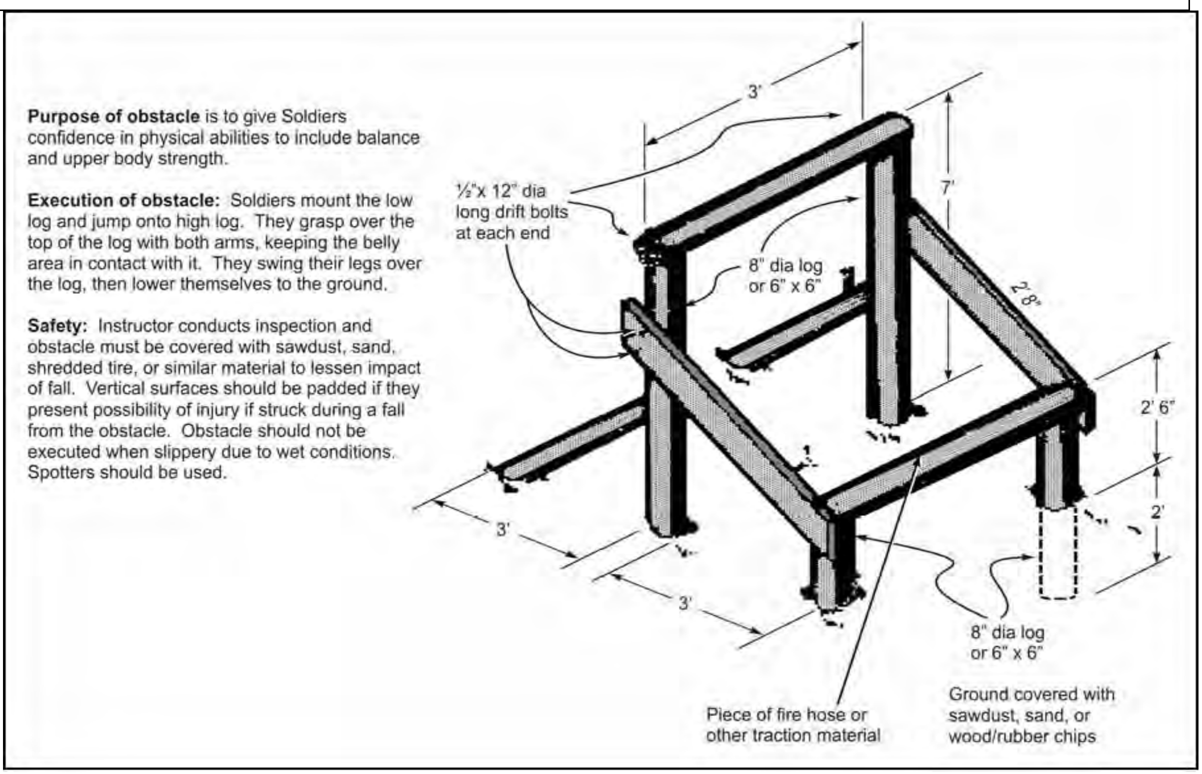


Figure C-16. Low belly over

(8) See table C-12 and figure C-17 for "the dirty name."

Table C-12
The dirty name checklist

	AREA	STANDARD	GO	NO GO
1	Wood timbers	a. There are no signs of rot, warping, severe weathering, or impact damage.		
		b. All timbers meet specified dimensions as stated in engineer drawings.		
		c. There are no protruding nails or splinters that may cause injury when obstacle is negotiated.		
		d. All timbers are securely connected together without excess separation between joints.		
2	Hardware	All bolts, nuts, and washers are in place and of the designated type and size.		
3	Design	Professional safety staff reviews obstacle construction plans.		
4	Padding on timbers	a. All padding on timbers is in good condition without signs of damage.		
		b. Pads are securely attached to the timber supports to prevent movement when impacted.		
5	Base contain-ment box	a. Base containment box is adequate for containment of absorbent material located at base of obstacle.		
		b. Containment box does not display signs of rot, damage, or instability.		
		c. Containment box is large enough to dismount from obstacle without injury.		
Remarks:				

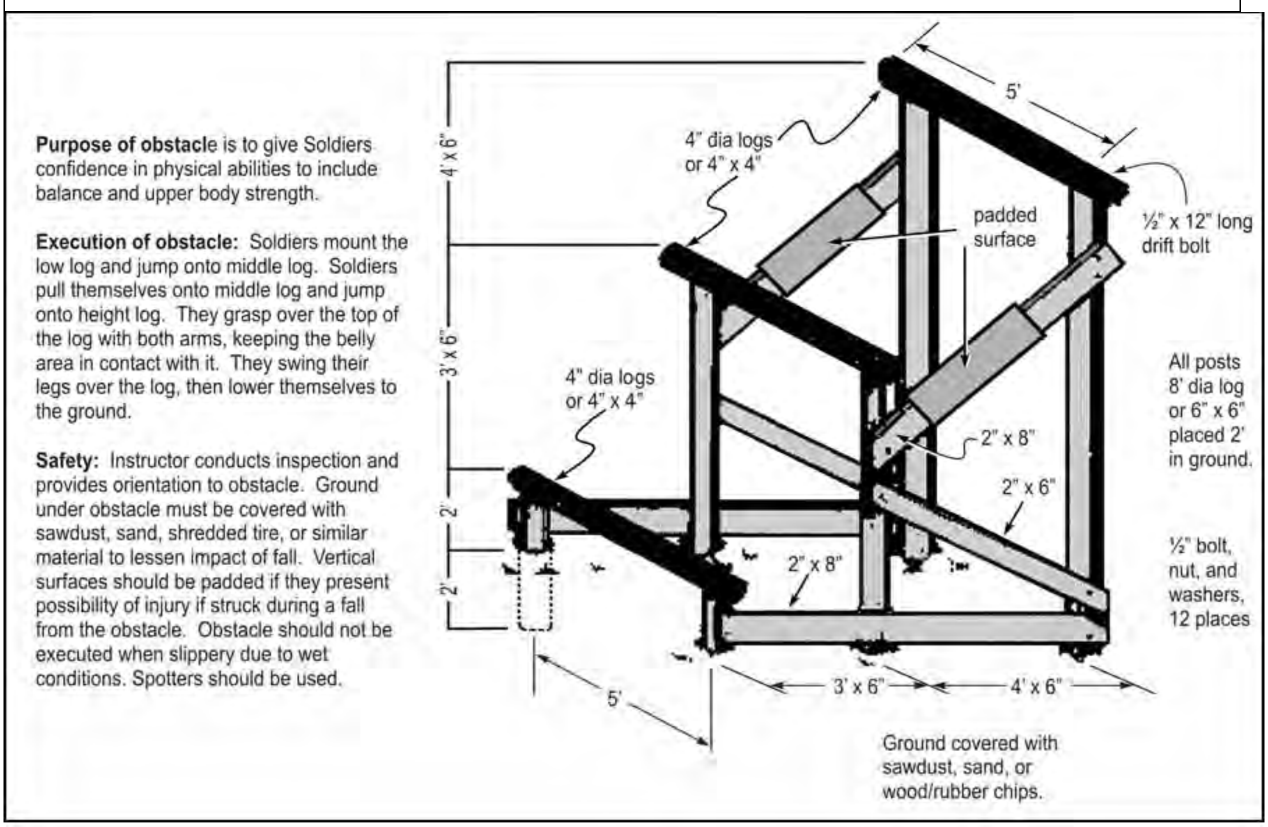


Figure C-17. The dirty name

(8) See table C-13 and figure C-18 for "the tough nut."

Table C-13
The tough nut checklist

	AREA	STANDARD	GO	NO GO
1	Wood timbers	a. There are no signs of rot, warping, severe weathering, or impact damage.		
		b. All timbers meet specified dimensions as stated in engineer drawings.		
		c. There are no protruding nails or splinters that may cause injury when obstacle is negotiated.		
		d. All timbers are securely connected together without excess separation between joints.		
		e. All timbers are free of chemical coatings or substances that affect Soldier's ability to negotiate obstacle.		
2	Hardware	All wire/bolts are of the designated type and size.		
3	Design	a. Professional safety staff reviews obstacle construction plans.		
		b. Center height of "X" does not exceed 30 inches.		
Remarks:				

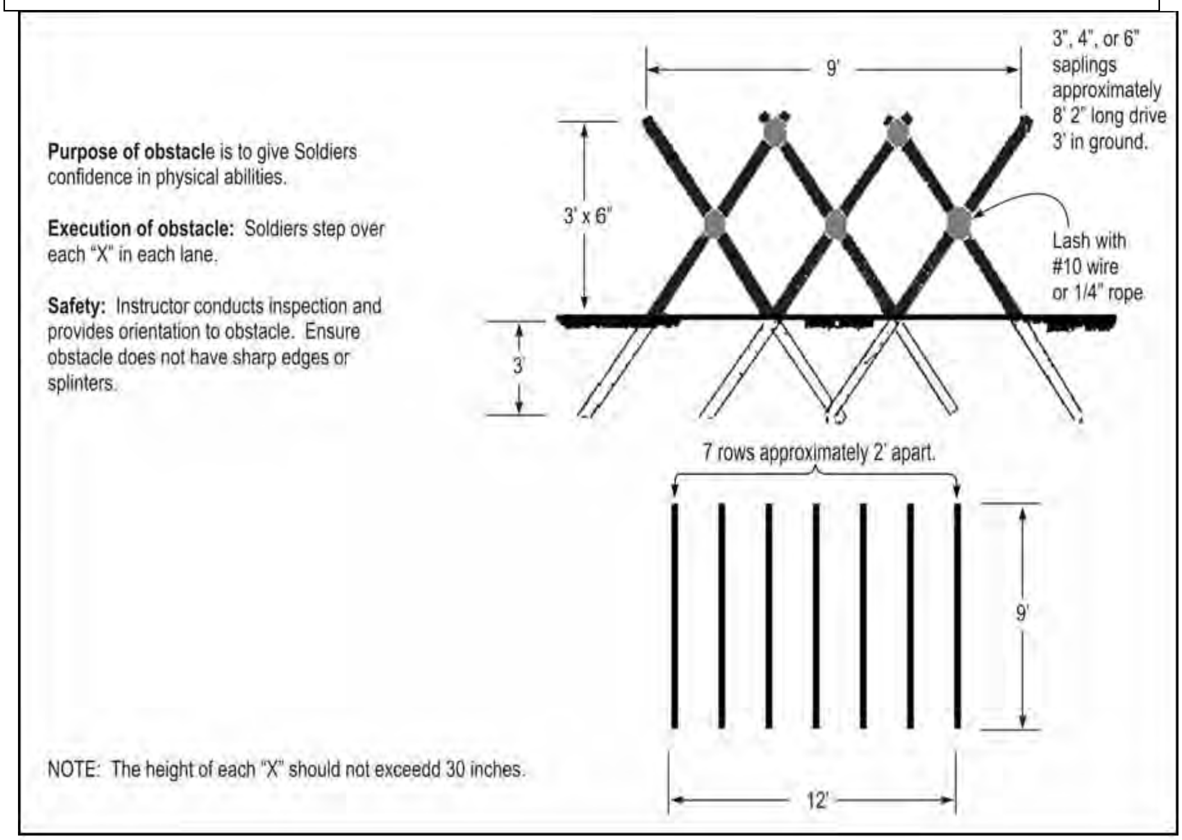


Figure C-18. The tough nut

(9) See table C-14 and figure C-19 for the "belly crawl."

Table C-14
Belly crawl checklist

	AREA	**STANDARD**	**GO**	**NO GO**
1	Wood timbers	a. There are no signs of rot, warping, severe weathering, or impact damage.		
		b. All timbers meet specified dimensions as stated in engineer drawings.		
		c. There are no protruding nails or splinters that may cause injury when obstacle is negotiated.		
2	Hardware	All wires, screws, or nails are in place and of the designated type and size.		
3	Design	Professional safety staff reviews obstacle construction plans.		
4	Surfaces	All surfaces beneath low surfaces are free of hazards with the potential to cause injury.		
Remarks:				

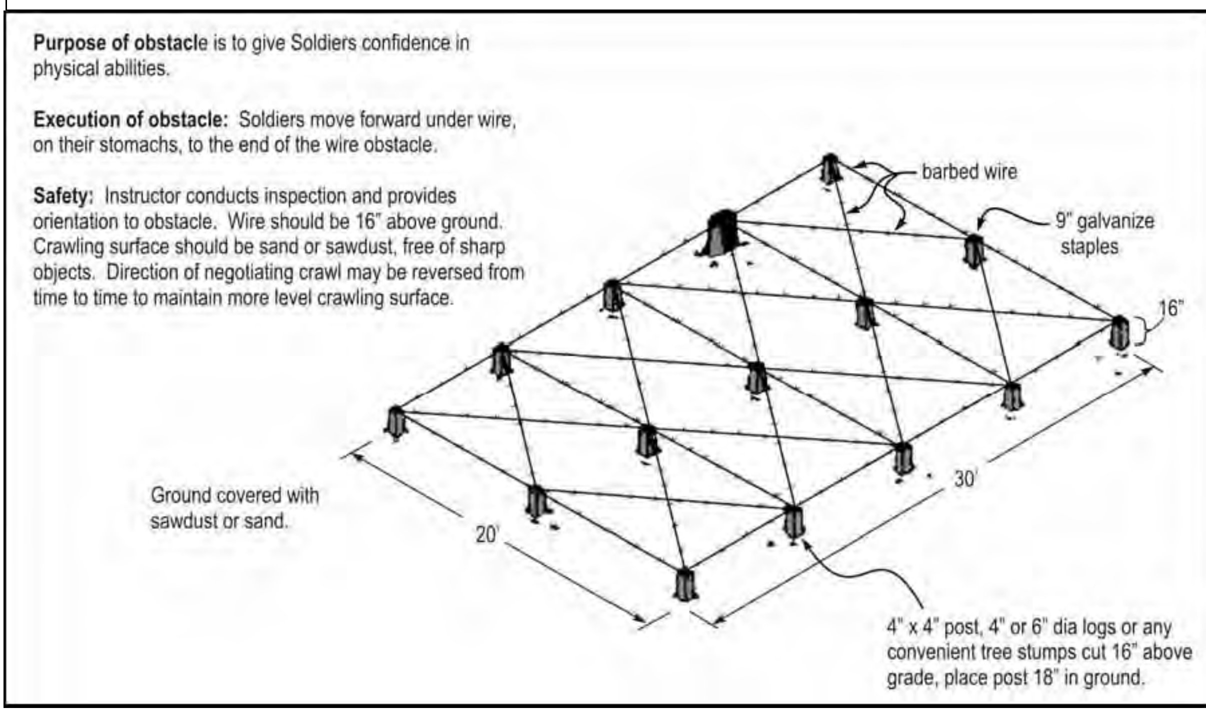


Figure C-19. Belly crawl

(10) See table C-15 and figure C-20 for the "inclining wall."

Table C-15
Inclining wall checklist

	AREA	STANDARD	GO	NO GO
1	Wood timbers	a. There are no signs of rot, warping, severe weathering, or impact damage.		
		b. All timbers meet specified dimensions as stated in engineer drawings.		
		c. There are no protruding nails or splinters that may cause injury when obstacle is negotiated.		
		d. All timbers are securely connected together without excess separation between joints.		
2	Wall boards	a. All boards are securely attached to structure with proper hardware.		
		b. All boards free of protruding nails, splinters, rot, or damage.		
		c. Edges of boards rounded/smooth where used to support individual’s weight..		
3	Hardware	a. All bolts, nuts, and washers in place and of the designated type, size, and placement.		
		b. All cable clamps are positioned with U-bolt placed on the dead or short end of cable.		
4	Design	Professional safety staff reviews obstacle construction plans.		
Remarks:				

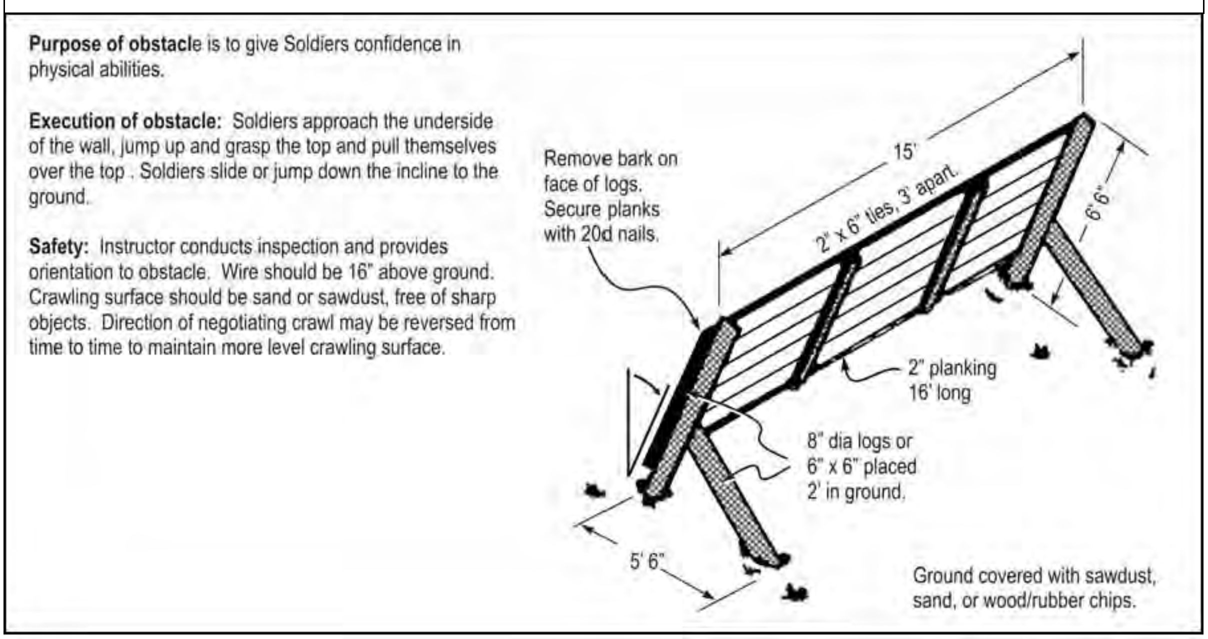


Figure C-20. Inclining wall

(10) See table C-16 and figure C-21 for the “swing, stop, and jump.”

Table C-16
Swing, stop, and jump checklist

	AREA	STANDARD	GO	NO GO
1	Wood timbers	a. There are no signs of rot, warping, severe weathering, or impact damage.		
		b. All timbers meet specified dimensions as stated in engineer drawings.		
		c. There are no protruding nails or splinters that may cause injury when obstacle is negotiated.		
		d. All timbers are securely connected together without excess separation between joints.		
		e. All timbers are free of chemical coatings or substances that affect Soldier's ability to negotiate obstacle.		
2	Hardware	a. All bolts, nuts, and washers are in place and of the designated type and size.		
		b. Surmounting ropes have knots at ends or are taped to prevent fraying.		
3	Fiber ropes	All ropes are free of rips, tears, cuts, frays, rot, or unraveled sections due to age, excess wear, or contact with the ground.		
4	Design	Professional safety staff reviews obstacle construction plans.		
5	Padding on timbers	a. All padding on timbers is in good condition without signs of damage.		
		b. Pads are securely attached to the timber supports to prevent movement when impacted.		
6	Base containment box	a. Base containment box is adequate for containment of absorbent material located at base of obstacle.		
		b. Containment box does not display signs of rot, damage, or instability.		
		c. Containment box is large enough to dismount from obstacle without causing injury.		
Remarks:				

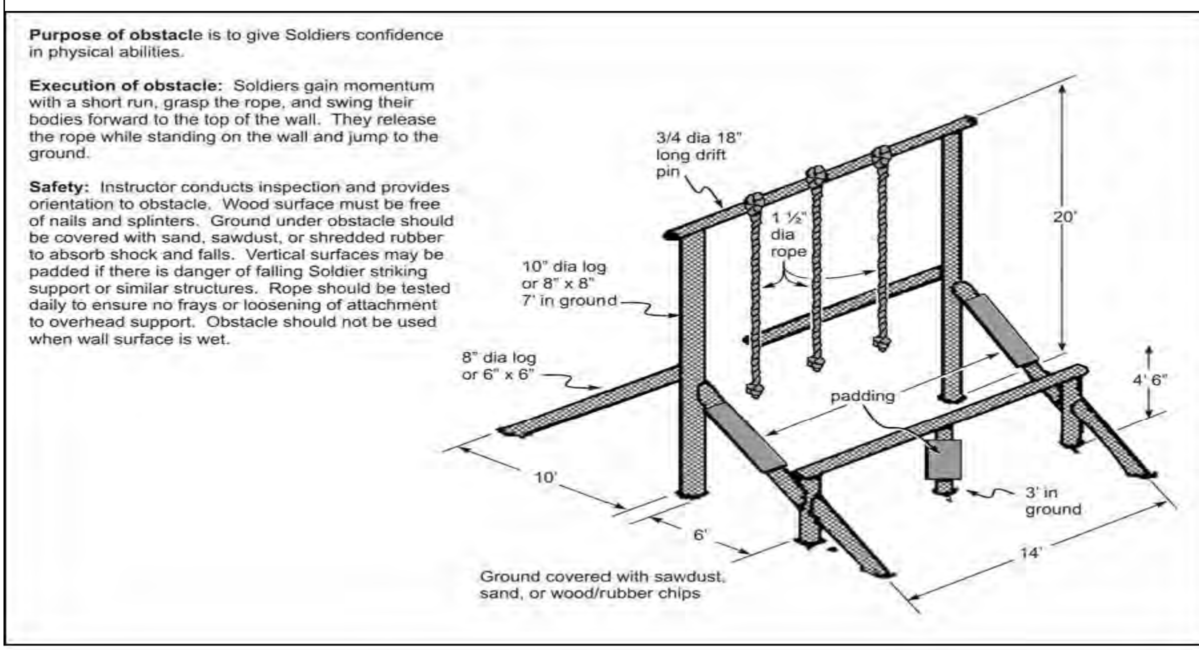


Figure C-21. Swing, stop, and jump

(11) See table C-17 and figure C-22 for the "six vaults."

Table C-17
Six vaults checklist

	AREA	STANDARD	GO	NO GO
1	Wood timbers	a. There are no signs of rot, warping, severe weathering, or impact damage.		
		b. All timbers meet specified dimensions as stated in engineer drawings.		
		c. There are no protruding nails or splinters that may cause injury when obstacle is negotiated.		
		d. All timbers are securely connected together without excess separation between joints.		
		e. All timbers are free of chemical coatings or substances that affect Soldier's ability to negotiate obstacle.		
2	Hardware	All bolts, nuts, and washers are in place and of the designated type and size.		
3	Design	Professional safety staff reviews obstacle construction plans.		
Remarks:				

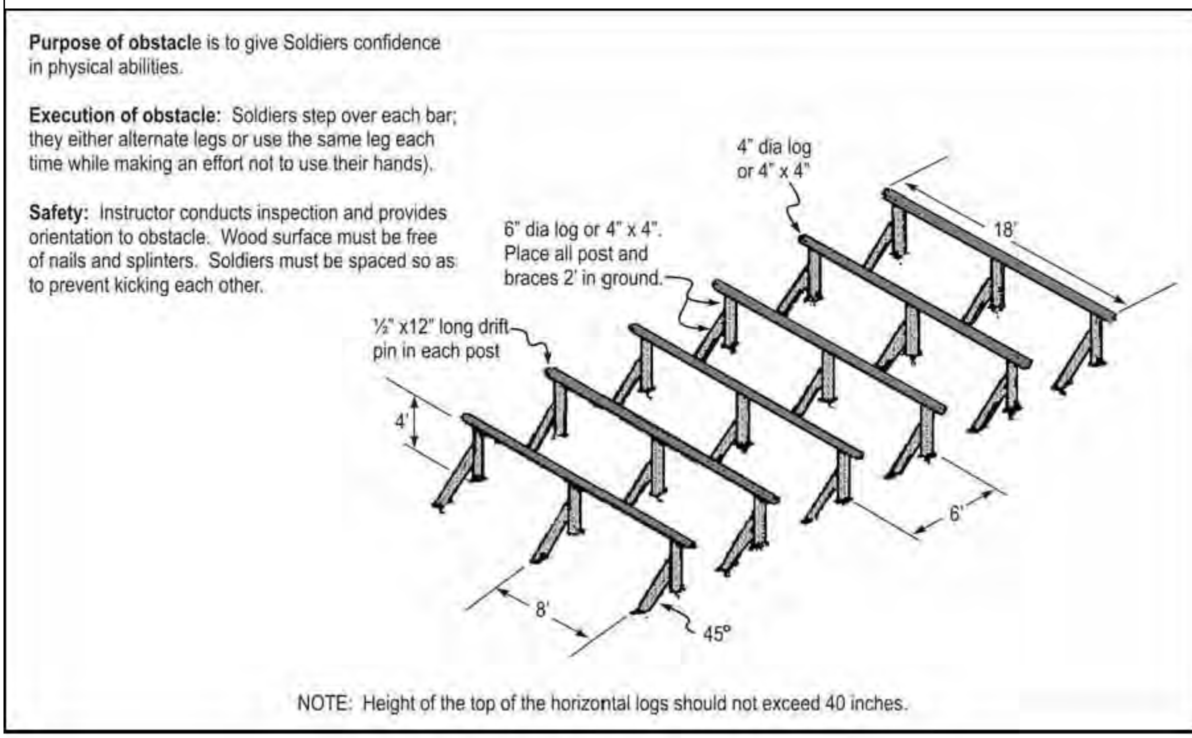


Figure C-22. Six vaults

(12) See table C-18 and figure C-23 for the "easy balancer."

Table C-18
Easy balancer checklist

	AREA	STANDARD	GO	NO GO
1	Wood timbers	a. There are no signs of rot, warping, severe weathering, or impact damage.		
		b. All timbers meet specified dimensions as stated in engineer drawings.		
		c. There are no protruding nails or splinters that may cause injury when obstacle is negotiated.		
		d. All timbers are securely connected together without excess separation between joints.		
		e. All timbers are free of chemical coatings or substances that affect Soldier's ability to negotiate obstacle.		
2	Hardware	All bolts, nuts, and washers are in place and of the designated type and size.		
3	Design	Professional safety staff reviews obstacle construction plans.		
4	Base containment box	a. Base containment box is adequate for containment of absorbent material located at base of obstacle.		
		b. Containment box does not display signs of rot, damage, or instability.		
		c. Containment box is large enough to dismount from obstacle without causing injury.		
Remarks:				

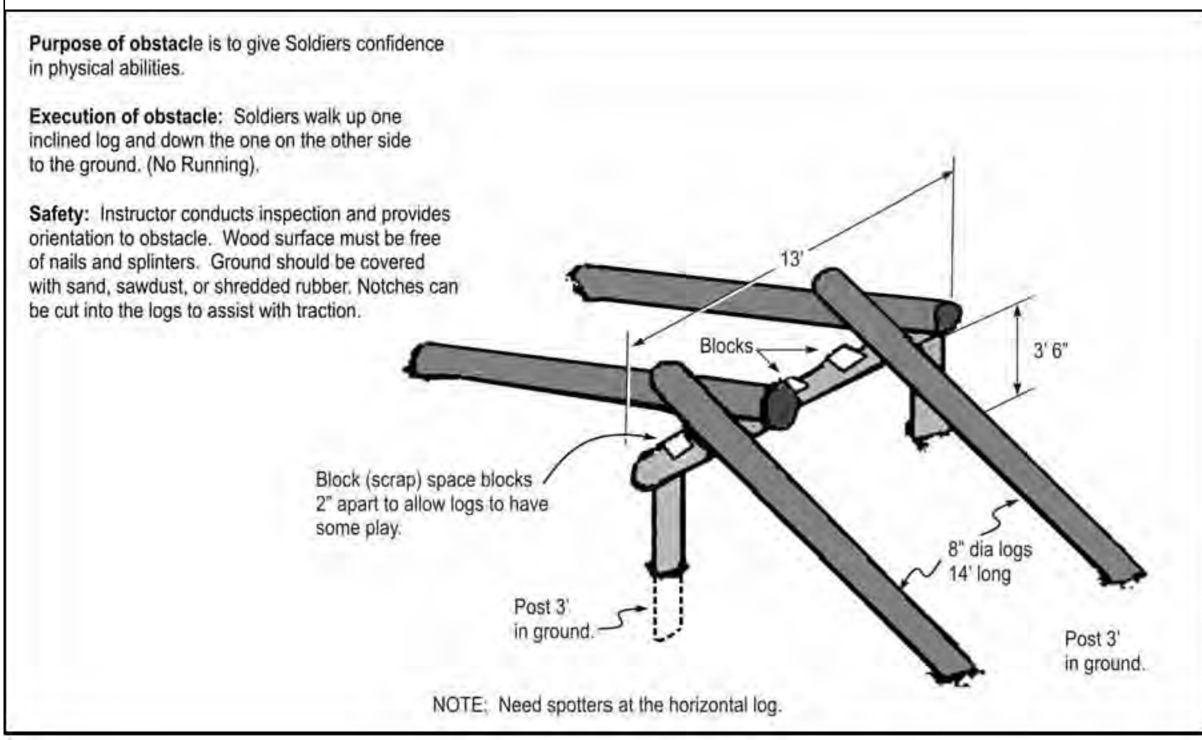


Figure C-23. Easy balancer

(13) See table C-19 and figure C-24 for the "low wire."

Table C-19
Low wire checklist

	AREA	**STANDARD**	**GO**	**NO GO**
1	Wood timbers	a. There are no signs of rot, warping, severe weathering, or impact damage.		
		b. All timbers meet specified dimensions as stated in engineer drawings.		
		c. There are no protruding nails or splinters that may cause injury when obstacle is negotiated.		
		d. All timbers are securely connected together without excess separation between joints.		
2	Hardware	All wire, nails, or screws are in place and of the designated type and size.		
3	Design	Professional safety staff reviews obstacle construction plans.		
4	Surfaces	All surfaces beneath low obstacles are free of hazards with the potential to cause injury.		
Remarks:				

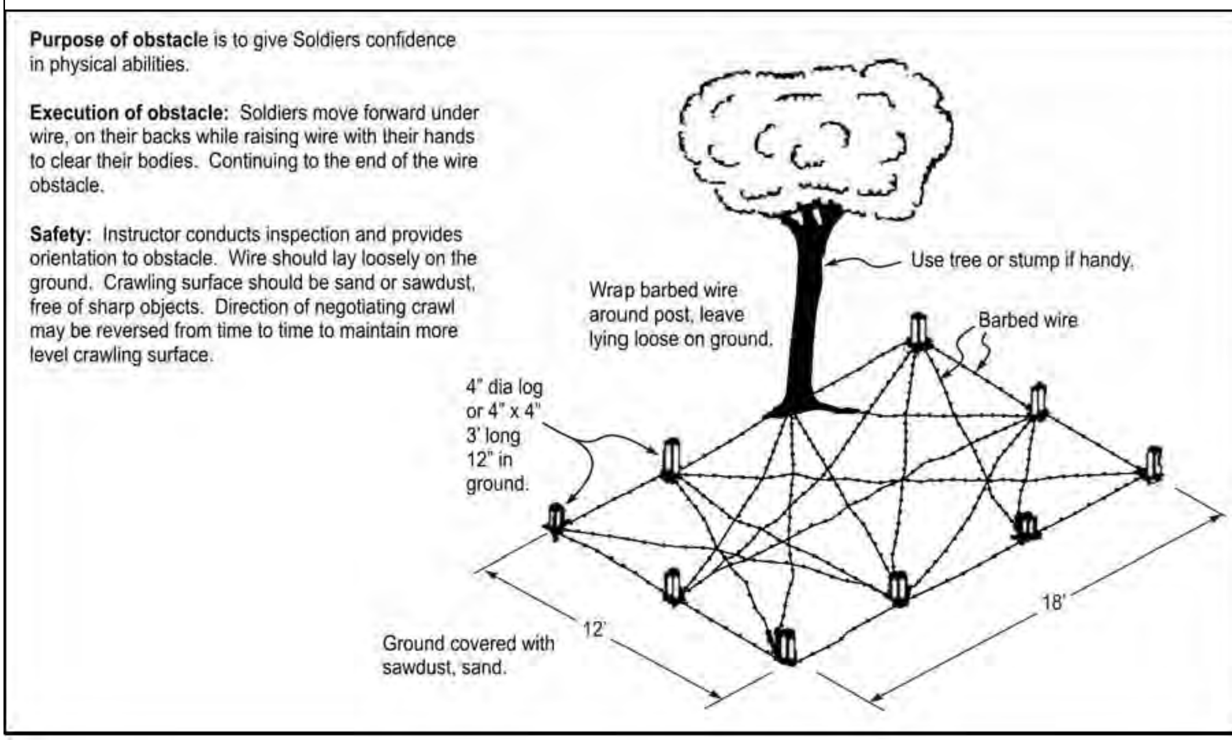


Figure C-24. Low wire

(14) See table C-20 and figure C-25 for “the belly buster.”

Table C-20
The belly buster checklist

	AREA	STANDARD	GO	NO GO
1	Wood timbers	a. There are no signs of rot, warping, severe weathering, or impact damage.		
		b. All timbers meet specified dimensions as stated in engineer drawings.		
		c. There are no protruding nails or splinters that may cause injury when obstacle is negotiated.		
		d. All timbers are securely connected together without excess separation between joints.		
		e. All timbers are free of chemical coatings or substances that affect Soldier's ability to negotiate obstacle.		
2	Hardware	a. All bolts, nuts, and washers are in place and of the designated type/size.		
		b. Soldiers are warned to keep hands and fingers away from parts of log resting on cradle.		
		c. Soldiers are informed not to rock or roll log while others are negotiating obstacle.		
3	Design	Professional safety staff reviews obstacle construction plans.		
4	Base containment box	a. Base containment box is adequate for containment of absorbent material located at base of obstacle.		
		b. Containment box does not display signs of rot, damage, or instability.		
		c. Containment box is large enough to dismount from obstacle without causing injury.		
Remarks:				

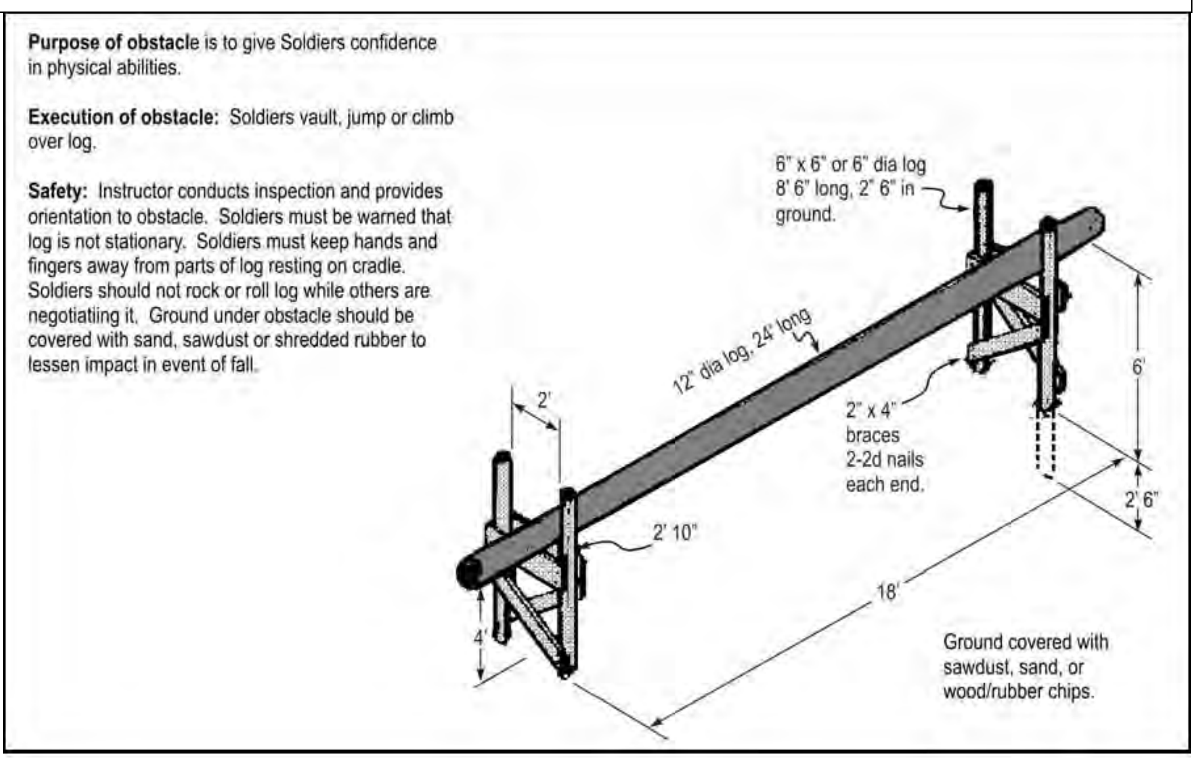


Figure C-25. Belly buster

(15) See table C-21 and figure C-26 for "the belly buster."

Table C-21
Hip-hip checklist

	AREA	STANDARD	GO	NO GO
1	Wood Timbers	a. There are no signs of rot, warping, severe weathering, or impact damage.		
		b. All timbers meet specified dimensions as stated in engineer drawings.		
		c. There are no protruding nails or splinters that may cause injury when obstacle is negotiated.		
		d. All timbers are securely connected together without excess separation between joints.		
		e. All timbers are free of chemical coatings or substances that affect Soldier's ability to negotiate obstacle.		
2	Hardware	All bolts, nuts, and washers are in place and of the designated type and size.		
3	Design	Professional safety staff reviews obstacle construction plans.		
4	Surfaces	All surfaces beneath low obstacles are free of hazards with the potential to cause injury.		
Remarks:				

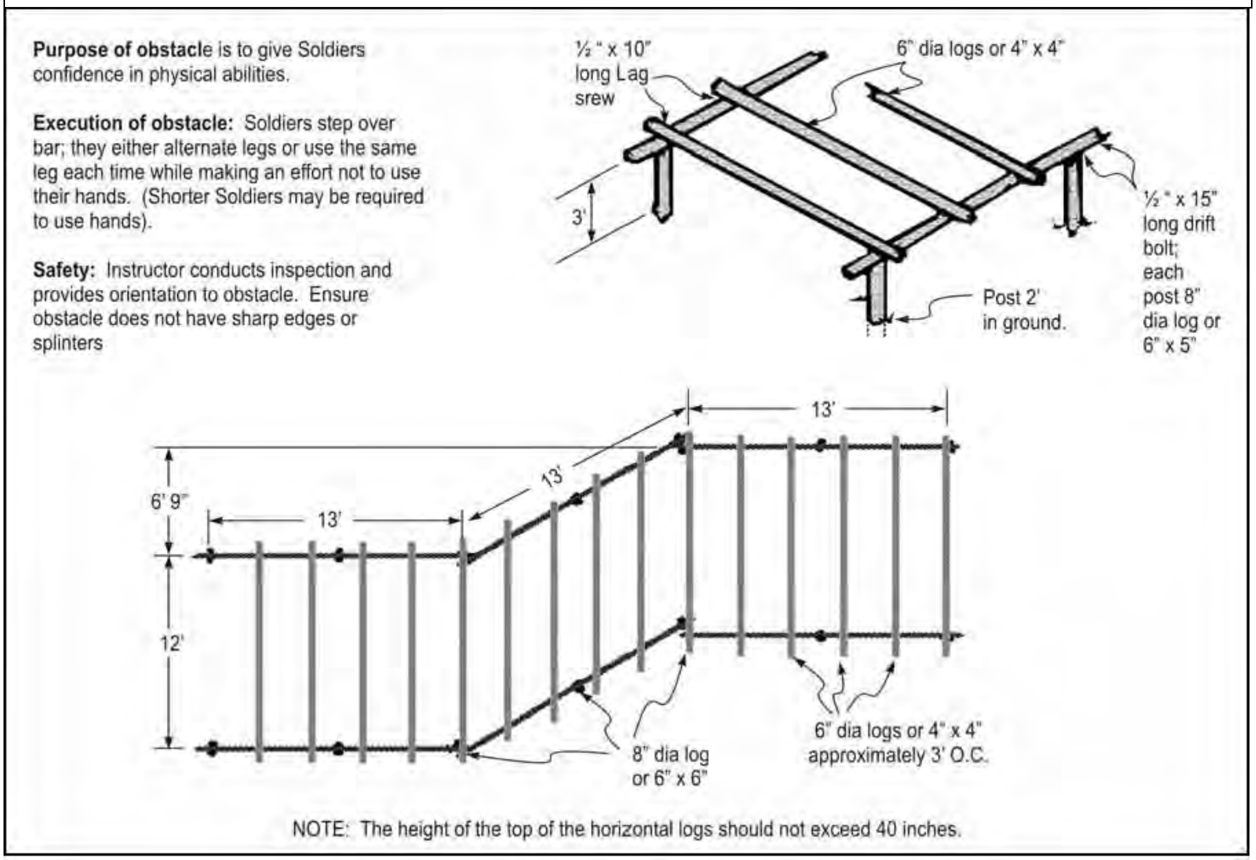


Figure C-26. Hip-hip

(16) See table C-22 and figure C-27 for the "reverse climb."

Table C-22
Reverse climb checklist

	AREA	STANDARD	GO	NO GO
1	Wood timbers	a. There are no signs of rot, warping, severe weathering, or impact damage.		
		b. All timbers meet specified dimensions as stated in engineer drawings.		
		c. There are no protruding nails or splinters that may cause injury when obstacle is negotiated.		
		d. All timbers are securely connected together without excess separation between joints.		
		e. All timbers are free of chemical coatings or substances that affect Soldier's ability to negotiate obstacle.		
2	Hardware	All bolts, nuts, and washers are in place and of the designated type and size.		
3	Design	Professional safety staff reviews obstacle construction plans.		
4	Padding on timbers	a. All padding on timbers is in good condition without signs of damage.		
		b. Pads are securely attached to the timber supports to prevent movement when impacted.		
5	Base containment box	a. Base containment box is adequate for containment of absorbent material located at base of obstacle.		
		b. Containment box does not display signs of rot, damage, or instability.		
		c. Containment box is large enough to dismount from obstacle without injury.		
Remarks:				

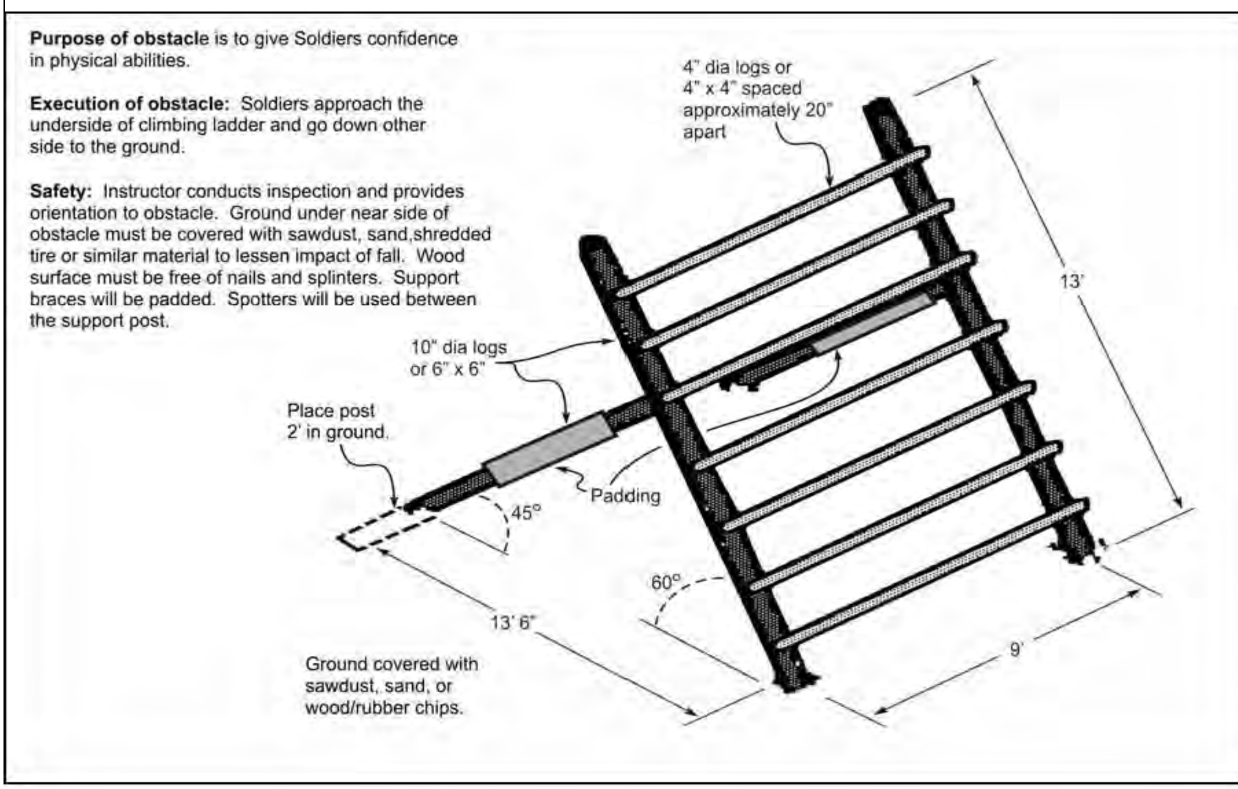


Figure C-27. Reverse climb

(17) See table C-23 and figure C-28 for "the weaver."

Table C-23
The weaver checklist

	AREA	STANDARD	GO	NO GO
1	Wood timbers	a. There are no signs of rot, warping, severe weathering, or impact damage.		
		b. All timbers meet specified dimensions as stated in engineer drawings.		
		c. There are no protruding nails or splinters that may cause injury when obstacle is negotiated.		
		d. All timbers are securely connected together without excess separation between joints.		
		e. All timbers are free of chemical coatings or substances that affect Soldier's ability to negotiate obstacle.		
2	Hardware	All bolts, nuts, and washers are in place and of the designated type and size.		
3	Design	Professional safety staff reviews obstacle construction plans.		
4	Base containment box	a. Base containment box is adequate for containment of absorbent material located at base of obstacle.		
		b. Containment box does not display signs of rot, damage, or instability.		
		c. Containment box is large enough to dismount from obstacle without causing injury.		
Remarks:				

Purpose of obstacle is to give Soldiers confidence in physical abilities.

Execution of obstacle: Soldiers move from one end of the obstacle to the other by weaving their bodies under one bar and over the next.

Safety: Instructor conducts inspection and provides orientation to obstacle. Ground under obstacle must be covered with sawdust, sand, shredded tire or similar material to lessen impact of fall. Wood surface must be free of nails and splinters. Spotters should be used in center. Safety pads will be used under the apex.

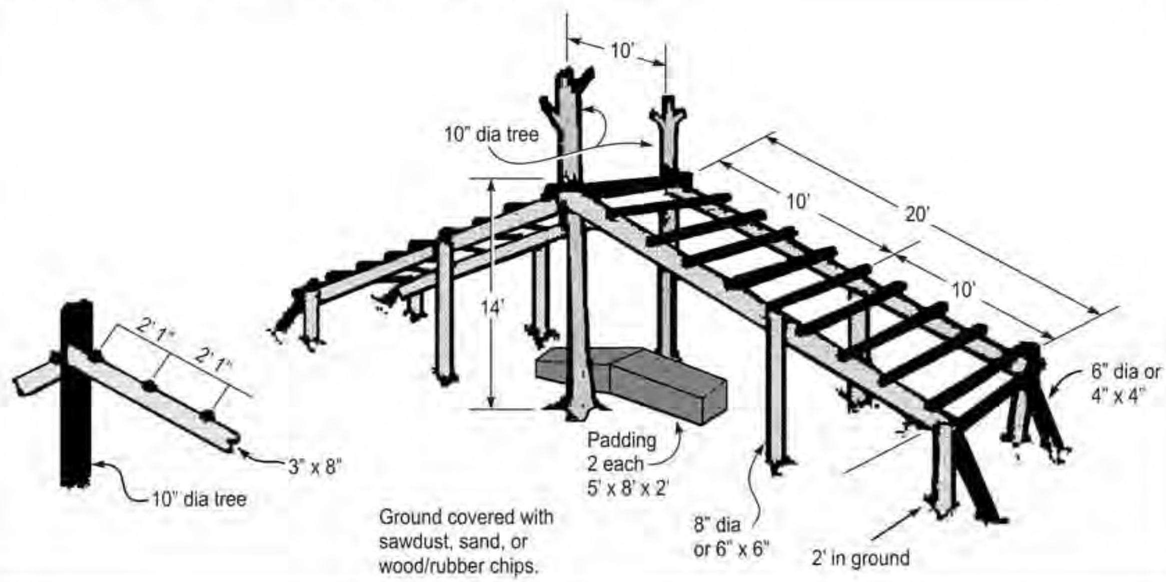


Figure C-28. The weaver

(18) See table C-24 and figure C-29 for the "balancing logs."

Table C-24
Balancing logs checklist

	AREA	STANDARD	GO	NO GO
1	Wood timbers	a. There are no signs of rot, warping, severe weathering, or impact damage.		
		b. All timbers meet specified dimensions as stated in engineer drawings.		
		c. There are no protruding nails or splinters that may cause injury when obstacle is negotiated.		
		d. All timbers are securely connected together without excess separation between joints.		
		e. All timbers are free of chemical coatings or substances that affect Soldier's ability to negotiate obstacle.		
2	Hardware	All bolts, nuts, and washers are in place and of the designated type and size.		
3	Design	Professional safety staff reviews obstacle construction plans.		
Remarks:				

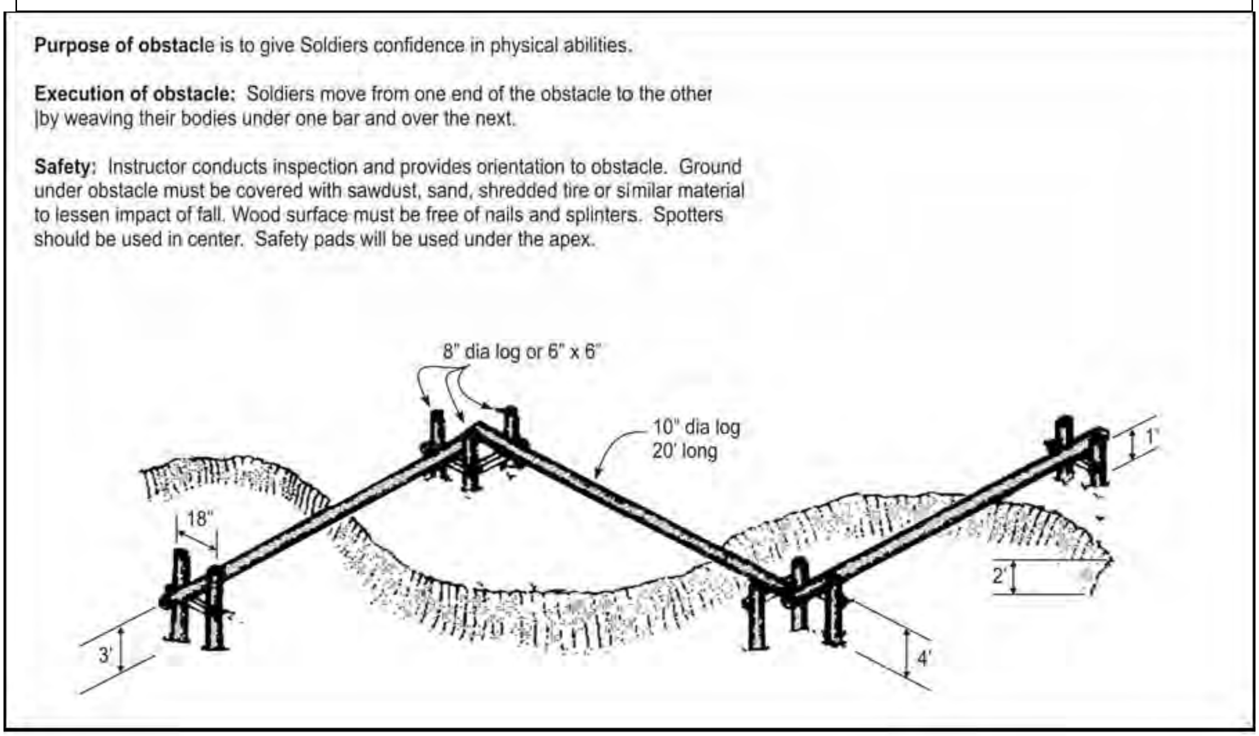


Figure C-29. Balancing logs

(19) See table C-25 and figure C-30 for the "island hoppers."

Table C-25
Island hoppers checklist

	AREA	STANDARD	GO	NO GO
1	Wood timbers	a. There are no signs of rot, warping, severe weathering, or impact damage.		
		b. All timbers meet specified dimensions as stated in engineer drawings.		
2	Design	Professional safety staff reviews obstacle construction plans.		
Remarks:				

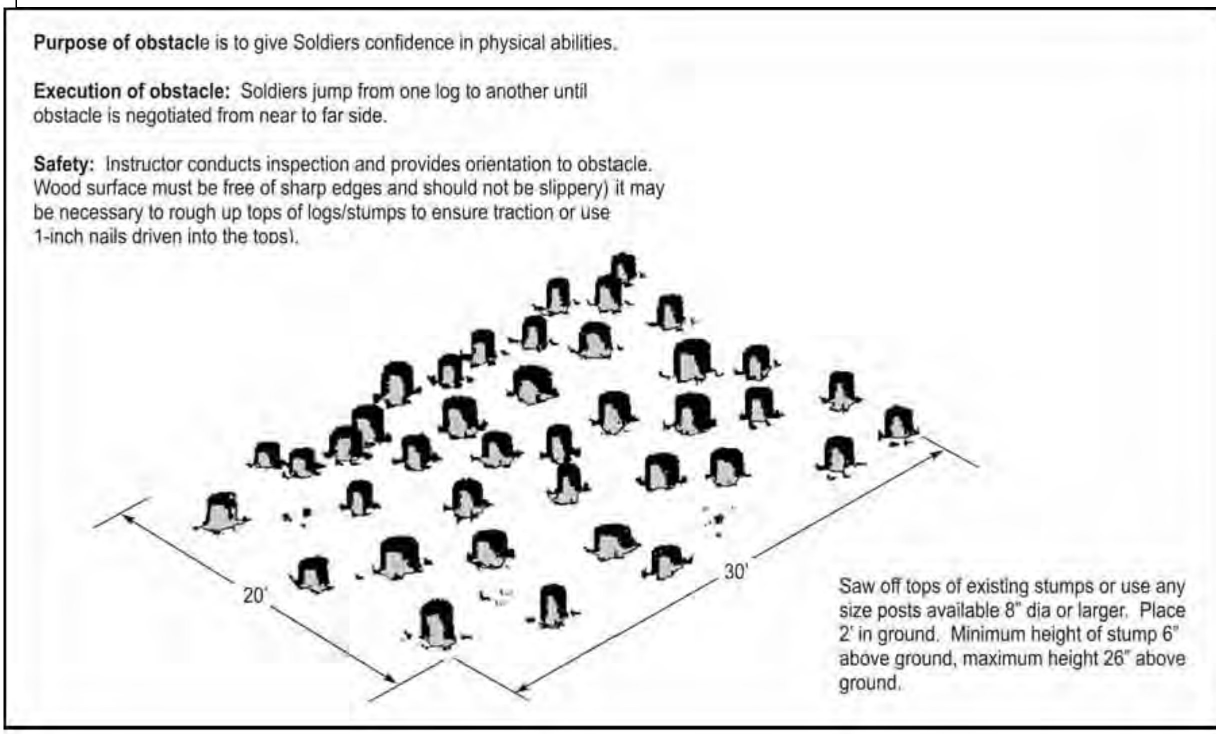


Figure C-30. Island hoppers

(20) See table C-26 for the “fitness tower.”

Table C-26
Fitness tower checklist

	Area	Standard	GO	NO GO
1	Adminis-tration	Copies of engineer drawings are maintained at the local safety office/facility engineers.		
2	Wood timbers	a. There are no signs of rot, warping, severe weathering, or impact damage.		
		b. All timbers meet specified dimensions as stated in engineer drawings and TRADOC Regulation 350-6.		
		c. There are no protruding nails or splinters that may cause injury when obstacle is negotiated.		
		d. All timbers are connected securely together without excess separation between joints.		
		e. All timbers are free of chemical coatings or substances that affect Soldier's ability to negotiate obstacle.		
3	Hardware	a. All bolts, nuts, and washers are in place and of the designated type and size.		
		b. All anchors are made of 3-strand galvanized guy wire.		
		c. Take-up galvanized turnbuckles are used at anchor points of each cable to allow for adjustment.		
		d. Anchor cables are not used to support obstacles not properly constructed or improperly emplaced in the ground.		
		e. All cable clamps are positioned with U-bolt placed on the dead or short end of cable.		
		f. All attachment points are tested to ensure each will support 1.5 times usage weight.		
		g. Certified rappel masters inspect all ropes used for rappelling prior to each use.		
		h. Ropes used for surmounting are all 1.5 inches in diameter.		
4	Design	Professional safety staff reviews obstacle construction plans.		
5	Fall protection	a. All areas in and around tower facility are covered with non-compressed wood chips, mulch, sawdust, or shredded tire rubber.		
		b. All nets designed for fall protection extend 8 feet out from point of potential fall.		
		c. Forged steel hooks are used to fasten net to its supports.		
		d. Nets are weight tested after initial installation and before being used as a fall protection system, whenever relocated, after major repair and every 6 months. The drop-test shall consist of 400 pound (180 kg) bag of sand 30 + or - 2 inches (76 + or - 5 cm) in diameter dropped into the net from the highest walking/working surface at which employees are exposed to fall hazards, but not from less than 42 inches (1.1 m) above that level. When the commander can demonstrate that it is unreasonable to perform the drop-test required by 29 CFR 1926.502 (c)(4)(i), the commander (or a designated competent person) shall certify that the net and net installation is in compliance with 29 CFR 1926.502(c)(4)(i) by preparing a certification record prior to the net being used as a fall protection system. The certification record must include an identification of the net and net installation for which the certification record is being prepared; the date that it was determined that the identified net and net installation were in compliance with 29 CFR 1926.502 (c)(3) and the signature of the person making the determination and certification. The most recent certification record for each net and net installation shall be available at the training site for inspection.		
		e. Nets with padding are placed beneath all suspended bridges.		

	AREA	STANDARD	GO	NO GO
6	Rappelling	a. Instructors working at the top of tower are secured to tower with fall arrest system/attached harness.		
		b. Only certified and current rappel masters conduct rappel operations.		
		c. All anchor point have been tested to support loads of 5000 lbs.		
		d. All anchor points are secure and free of damage.		
		e. Top edge of rappel wall is padded to protect rope from cuts or abrasion.		
		f. Protective padding at top of rappel wall is tightly secured on all edges.		
		g. Rappel wallboards are free of damage, rot, protruding nails, and secured to tower with proper hardware.		
		h. Rappel landing area is free of obstructions and hazards.		
		i. Landing areas extends an uninterrupted distance of 15 feet from base of tower.		
		j. Landing area is cushioned with 24 inches of non-compressed wood chips, mulch, sawdust, 18 inches of sand, or 12 inches of shredded tire rubber.		
		k. Landing area cushioning material held in place by a containment barrier (timbers/sand bags).		
7	Ladders	a. All ladders are inspected for structural integrity.		
		b. Rungs spacing on ladders do not exceed 36 inches.		
		c. Nets are placed under all rope bridges.		
		d. Nets are weight tested after initial installation and before being used as a fall protection system, whenever relocated, after major repair and every 6 months. The drop-test shall consist of 400 pound (180 kg) bag of sand 30 + or - 2 inches (76 + or - 5 cm) in diameter dropped into the net from the highest walking/working surface at which employees are exposed to fall hazards, but not from less than 42 inches (1.1 m) above that level. When the commander can demonstrate that it is unreasonable to perform the drop-test required by 29 CFR 1926.502 (c)(4)(i), the commander (or a designated competent person) shall certify that the net and net installation is in compliance with 29 CFR 1926.502(c)(4)(i) by preparing a certification record prior to the net being used as a fall protection system. The certification record must include an identification of the net and net installation for which the certification record is being prepared; the date that it was determined that the identified net and net installation were in compliance with 29 CFR 1926.502 (c)(3) and the signature of the person making the determination and certification. The most recent certification record for each net and net installation shall be available at the training site for inspection.		
		e. Nets used for fall protection have padding installed to prevent limbs from passing through webbing.		
Remarks:				

C-5. Fall Protection

a. Fall protection will be provided for those obstacles designated as high, or have the ability to cause injury during a fall, or required by design.

b. The areas under and around obstacles will be covered with an impact reducing material appropriate for preventing serious injury in the event a Soldier falls while negotiating subject obstacle.

c. When purchasing fall protection equipment required for an obstacle, installations will ensure equipment meets or exceeds standards without creating a greater hazard. Where impact-reducing material is required, sand, wood chips, saw dust, or shredded tire rubber is sufficient.

d. Below are required essential items of fall protection, identified by obstacle.

(1) "The tough one:"

(a) Wood chips/sand/or shredded rubber beneath obstacle.

(b) Pole vault safety pad placed at base of obstacle.

(c) Safety net placed beneath obstacle, extended 8 feet out from point of potential fall. All netting will be rated for outside use and meet OSHA specifications for fall protection.

(d) Eye bolt or hook for instructor safety harness positioned at top of obstacle.

(2) "Inverted rope descent/slide for life:"

(a) Instructor platform with eye bolt or metal hook to secure safety harness.

(b) Net placed beneath the length of descent rope.

(c) Padding placed on net beneath descent rope.

(d) Pads at end of net near release point.

(e) Pole vault pad at the base of release point.

(f) The area under and around (minimum of 6 feet) obstacles covered with impact reducing material.

(3) "Confidence climb:"

(a) Eye bolt or hook for instructor's safety harness at top of obstacle.

(b) Pole vault padding on both sides at base of obstacle (4 each @ 5 feet x 8 feet x 2 feet).
(c) Ground around base of obstacle covered with impact reducing material.

(4) "Skyscraper:"

(a) Pole vault padding at base of tower.

(b) Netting extended from first level (optional).

(5) "Belly robber:" Ground beneath obstacle covered with impact reducing material.

(6) "The Tarzan:" Ground beneath obstacle covered with impact reducing material.

(7) "Low belly over:"

(a) Ground covered with impact reducing material.

(b) Tops of side rails covered with padding.

(8) "The dirty name:"

(a) Padding on tops of upper side braces.

(b) Ground beneath obstacle covered with impact reducing material.

(9) "The tough nut:" Ground beneath obstacle covered with impact reducing material (optional).

(10) "Belly crawl:" Ground beneath obstacle covered with impact reducing material.

(11) "Inclining wall:" Ground beneath obstacle covered with impact reducing material.

(12) "High step over" - Ground beneath obstacle covered with impact reducing material.

(13) "Swing, stop, and jump:"

(a) Padding on tops of front support logs.

(b) Ground beneath obstacle covered with impact reducing material.

(14) "Six vaults:" Ground beneath obstacle covered with impact reducing material.

(15) "Easy balancer:" Ground beneath obstacle covered with impact reducing material.

(16) "Low wire" Ground beneath obstacle covered with impact reducing material.

(17) “The belly buster:” Ground beneath obstacle covered with impact reducing material.
(18) “Hip-hip:” Ground beneath obstacle covered with impact reducing material.

(19) “Reverse climb:”

(a) Padding on the tops of rear support logs.

(b) Ground beneath obstacle covered with impact reducing material.

(20) “The weaver:”

(a) Pole vault padding beneath center of obstacle.

(b) Ground beneath obstacle covered with impact reducing material.

(21) “Balancing logs:” Ground beneath obstacle covered with impact reducing material.

(22) “Island hopper:” Ground beneath obstacle covered with impact reducing material.

e. Safety equipment (nets, pads, and ground covering) should be procured from reliable sources. If shredded rubber is used, get samples prior to purchasing. Several companies are selling shredded rubber contaminated with petroleum products that may cause allergic reaction in some people. When procuring netting, ensure provider includes design specifications and usage restrictions.

f. To ensure maximum life of safety equipment, inspect on a regular interval and store away from extreme weather conditions when possible.

g. See figure C-31 for required obstacle information.

Obstacle information

Total number of obstacles: _______________

Number of standard obstacles: ________________

Number of nonstandard obstacles: ________________

Number of modified obstacles: _______

Total injuries occurring at each obstacle course:

Remarks:

Figure C-31 Obstacle Information

Appendix D
Rappel Tower Site Inspection Criteria

D-1. Rappel tower site inspection criteria
The minimum inspection criteria for towers and other facilities utilized for military rappelling training is shown in figure D-1 and table D-1.

Name, title, organization, and phone number of inspector(s):

Date of inspection:

Name and location of tower:

Date of tower construction:

Built by:

Owned by:

Last date of any <u>MAJOR</u> modifications:
(If applicable, list modification, and by who performed, in addition to date; otherwise state not applicable.)

Date of previous inspection:

Name, title, and organization of previous inspector:

Is a copy of previous inspection available?

Name, title, organization, and phone number of local point of contact:

Date of last structural inspection:

Date of last anchor point load test:

Signature of inspector(s):

Figure D-1. Rappel tower site inspection information

Table D-1
Rappel tower inspection criteria checklist

	AREA	STANDARD	YES	NO	NA
1	Inspect	a. Is the tower structurally sound? Do structural support members appear serviceable, free from deterioration, breaks, or damage?.			
		b. Are there any signs of insect infestation? [29 CFR 1910.141(a)(5)]			
		c. Are bolts that connect structural members or support cables serviceable and properly connected/tightened?			
		d. Are stairs or ladders firmly attached to the tower?			
		e. Do stairs/fixed ladders comply with OSHA standards? [29 CFR 1910.24 and 29 CFR 1910.27]			
		f. Are all areas marked in yellow that pose a potential trip hazard or head hazard? [29 CFR 1910.144(a)(3)]			
		g. Are the tower platform and all rappel rope stations accessible without having to climb over any obstacles (guard rails, support cables, etc.)?			
		h. Is the tower deck free of slip/trip hazards such as water, protruding nails/bolts/splinters, loose equipment, etc? [29 CFR 1910.141(a)(3)(ii) and 29 CFR 1910.141(a)(3)(iii)]			
		i. Are the tower deck and any open areas (above 4’) not actively being used for rappelling, guarded with guardrails? [29 CFR 1910.23(c)(1)]			
		j. Are all guard rails a minimum of 42” high and capable of withstanding a side force of 200 lbs? [29 CFR 1910.23(e)(1) and 29 CFR 1910.23(e)(3)(iv)]			
		k. Are toe boards or similar barriers installed in all areas where personnel could pass underneath? [29 CFR 1910.23(c)(1)]			
		l. Do all tower rope stations have primary and secondary anchor points?			
		m. Are all anchor points in serviceable condition and free of corrosion, sharp edges, burrs, or grooves that could cut or damage ropes?			
		n. Have all anchor points been designed to ensure that they will accommodate a weight of at least 5000 pounds for each Soldier attached? [29 CFR 1910.66, appendix C (I)(c)(10)]			
		o. Is the rappel wall face area free of protruding nails, bolts, or splinters?			
		p. Is the rappel wall face area free of broken, loose, decayed, or missing boards?			
		q. Is padding material in place on all edges that ropes and/or personnel cross?			
		r. Is the edge padding in good condition and securely fastened?			
		s. Is the edge padding free from protruding nails, bolts, or other fasteners that could fray or cut ropes or injure rappelers?			
		t. Are all structural areas of the tower properly padded that a rappeller might contact during rappel operations?			
		u. Is the structural padding in serviceable condition, securely fastened, and free from protruding nails, bolts, or fasteners?			
		v. Is the landing area free of obstructions and hazards?			
		w. Does the landing area extend an uninterrupted distance of 15 feet from the tower base and at least 2 feet beyond the width of the base with cushioning material in the event of a fall?			
		x. Is the landing area adequately cushioned in case of a fall (24 inches of non-compressed wood chips, mulch, or sawdust; 12 inches of commercially produced shredded rubber; or safety pads that offer similar fall protection)?			
		y. Has the cushioning material in the landing area been loosened up prior to use and, if large numbers of students are rappelling, are procedures in place and equipment available to loosen it up again during training?			

Table D-1
Rappel tower inspection criteria checklist, continued

	AREA	STANDARD	YES	NO	NA
2	Physical security and fire protection criteria	a. Is there a positive locking device on the ladder/steps or a locked fence around the tower that denies unauthorized access to the tower?			
		b. Is there a prominently displayed warning sign that discourages unauthorized use of the tower (for example, WARNING: OFF LIMITS TO UNAUTHORIZED PERSONNEL)?			
		c. Are NO SMOKING signs posted at the tower to preclude potential ignition of cushioning materials?			
3	CRM and training considera-tions	a. Is there a current risk management worksheet on file and available onsite?			
		b. Has the risk management worksheet been reviewed, approved, and signed at the appropriate level?			
		c. Is the tower within 1 hour of an advanced trauma life support facility?			
		d. Are certified combat life support or medical personnel and a dedicated medical vehicle onsite to render emergency medical aid and evacuation, if required?			
		e. Is training conducted in accordance with Training Circular 21-24 and the appropriate TSP?			
		f. Is there a current SOP available that delineates requirements for instructors, students, support personnel, and other requirements?			
		g. Are properly “certified” instructors available to conduct rappel training? (**IF NO, DO NOT CONDUCT RAPPEL TRAINING!)** Name(s): Location and date of certification:			
4	Ropes and equipment	a. Are rappel ropes serviceable and properly inspected and stored?			
		b. Are rope inspections and usage properly documented on DA Form 5752-R (Rope Log (Usage and History))?			
		c. Are snap links serviceable (no excessive rust, sharp edges, improper gate opening and closing, excessive pin movement, missing pins, etc.)?			
		d. Are properly sized, serviceable, heavy leather gloves, and protective headgear available for rappelers?			

Glossary

Section I
Abbreviations

ADSO	additional duty safety officer
AIT	advance individual training
AMC	Army Materiel Command
ANSI	American National Standards Institute
AR	Army Regulation
ARA	Army radiation authorizations
ARIMS	Army Records Information Management System
ASO	aviation safety officer
BCT	basic combat training
CDSO	collateral duty safety officer
CFR	Code of Federal Regulations
CLS	combat lifesaver
CRM	composite risk management
DA	Department of the Army
DOD	Department of Defense
DODI	Department of Defense Instruction
DVD	digital versatile disc
FM	field manual
IAW	in accordance with
IMT	initial military training
LASER	Light Amplification by Stimulated Emission of Radiation
lb	pound
MOA	memorandum of agreement
NCO	noncommissioned officer
NRC	Nuclear Regulatory Commission
OHR	operational hazard report
OPM	Office of Personnel Management
OSHA	Occupational Safety and Health Act
Pam	pamphlet
POV	privately owned vehicle
QASAS	quality assurance specialist ammunition surveillance
RAC	risk assessment code
RFR	radiofrequency radiation
RSO	radiation safety officer
SOHAC	Safety and Occupational Health Advisory Council
SOP	standing operating procedure
TB	technical bulletin
TDA	table of distribution and allowance
TRADOC	U.S. Army Training and Doctrine Command
TRiPS	Travel Risk Planning System
TSP	training support package

USACR/SC U.S. Army Combat Readiness Center/Safety Center

Section II
Terms

branch proponent
The service school that has primary responsibility for developing concepts, doctrine, tactics, training, techniques, procedures, organizational designs, and materiel requirements for a particular branch in the Army.

branch safety proponency
School commandants are the safety officers for their branch, responsible for integrating safety into the development and employment of service school products (for example, doctrine, organizations, training, materiel, leadership and education, personnel, and facilities) and monitoring safety performance of branch units and proponent materiel systems worldwide.

composite risk management (CRM)
Making trade off decisions between potential/expected loss/injury versus the mission benefit of accepting the residual risk. CRM supports the commander's overall estimate and decisionmaking process. The objective is to accomplish the mission safely by identifying and eliminating unnecessary risk.

explosives
All items of ammunition; propellants, liquid and solid; high and low yield explosives; pyrotechnics; and substances associated with the foregoing that present real and potential hazards to life or property. The term includes any device or assembly of devices that contains an explosive material. Examples are bombs, guided or unguided; water and land mines; depth charges; non-nuclear warheads; explosive-loaded projectiles; explosive components of aircrew escape systems; missile propellants; unguided missiles; pyrotechnic, illuminating, and signaling devices; and cartridge-actuated tools, such as stud drivers.

manpower and personnel integration
A comprehensive management and technical program to enhance human performance and reliability in the operation, maintenance, and use of weapon systems and equipment. Manpower and personnel integration achieves this objective by integrating the full range of human factors--engineering, manpower, personnel, training, system safety, and health hazard consideration--into the materiel development.

residual hazard
A hazard that was not eliminated by design.

residual risk
Expected loss from a residual hazard. The risk remaining after one or more cycles of risk reduction efforts.

risk
An expected loss or danger resulting from a hazard. Risk is expressed in terms of estimated severity and probability of injury or damage. Over time, uncontrolled HIGH level risks will produce high levels of loss.

risk acceptance
A formal or implied decision to accept the consequences of a risk based on a risk assessment.

risk assessment
Evaluation of expected consequences of a risk against the benefits to gain from accepting the risk.

safety assessment report
A formal, comprehensive summary of the safety data collected during the design and development of a system. It includes the hazard potential of the item; provides risk assessments; and recommends procedures or other corrective actions to reduce the exposure or consequences of these hazards.

safety awareness
A consciousness of hazards, and the knowledge to avoid them or minimize their effect. Safety awareness training gives leaders the knowledge and motivation to accomplish the mission, while not unnecessarily jeopardizing the lives of personnel or readiness of equipment. Safety awareness leads to a proactive approach that uses risk management to evaluate the risks and eliminate those with inadequate benefits.

safety lesson learned
A safety or health-related warning, based on experience, which can be applied to current and future operations and systems to prevent recurrence of the hazard.

system safety risk assessment (SSRA)
A document that comprehensively evaluates the residual risks of an operation, activity, or materiel system and documents their acceptance by the materiel developer and combat developer.

Section III
Special Abbreviations and Terms

This section contains no entries.

Department of the Army
Pamphlet 385–30

Safety

Risk Management

Headquarters
Department of the Army
Washington, DC
2 December 2014

UNCLASSIFIED

SUMMARY of CHANGE

DA PAM 385–30
Risk Management

This major revision, dated 2 December 2014--

o Clarifies the applicability of this pamphlet (para 1-5).

o Introduces DD Form 2977 (Deliberate Risk Assessment Worksheet) and rescinds DA Form 7566 (Composite Risk Management Worksheet) (now obsolete) (para 1-8).

o Updates and clarifies the requirements and terminology for deviations from Army safety standards (paras 1-8*e*, 4-5, and 4-6).

o Updates table on severity and risk acceptance authority (table 3-2).

o Clarifies the documentation requirements for risk acceptance (paras 4-5 and 4-6).

o Provides updated instructions for DA Form 7632 (Deviation Approval and Risk Acceptance Document (DARAD)) (para 4-6 and app C).

o Provides appendices containing guidance on the integration of risk management into the areas of Army learning and policy systems, sexual harassment and assault prevention, private motor vehicle accident prevention, and suicide prevention (apps D and E).

o Updates definitions in accordance with Army Techniques Publication 5-19 (glossary).

o Incorporates doctrinal changes in Army Techniques Publication 5-19 (throughout).

o Makes administrative changes (throughout).

Headquarters
Department of the Army
Washington, DC
2 December 2014

***Department of the Army Pamphlet 385–30**

Safety

Risk Management

By Order of the Secretary of the Army:

RAYMOND T. ODIERNO
General, United States Army
Chief of Staff

Official:

GERALD B. O'KEEFE
Administrative Assistant to the Secretary of the Army

History. This publication is a major revision.

Summary. This pamphlet provides information needed to carry out policies and procedures prescribed by AR 385–10. It is designed to assist users in implementing and integrating risk management into all phases of the Army operations.

Applicability. This pamphlet applies to the Active Army, the Army National Guard/Army National Guard of the United States, and the U.S. Army Reserve, unless otherwise stated.

Proponent and exception authority. The proponent of this pamphlet is the Director of the Army Staff. The proponent has the authority to approve exceptions or waivers to this pamphlet that are consistent with controlling law and regulations. The proponent may delegate this approval authority, in writing, to a division chief within the proponent agency or its direct reporting unit or field operating agency, in the grade of colonel or the civilian equivalent. Activities may request a waiver to this pamphlet by providing justification that includes a full analysis of the expected benefits and must include a formal review by the activity's senior legal officer. All waiver requests will be endorsed by the commander or senior leader of the requesting activity and forwarded through their higher headquarters to the policy proponent. Refer to AR 25–30 for specific guidance.

Suggested improvements. Users are invited to send comments and suggested improvements on DA Form 2028 (Recommended Changes to Publications and Blank Forms) directly to Army Safety Office (DACS–SF), Building 1456, 9351 Hall Road, Fort Belvoir, VA 22060–5527.

Distribution. This publication is available in electronic media only and is intended for command levels C, D, and E for the Active Army, the Army National Guard/Army National Guard of the United States, and the U.S. Army Reserve.

Contents (Listed by paragraph and page number)

*This pamphlet supersedes DA Pam 385–30, dated 10 October 2007.

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Contents—Continued

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Glossary

Chapter 1
Risk Management

1–1. Purpose
This pamphlet establishes a framework for making risk management a routine and required part of planning, preparing, and executing missions and everyday tasks in accordance with Department of Defense Instruction (DODI) 6055.1 and Army Regulation (AR) 385–10. This framework allows Army leaders to operate with maximum initiative, flexibility, and adaptability. Army operations, whether they involve military situations including tough, realistic training, combat operations, contingency basing, or the industrial base supporting research, development, testing, and production, are demanding and complex. They are all inherently dangerous and each has the potential to jeopardize Soldiers and Army civilians, resulting in the needless loss of limited resources. Managing risks related to such operations requires educated judgment, situational knowledge, demonstrated experience, and professional competence. The risk management process enables Army leaders to make informed, conscious decisions to accept risk involving safety and occupational health and other risk factors. For detailed techniques on implementation of risk management in the operational environment, see Army Techniques Publication (ATP) 5–19. ATP 5–19 provides doctrinal guidance on managing risk within the conduct of operations. This pamphlet and ATP 5–19 are designed to be complimentary, and in tandem, they provide guidance on the implementation of risk management throughout the Army.

1–2. References
Required and related publications and prescribed and referenced forms are listed in appendix A.

1–3. Explanation of abbreviations and terms
Abbreviations and special terms used in this pamphlet are explained in the glossary.

1–4. Introduction
a. Unidentified and unmanaged hazards and their associated risks impede successful Army missions, undermine readiness, decrease morale, and deplete resources. The holistic approach of risk management provides commanders a tool to recognize, evaluate, eliminate, and control the diverse threats and risks to mission execution. The underlying philosophy of risk management is that a loss is a loss. The loss can be any one of the following:

(1) Tactical (threat-based) loss.

(2) Accidental (hazard-based) loss.

(3) Loss due to terrorism, suicide, homicide, illness, or substance abuse.

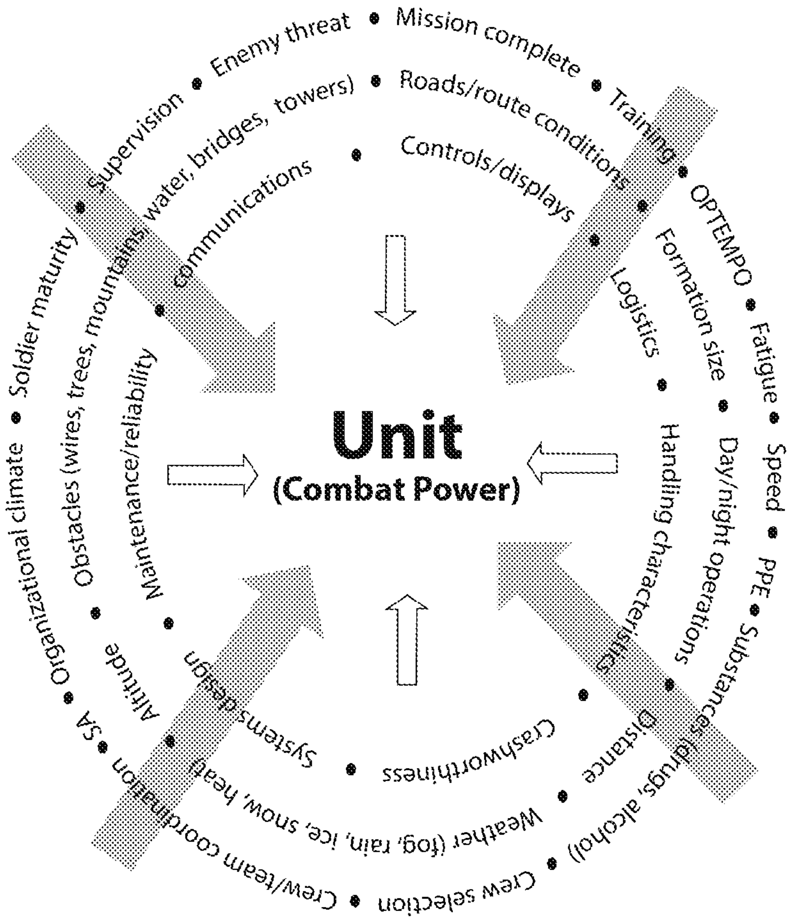
b. Any event that threatens combat readiness and the ability to project power can and should be considered a risk factor.

c. Army leadership and management at every level need to exercise risk management. As shown in figure 1–1, due to the holistic nature of risk management, the process requires multidisciplinary participation using a range of diverse tools to provide the commander with the knowledge to make informed risk decisions about all the identified hazards and their risk. Losses caused by accidents are a major threat to combat readiness. Practitioners use risk management to identify, evaluate, and manage risks to missions, personnel, equipment, facilities, and the environment during peacetime, contingency operations, and wartime due to safety and occupational health and other risk factors.

d. Risk management provides consistent and systematic identification and communication of risks, consequences, and potential actions to mitigate those risks to the appropriate commander for an acceptance decision.

e. Safety standards and policy cannot cover every Army mission and operation. Use of risk management allows commanders the operational flexibility required to make informed decisions.

f. A properly documented risk assessment serves as evidence that command decisionmaking was based on sound judgment and reasonable principles and aids in defense of negligence claims against the Army by practicing due diligence.



Legend for Figure 1–1;
SA — situational awareness
PPE — personal protective equipment
OPTEMPO — operating tempo

Figure 1–1. Holistic approach of risk management

1–5. Applicability

In accordance with AR 385–10, Army leaders will integrate risk management into all aspects of military missions and operations, industrial planning, research and development, systems, equipment, procurement, testing, construction, and processes to increase efficiency and effectiveness by eliminating or controlling adverse and risky conditions that will degrade their execution and value to the Army. Risk management will be applied to Soldiers, Army civilians, and the total life cycle of missions, systems, operations, equipment, and facilities, from conception to completion or disposal.

a. The basic concepts of risk management apply to all Army operations and functional areas. However, the methodology for evaluating and executing the military decisionmaking process and troop leading procedures has been established under ATP 5–19. Tools and techniques found in this pamphlet are available to support ATP 5–19 analyses and decisionmaking. Guidance for the application of risk management to Army learning systems, leadership, sexual harassment and/or assault prevention, suicide prevention, and private motor vehicle (PMV) accident prevention is provided in appendices E and F of this pamphlet.

b. The Army Acquisition Community risk assessment and acceptance processes are contained in AR 70–1, Military Standard (MIL–STD)-882, and Department of the Army Pamphlet (DA Pam) 385–16. The Army has established several weapon system related safety review boards, such as the Army Weapon System Safety Review Board (AWSSRB), the Army Fuze Safety Review Board, the Ignition System Safety Review Board, and the U.S. Army Aviation and Missile Command Software Safety Review Board, to assist acquisition program managers (PMs) in the evaluation and management of the risks associated with their systems.

c. Deviations from range standards and procedures are addressed in AR 385–63 and DA Pam 385–63.

d. Facility design and construction will apply the risk management principles contained in DA Pam 385–16.

e. AR 95–1 governs flight operations. Commanders will integrate risk management into aviation mission planning and execution at every level. Commanders will establish a training and certification program to ensure standardization and understanding of the mission approval and risk management for all personnel. Commanders will develop local briefing checklists and risk assessment worksheets for use in assessing aircrew mission planning and risk. Guidance on risk management is contained in Technical Circular 3–04.11, Army Doctrine Publication (ADP) 5–0, ATP 5–19, and AR 385–10.

f. When Army units, facilities, or operations are tenants on another Service's or allied nation's installation or are subordinate to another Service's or allied nation's lead during Joint operations, Army risk management must include Joint and/or multi-national risk management methodology considerations. Joint operations at non-enduring locations will use the process and procedures in Chairman of the Joint Chiefs of Staff Instruction (CJCSI) 4360.01 for deviations from ammunition and explosives (AE) or chemical agent safety standards (see para 4–6).

1–6. The principles of risk management

The four principles of risk management are—

a. Integrate risk management into all phases of missions and operations.

b. Make risk decisions at the appropriate level.

c. Accept no unnecessary risk.

d. Apply risk management cyclically and continuously.

1–7. Hazard versus risk

a. Hazard is a condition with the potential to cause injury, illness, or death of personnel; damage to or loss of equipment or property; or mission degradation. Therefore, a hazard can have several possible negative outcomes or losses (for example, injury, death, damage, mission failure, mission degradation, increased resource(s) expenditures, and adverse public relations).

b. Risk is determined after hazards are identified and analyzed and is presented as a combined expression of loss probability and severity.

1–8. Risk management

a. Risk management is the Army's primary process for assisting organizations and individuals in making informed risk decisions in order to reduce or offset risk, thereby increasing effectiveness and the probability of mission success. It is a systematic, cyclical process of identifying and assessing hazards, then mitigating the associated risks. It is the responsibility of all commanders, staff, leaders, Soldiers, and Army civilians to integrate risk management into all planning and operations.

b. The process consists of the following five steps (see figure 1–2):

(1) Identify the hazards.

(2) Assess the hazards.

(3) Develop controls and make risk decisions.

(4) Implement controls.

(5) Supervise and evaluate.

c. The risk assessment consists of the first two steps of the risk management process. In step 1, individuals identify the hazards that may be encountered in executing an activity. In step 2, they determine the impact of each hazard on the activity. The risk assessment provides for enhanced situational awareness. This awareness builds confidence and allows Soldiers, units, Army civilians, and organizations to implement timely, efficient, and effective protective control measures.

d. Steps 3 through 5 are the essential follow-through actions to manage risk effectively. In these steps, leaders balance risk against costs and take appropriate actions to eliminate unnecessary risk and accept residual risk at the appropriate level. During execution, leaders continuously assess the risk to the overall mission and to those involved in the task. Finally, leaders and individuals evaluate the effectiveness of controls and provide lessons learned so that others may benefit from the experience.

e. Risk assessments, with the exception of deviations from AE or chemical agent safety standards, will be documented using DD Form 2977 (Deliberate Risk Assessment Worksheet). Instructions for DD Form 2977 can be found in appendix B. DA Form 7632 is mandatory for deviations from AE or chemical agent safety standards. Instructions for DA Form 7632 can be found in appendix C.

1–9. Compliance and risk management

a. Risk management provides commanders with the ability to balance risk levels with other desired outcomes in terms of impact to mission, cost, performance, and schedules. Risk management does not give the Army the authority to violate or deliberately disobey local, state, national, or host nation laws: commanders cannot use the process to justify ignoring regulatory restrictions, such as occupational safety and health regulations, life safety, and fire protection codes, physical security requirements, or to alter or bypass legislative intent. However, when restrictions imposed by other entities adversely affect the mission, planners may use risk management to develop alternate courses of action (COAs) that still conform to legal requirements and require approval at the appropriate level of leadership.

b. Risk management assists the commander in complying with regulatory and legal requirements by—

(1) Identifying applicable legal standards that affect the mission.

(2) Identifying alternate COAs or alternate standards that meet the intent of the law.

(3) Ensuring better use of limited resources by establishing priorities to correct known hazardous conditions that will result in the highest return on investment.

(4) Documenting their deviations from non-statutory regulations using DD Form 2977 (and, as applicable, DA Form 7632).

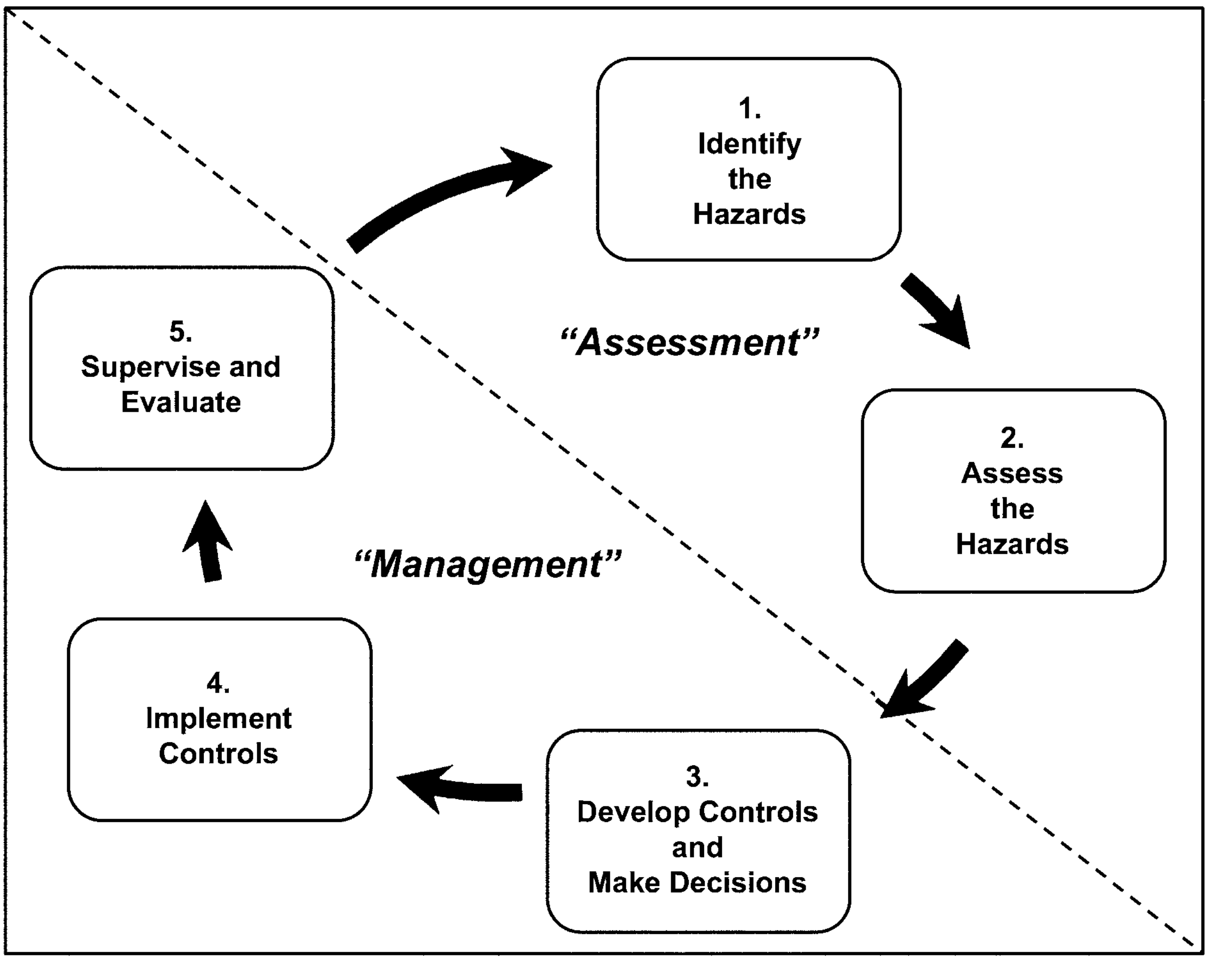


Figure 1–2. Five-step cycle of risk management

Chapter 2
Step 1 – Identify the Hazards

2–1. Introduction

The first step in risk management is to identify the hazards associated with a task and/or subtask, operation, process, facility, or equipment. DD Form 2977 is an effective tool for systematically documenting the identification of hazards.

2–2. Defining limits and tasks

a. Before beginning hazard identification the limits of the assessment must be defined. For example, determine the scope of the tasks and/or subtasks, operations, processes, facilities, equipment, and so forth, of the mission or overall task to which risk management is being applied. The purpose of defining limits is not to ignore hazards, but rather to clearly define what is being analyzed. This allows the assessor to focus on those hazards associated with the event and not on other hazards that have no relationship to it. Those unassociated hazards should be addressed by another risk assessment. As an example, if the analysis were being conducted of a vehicle repair operation, then the limits of the analysis would be stated as the garage area or even as just bay 1 in the garage area. The assessor would only consider those hazards that might be present in bay 1 and would not look at identifying possible hazards on the driveway coming into the bay or on the street outside.

b. Once the limits are defined, the tasks (and, as appropriate, facilities and equipment) will be listed. A task analysis will aid in identifying hazards and may also serve as a tool for developing standing operating procedures (SOPs).

c. DD Form 2977 is formatted in a manner that is conducive to defining the limits and tasks of the assessment.

2–3. Hazard identification methods and tools

Hazards are most effectively described when the following three components are addressed: source, mechanism, and outcome. When identifying hazards, consideration should be given to these three elements to ensure the relationships between hazards and mishaps are recognized. There are numerous methods for identifying hazards ranging from visual inspections to test and engineering analysis and predictive scenarios. Hazard identification works best when performed as a team effort with input and expertise from impacted operators and/or workers, safety and occupational health professionals such as explosives safety specialists and health physicists, and others such as engineers and scientists.

a. A visual inspection provides a rudimentary, but effective, means of identifying existing hazards and sources of potential hazards.

b. Accident reports can contain a wealth of information regarding hazards. Accident reports may address sub-systems or sub-elements of a task or the system or task in its entirety. When identifying hazards for a system (sub-system) or task (sub-elements) it is often advantageous to collect as much accident information as possible and then conduct trend analyses for the system or task under consideration.

c. Hazard reports, hazard analyses, defect reports, engineering change proposals, and analogous reports on the system or activity under consideration and similar or related systems or activities are great sources of information. As with accident reports, when identifying hazards for a system or task it is often advantageous to collect as much accident and hazard-related information as possible and then conduct trend analyses for the system or task under consideration.

d. Technical publications (for example, guides, studies, consensus standards, and so forth) from professional societies, Government organizations, industry, or academia can provide valuable assistance to hazard identification.

e. Engineering analysis of materials, systems, processes, and human interfaces can be used to identify potential hazard sources and failure modes. In addition, it may be advantageous to conduct destructive or non-destructive testing on systems and/or sub-systems to gather data that can aid in identifying and assessing failure modes and hazards.

f. Operator's manuals, safety data sheets, and hazard checklists and/or reference lists provide generic consolidated historical hazard information. Since these are generic (for example, they do not consider operator and facility and/or environmental specific factors) it is not suggested that they be used as the sole means of identifying system and/or activity hazards, but they are often beneficial for starting the hazard identification process.

g. Predictive scenarios, especially when combined with the above-listed methods and tools, provide the most comprehensive, system- and/or situation-specific means of identifying hazards. Predictive scenarios can range from "brain-storming" hazard scenarios to system mock-up and activity simulation. A "crawl-walk-run" approach should be taken including hazard assessment along the way.

Chapter 3
Step 2 – Assess the Hazards

3–1. Assessing the hazards
Step 2 involves evaluating each hazard and assigning a level of risk based on the estimated probability and severity. Risk always deals with uncertainty; it involves estimating future losses, for which neither the likelihood nor impact on mission, Soldiers, Army civilian personnel, the public, equipment, systems, or the environment is known with certainty.

3–2. Definitions
a. Risk. Risk is defined as the probability and severity of loss linked to hazards. It is simply the measure of the expected loss from a given hazard or group of hazards, usually estimated as the combination of the likelihood (probability) and consequences (severity) of the loss.

b. Probability. An approximation of the likelihood of a hazard scenario or mishap occurring. Probability is assessed as frequent, likely, occasional, seldom, or unlikely.

c. Severity. An approximation of the amount of potential harm, damage, or injury associated with a given mishap.

d. Residual risk. The risk associated with a hazard that remains after implementing all planned countermeasures or controls to eliminate, reduce, or control the impact of the hazard. The residual risk may be equal to the initial risk, especially when the initial risk was so low that the hazard did not warrant expenditure of funds to mitigate.

3–3. Probability
Probability is the basis of the likelihood of something happening. In risk management, probability refers to an approximation of the likelihood of a hazard scenario or mishap occurring. The likelihood of an event can range between 0 and 1.0. Zero represents an event that cannot possibly occur. A probability of 1.0 indicates an event that always occurs.

a. For a probability to be meaningful, an exposure interval must be associated with it. The exposure interval can be a unit of time; an activity, such as, miles driven, aircraft landings, operations, machine cycles, units produced; or the life cycle of the facility, equipment, or process.

(1) Normally, the life cycle for a building is 25 years; special purpose facilities may have a greater or shorter life cycle.

(2) For equipment, the life cycle is considered 10 years except for electronic equipment, which can have a very short life cycle.

b. Probabilities are estimations. The better the knowledge of the situation, the more factual and historical information used, and the greater the experience of the evaluator, the more accurate the estimation will be. Except in extremely technical evaluation, the probabilities should be considered as falling within a range.

c. In the real world, it is often very hard to determine objective or numerical probability values. The information necessary to derive these values is often missing, or more often than not, there is just not enough time to make the necessary studies. When the information and time are available, an effort should be made to use the numerical probability values. However, in the other situations it becomes necessary to make estimates based on available knowledge. To aid evaluators, probability ranges have been established using keywords and phrases to help estimate the likelihoods for the occurrence of a hazard scenario or mishap. Table 3–1 shows these probability ranges.

Table 3–1.
Risk management probability categories

Probability	Symbol	Definition
Frequent	A	Continuous, regular, or inevitable occurrences
Likely	B	Several or numerous occurrences
Occasional	C	Sporadic or intermittent occurrences
Seldom	D	Infrequent occurrences
Unlikely	E	Possible occurrences but improbable

3–4. Severity

Severity approximates the amount of potential harm, damage, or injury associated with a given mishap occurring. It is the second of two risk components.

a. Severity and probability are independent of each other. In other words, determining severity has no relationship to determining the probability.

b. It is often hard to determine an objective amount or cost of a mishap outcome. Therefore, severity ranges have been established to aid in this process. They delineate a range of mishap outcomes similar to the probability ranges. They are shown in table 3–2.

c. Once more, the recommended procedure is to start at the top and work down the table, selecting the range representing the maximum credible damage or loss.

d. When selecting, the assessor must consider the impact on the mission, possible human loss, and equipment or system damage. For instance, an accident might not result in any injuries but a simple piece of equipment, worth only a few hundred dollars, is damaged. While this might be classified as marginal from standpoint of human and equipment loss, its loss could result in having to cancel the mission, task, and job.

Table 3–2.
Risk management severity categories

Severity	Symbol	Quantitative value — Injury or Illness[1]	Quantitative value — Dollars[1]	Definition
Catastrophic	I	1 or more death or permanent total disability	Loss equal to $2 million or more	Death, unacceptable loss or damage, mission failure, or unit readiness eliminated
Critical	II	1 or more permanent partial disability or hospitalization of at least 3 personnel	Loss equal to or greater than $500 thousand but less than $2 million	Severe injury, illness, loss, or damage; significantly degraded unit readiness or mission capability
Moderate	III	1 or more injury or illness resulting in lost time	Loss equal to or greater than $50 thousand but less than $500 thousand	Minor injury, illness, loss, or damage; degraded unit readiness or mission capability
Negligible	IV	1 or more injuries or illnesses requiring first aid or medical treatment	Loss less than $50 thousand	Minimal injury, loss, or damage; little or no impact to unit readiness or mission capability

Notes:
[1] Quantitative values are based on definitions for Class A through D accidents. See AR 385–10.

3–5. Matrices

Table 3–3 is an expression of the Army's standard risk matrix, as found on DD Form 2977 and within ATP 5–19. Table 3–3 shows conversion of probability and severity into both a specific risk level and corresponding risk assessment code. This assessment is an estimate, not an absolute. It may or may not be indicative of the relative danger of a given operation, activity, or event. The levels of risk are listed in table 3–4.

a. Extremely high risk. Loss of ability to accomplish the mission or the mission produces extremely severe outcomes. This implies that the risk associated with this mission, activity, or event may have severe consequences beyond those associated with this specific operation or event. The decision to continue must be weighted carefully against the potential gain to be achieved by continuing this COA.

b. High risk. Significant degradation of mission capabilities in terms of the required mission standard, inability to accomplish all parts of the mission, high potential for serious injury to personnel, or inability to complete the mission to standard, if hazards occur during the mission. This implies that, if a hazardous event occurs, serious consequences will occur. The decision to continue must be weighted carefully against the potential gain to be achieved by continuing this COA.

c. Medium risk. The ability to complete the mission will be slightly degraded in the event this hazard occurs. If a hazardous event occurs, it will only slightly impact on the mission, result in only minor injury or loss, and not affect overall readiness.

d. Low risk. Expected losses have little or no impact on accomplishing the mission. Injury, damage, or illness will be minor and have no long-term impact or effect.

Table 3–3.
Standardized Army risk matrix

		Probability (expected frequency)				
		Frequent: Continuous, regular, or inevitable occurrences	**Likely: Several or numerous occurrences**	**Occasional: Sporadic or intermittent occurrences**	**Seldom: infrequent occurrences**	**Unlikely: Possible occurrences but improbable**
Severity (expected consequence)		A	B	C	D	E
Catastrophic: Death, unacceptable loss or damage, mission failure, or unit readiness eliminated	I	EH	EH	H	H	M
Critical: Severe injury, illness, loss, or damage; significantly degraded unit readiness or mission capability	II	EH	H	H	M	L
Moderate: Minor injury, illness, loss, or damage; degraded unit readiness or mission capability	III	H	M	M	L	L
Negligible: Minimal injury, loss, or damage; little or no impact to unit readiness or mission capability	IV	M	L	L	L	L

Legend for Table 3-3.:
EH – extremely high risk
H – high risk
L – low risk
M – medium risk

Table 3–4.
Risk matrix codes and descriptions

Symbol	Risk Assessment Code (RAC)	Description
EH	1	Extremely High
H	2	High
M	3	Medium
L	4	Low

3–6. Maximum credible risk

Maximum credible risk is the risk associated with the hazard that is the most severe and the most credible. This is the most commonly used summation method. It is possible in a given analysis that several risks of the same magnitude would be identified. For instance, during analysis of a process, the assessor identified 2 extremely high, 7 high, 5 medium, and 26 low risks. In this example, one of the two extremely high risks events would be the maximum credible risk. To decide which, the following should be considered:

a. The one with the greatest severity would be used as maximum credible risk.

b. If the severities are the same, then the one with the greatest probability should be used. If severity and probability are the same for both, additional hazard analysis techniques should be used to identify the maximum credible event - the most disastrous maximum credible loss identified for a given system or operation.

3–7. Other matrices.

a. The risk matrix and associated probability and severity definitions prescribed in MIL–STD–882 differ from those defined in this pamphlet and are applicable to the Army Acquisition Community for use in the systems engineering process (see also para 1–5*b*). DODI 5000.02 defines the risk acceptance authorities for these applications. These standards allow for the use of alternate, tailored probability and severity definitions and risk matrices when formally approved (see AR 70–1 and DA Pam 385–16).

b. Differing risk matrices and probability and severity definitions may be used by other Services and nations with which the Army routinely partners. Paragraph 1–5*f* provides guidance for reconciling these differences during Joint and multi-national operations.

Chapter 4
Step 3 – Develop Controls and Make Risk Decisions

4–1. Develop controls and make risk decisions

Step 3 is made up of two sub-steps.

a. Substep 1–Develop controls. After assessing each hazard, the assessor develops one or more controls that either eliminate the hazard or reduce the risk (probability or severity) of a hazardous incident. When developing controls, the assessor considers the reason for the hazard (that is, the root cause), not just the hazard itself.

b. Substep 2–Make risk decisions. Risk decisionmaking involves determining whether the residual risk is justified. The decision maker decides whether controls are sufficient and acceptable and whether to accept the resulting residual risk. If the decision maker determines the residual risk level is too high, the decision maker can direct the development of additional controls or alternate controls, or the decision maker can modify, change, or reject the COA.

4–2. Developing controls

a. Chapter 3 (step 2) provides guidance for assessing hazards and analyzing their sources, mechanisms, and outcomes. Once these elements of the hazard are understood, various controls and countermeasures should be developed. In this step of risk management, the idea is to brainstorm as many controls and countermeasures as possible.

b. Once a list of possible controls has been developed for each hazard, the next step is to evaluate them. The selection of the best control measures should be made based on the risk control hierarchy, effectiveness in mitigating the risk (that is, the resultant residual risk), cost, feasibility, and required level of support and/or supervision. Apply the following hierarchy to risk control selection:

(1) Elimination;

(2) Substitution of less hazardous materials, processes, operations, or equipment;

(3) Engineering controls;

(4) Warnings;

(5) Administrative controls;

(6) PPE. PPE will be used only after a hazard assessment meeting requirements of subpart 1910.132 of Title 29, Code of Federal Regulations has been completed and:

(a) Engineering or management controls are not feasible or do not sufficiently eliminate the hazard; or,

(b) Development or installation of engineering controls are pending; or,

(c) For short-term, non-routine operations, for which engineering controls are not practical or for emergencies (for example, spills, including cleanup operations), malfunctions, emergency egress, and damage-control activities.

4–3. Residual level of risk

a. After identifying effective controls, the risk assessor returns to the risk assessment matrix to determine the residual level of risk for each hazard and the overall residual risk for the operation. The process of analyzing the hazards and proposing options to reduce or eliminate them should be repeated until the most effective controls have been identified. Even though some proposed controls do not significantly lower the risk level of a given hazard, they should be implemented if their benefits outweigh the costs of implementation.

b. The appropriate level of command must approve the mission, making a final risk decision based on the residual level of risk. The overall residual level of risk combines the residual level of risk for all identified hazards. The residual level for each hazard may differ. The overall residual level will be equal to or higher than the highest residual level for each hazard. The responsible individual must consider the number and type of hazards present. In some cases, for example, a commander may determine that the overall residual level of risk is higher than any one hazard. The assessment could be based on a number of lower-risk hazards, if in combination they present a higher risk. For example, commanders may determine that a mission risk assessment should have medium risk level even when all hazards have a low residual level. Based on the complexity of required controls and the potential synergistic effect of all hazards, a commander may determine the level of risk for a mission is high when the residual level for the individual hazards ranges from low to medium.

4–4. Making risk decisions

Once the potential countermeasures and controls have been developed, risk decisions need to be made. This involves deciding which countermeasures to use and accepting residual risks.

a. The decision to select countermeasures and controls can often be made at the lowest echelons, by the immediate leader, designer, or process developer. However, when the hazard is not eliminated or controlled to tolerable limits, Army leadership needs to decide about the acceptability of the risk based upon mission requirements. Accepting risk is a serious matter; therefore, the appropriate level of Army leadership must weigh the increased danger to the mission, personnel, equipment, public, property, and environment against the operational requirement that necessitated acceptance of a significant level of risk. As a decisionmaking tool, risk management is effective only when the information is passed to the appropriate level of command for decision.

b. The appropriate risk acceptance authority is typically determined by three factors: the duration of the risk, the level of risk, and the ownership of the resources necessary to control, eliminate, or correct the hazard in an appropriate time frame. The exposure of unrelated personnel to risk and the resultant level of required coordination may also affect the required level of risk acceptance (for example, the exposure of host nation facilities to risk from an Army operation).

c. Army headquarters commanders are required to establish and publish approval authority for risk acceptance and decisionmaking for their command or adopt, in writing, table 4–1 of this pamphlet.

d. The duration of the risk is the total length of time that the mission, personnel, equipment, property, or environment will be exposed to the hazard. When determining the required risk acceptance level in table 4–1, the duration of the risk will not be divided into shorter increments to lower the risk acceptance authority level. Consideration must be given to whether the mission is recurring or nonrecurring.

(1) *Recurring missions*. Recurring missions are operations that are cyclic in nature, are anticipated to occur again in the near future, and involve the same hazards, control measures, and risks during each occurrence, such as night-training flights, rifle-range training, and so forth. For recurring missions, the duration should be based on the anticipated total time period to accomplish all recurring missions; for example, if the mission will be conducted for 1 week every month for 3 years, then the duration used would be 3 years, not 1 week or 1 month.

(2) *Nonrecurring missions*. Nonrecurring missions are missions that are not anticipated to occur again in the near future. Normally, these types of operations occur during contingencies, wartime conditions, or other unique situations.

e. The level of authority accepting the potential consequences of a given hazard is determined by the level of residual risk associated with that hazard, mission, or event. The greater the risk and longer the duration the higher that decision must be elevated. In organizations led by Army civilian leaders, equivalent civilian grades may be substituted for military ranks; see table 4–2.

f. Risk can only be accepted by the commander with the resources and/or authority necessary to control, eliminate, or correct the hazard in an appropriate timeframe. When unrelated personnel, facilities, or equipment are exposed to a hazard, the appropriate authority in the exposed organization will acknowledge the hazard and accept the risk to their personnel, facilities, or equipment. On Army installations the installation commander holds ultimate responsibility for all risk on the installation and must be made aware and acknowledge the risk prior to acceptance. Coordination will be made with all units that are exposed to this risk. The most common scenario is when the risk is due to the operations of one organization (for example, a tenant on an installation), but exposes other organizations' personnel, facilities, or equipment to hazards. In this case, the other affected organizations (for example, the garrison commander and the installation commander) must be made aware and acknowledge the risk prior to risk acceptance by the organization creating the risk. Examples would include the risk associated with explosives arcs exposing another tenant's assets, tenant unit arms room in an installation-owned facility, or the storage of hazardous material in an installation-owned facility.

(1) When an Army organization exposes another Service's or another nation's personnel to a hazard the risk acceptance authority must communicate that risk to the exposed personnel's chain of command at a level equivalent to the risk acceptance authority.

(2) For all hazards that expose the public to high or extremely high risk, the risk acceptance authority will be the Army headquarters commanding general.

Table 4–1.
Risk acceptance authority for safety standards deviation

Risk acceptance matrix[2, 3, 4, 5]				
Duration of risk				
	Event waiver	**Waiver**		**Exemption**
Category of risk	1 month or less	1 month to 1 year	1 year to 5 years	Permanent or greater than 5 years
Extremely high risk	General officer (GO)	Army Headquarters Commanding General (CG)	Army Headquarters CG	Army Headquarters CG
High risk	Brigade commanding officer (CO) or responsible O–6	GO	GO	GO
Medium risk	Battalion CO[1] or responsible O–5	Brigade CO[1] or responsible O–6	GO[1]	GO[1]
Low risk	Company CO or responsible O–3	Battalion CO[1] or responsible O–5	Brigade CO[1] or responsible O–6	Brigade CO[1] or responsible O–6

Legend for Table 4-1.:

In organizations led by Army civilian leaders, equivalent civilian grades may be substituted for military ranks (see table 4–2).

The term “Army Headquarters CG” used in the table refers to Army commands (ACOMs), Army service component command (ASCCs) (including Joint Forces Land Component Commands (JFLCC) and GO level Joint Task Forces (JTFs)), direct reporting units (DRUs), and the Director, Army National Guard.

Notes:

[1] May delegate in writing authority to accept at the next lower command level.

[2] For deviations involving violations of AE or chemical agent safety standards during Joint operations planning, training, and execution, refer to CJCSI 4360. 01 and Service risk acceptance guidance. See also paragraph 4–6*i*.

[3] H risk (beyond 1 month) or EH risk will always be accepted by a GO or flag officer.

[4] For hazards discovered in fielded acquisition programs, risk will be accepted per DA Pam 385–16.

[5] Deviations from range standards and procedures are addressed in AR 385–63.

Table 4–2.
Military–Army civilian equivalent grades

Military rank	O–7 though O–10	O–6	O–5	O–4	O–3
Army civilian grade	Senior executive service (SES)–1 through SES–6	General schedule (GS)–15 or equivalent	GS–13 and GS–14 or equivalent	GS–12 or equivalent	GS–10 and GS–11 or equivalent

4–5. Deviation documentation and risk acceptance

a. When intentionally deviating from written safety standards, documentation will include specifics regarding the initial and residual levels of risk associated with the deviation, the policy and/or standard (that is, the publication and paragraph numbers) from which the operation will deviate, the control measures selected, and the required level of risk acceptance per table 4–1. Safety offices need to track and review all approved deviations for trends. Deviations (waivers, exemptions, and secretarial certifications) involving AE or chemical agents must be documented using DA Form 7632. DA Form 7632 may also be used to document safety deviations other than those involving AE and chemical agents.

b. Addressing a general risk, that is, a situation involving management of a risk that does not involve a standard, is referred to as risk acceptance. Risk acceptance documentation must include specifics regarding the initial and residual levels of risk, the control measures selected, and the required level of risk acceptance per table 4–1. Safety offices track and review all approved risk acceptances for trends.

4–6. Use of DA Form 7632 for documenting deviations and risk acceptance involving ammunition and explosives or chemical agents

a. Appendix C contains instructions for completing DA Form 7632. The following support documentation must accompany the DA Form 7632 for AE or chemical agent deviations: map or diagrams which depict the hazard area including quantity distance (QD) arcs and/or downwind hazard areas, preferably unclassified, clearly identifying locations and/or facilities of concern; timeline, listing milestones, to eliminate the need for deviation; and other supporting documents as necessary. The DA Form 7632 may cover multiple risks, if supported by accompanying documentation describing each hazard and associated risk covered.

b. An event waiver is a written authority that permits a temporary exception for strategic or other compelling reasons when conditions or circumstances causing the waiver arise unexpectedly and there is not enough time to comply with formal waiver submission and documentation procedures. Event waivers are for one-time emergency situations, not to exceed 1 month. Event waivers are not applicable to recurring missions as defined in paragraph 4–4*d*(1). The responsible commander must approve the event waiver in writing prior to onset of operations. Copies of event waivers involving AE or chemical agent must be provided to the organization's ACOM, ASCC, and/or DRU safety office and to the U.S. Army Technical Center for Explosives Safety (USATCES) for data collection and analysis. Event waivers involving AE or chemical agent may be documented using a memorandum or other command-specific format, and will include the following information:

(1) Type and net explosive weight (NEW) QD of munitions involved.

(2) Type of exposed site (ES). If people are present, give an estimate of the number of civilians and military.

(3) Strategic or other compelling reasons for approving the exception.

(4) Distance required versus distance available and QD standard not met.

(5) Narrative explanation outlining the reason or reasons why the explosive standards could not be met and a discussion of reasonable alternatives considered and rejected.

(6) Expected duration of event waiver.

(7) Point of contact (POC) name, grade, phone, and email.

c. A waiver is a written authority that permits temporary deviation from Army safety standards for strategic or compelling operational requirements. Waivers are granted for a period not to exceed 5 years pending termination of the waiver or correction of the waived conditions. Exceptional situations may require a waiver to be reissued to allow either completion of the operation requiring the waiver or time for completion of the corrective action. In such cases, the next higher approval authority will reissue the waiver. Copies of waivers and reviews involving AE or chemical agent must be provided to the organization's ACOM, ASCC, and/or DRU safety office, and USATCES for data collection and analysis. Copies of waivers for other safety standards may be provided to the organization's ACOM, ASCC, and DRU safety office for data collection and analysis. AE deviation waivers are reviewed annually - and non-AE and chemical deviation waivers at intervals not to exceed 2 years - to ensure risk assessments are current, to ensure that all exposures, risks, and mitigating actions are identified, and to validate the need for continuance.

d. An exemption is a written authority that permits long-term noncompliance with Army safety standards for strategic or compelling operational requirements. Exemptions may be granted by law, Congressional action, or in accordance with table 4–1. Exemptions are granted for periods over 5 years, to include permanent situations. Copies of exemptions and reviews involving AE or chemical agent must be provided to the organization's ACOM, ASCC, and/or DRU safety office, and USATCES for data collection and analysis. Copies of exemptions for other safety standards may be provided to the organization's ACOM, ASCC, and DRU safety office for data collection and analysis. AE exemptions are reviewed at intervals not to exceed 5 years to ensure risk assessments are current, to ensure that all exposures, risks, and mitigating actions are identified, and to validate the need for continuance. This review includes Secretarial Certificates, if applicable.

e. A Secretarial Certification is required for all new construction involving AE and chemical agent safety regulatory deviations. A certificate is written authority, granted by the Assistant Secretary of the Army for Installations, Energy and Environment (ASA (IE&E)) to build or perform a major modification on a facility or structure in violation of the provisions of AR 385–10 dealing with AE or chemical agents, DA Pam 385–61, or DA Pam 385–64. Secretarial Certifications only require one-time approval for construction and/or modification of the facility or structure: they do not require revalidation or renewal unless there is new construction and/or modification not previously approved. However, upon completion of construction and initiation of AE or chemical agent operations, an exemption must be developed for these operations. Such exemptions are executed and reviewed in accordance with requirements in paragraph 4–6*d*.

(1) Secretarial Certifications must be approved by the ASA (IE&E) prior to expenditure of funds for the project.

(2) A package needs to be completed and submitted through the chain of command of the organization having responsibility and authority over the structure to be constructed and/or modified. The submission package includes the following information:

(a) Memorandum requesting Secretarial Certification, detailing the operational necessity or compelling reason that requires the Secretarial Certification and what alternative solutions were considered, with endorsement up the chain of command.

(b) The estimated cost and project number (if assigned).

(c) The required contents of AE or chemical safety site plans per DA Pam 385–61, DA Pam 385–64, and DA Pam 385–65.

(d) The DA Form 7632 detailing the risk associated with the deviation and acceptance by the appropriate level of command for use of the facility and/or structure per table 4–1.

(3) Requests for Secretarial Certifications are routed through the command channels most responsible for the operation or facility. The commander at each level must approve the request, accepting the risk generated by the deviation, before forwarding to the next review level. ACOM, ASCC (JFLCC/GO level JTF), and DRU commanders,

and the Director, Army National Guard are required to certify that such projects are essential due to operational necessity or other compelling reasons and must explicitly accept the risk generated by the deviation.

(4) Requests for Secretarial Certifications for construction and/or modification of an Army facility and/or structure on other Services' installations will be submitted through Army and the other Service's chain of command. The ASA (IE&E) coordinates the approved submission package with the appropriate official for the other Service.

(5) Requests for Secretarial Certifications involving off-installation exposures in foreign nations must be coordinated with the host nations in accordance with applicable international treaties and status of forces agreements prior to submission to the ASA (IE&E).

f. All DA Form 7632s must be coordinated and deconflicted with the installation master plan holder.

g. DA Form 7632s must be kept accurate and kept current. When the organization's leadership transitions, the incoming leadership must be informed of and renew the risk acceptance.

h. A DA Form 7632 or System Safety Risk Assessment should be used for chartered system development programs unless another similar document has been identified in accordance with MIL–STD–882, DA Pam 385–16, or the approved System Safety Management Plan. For Joint weapon systems, the AWSSRB will review and concur with all system safety risk assessments or equivalent documents per DA Pam 385–16.

i. Required process and procedures for deviations from AE or chemical agent safety standards that occur during Joint operations at non-enduring locations are contained in CJCSI 4360.01 (this instruction does not apply to overseas enduring or Department of Defense (DOD) installations within the United States and U.S. Territories).

(1) CJCSI 4360.01 outlines the consequence and risk identification assessment process for identifying and managing hazards and risks associated with these deviations. Army-led operations determine risk levels per chapter 3.

(2) CJCSI 4360.01 contains requirements for the acceptance of risk associated with waivers and exemptions by geographic combatant commanders and their subordinates, when delegated.

(3) CJCSI 4360.01 also outlines the process for gaining military Service Secretary approval (for example, Secretarial Certification) for military construction that cannot meet AE and/or chemical agent safety requirements.

Chapter 5
Step 4 – Implement Controls

5–1. Implementing controls

Once the commander or supervisor has identified the hazards and selected controls, the controls must be effectively implemented and documented. This involves putting selected control measures in place and undertaking those activities necessary to allow the measures to be effective. DD Form 2977 should be used to document controls and measure the effectiveness of countermeasures. Army commanders and staff must ensure controls are integrated, communicated, and understood at all levels.

5–2. Implementation steps

The most important aspect of implementing controls is clearly communicating how the controls will be put into effect, who will implement them, how they will fit into the overall operation, and how the commander expects them to be enforced.

a. Examples of ways in which controls can be implemented are—

(1) SOPs and written and verbal orders.

(2) Job requirements, job descriptions, job hazard analysis, and physical requirements.

(3) Demonstrations, rehearsals, and emergency drills.

(4) During mission, task or job-safety briefings, safety committee meetings, and back-briefs.

(5) Conducting rehearsals, walking through processes, drills, and so forth.

(6) Training on the hazards and controls.

b. Integrating new control measures in work procedures is essential. Management, supervision, and worker responsibilities may need to be clearly defined in the work procedures (see DA Pam 385–10 for additional information on SOPs).

c. The workers and others must be informed about the control measures to be implemented and the reasons for the changes. This is accomplished by providing training and instruction on the new control measures and the hazards they are protecting against. This training and instruction must, at a minimum, be provided to—

(1) All new employees.

(2) All employees given new job assignments for which training has not been previously received.

(3) All employees when the new control is first established.

(4) All employees when new substances, processes, procedures, or equipment are introduced to the workplace and present a new hazard.

(5) All employees when a new or previously unrecognized hazard is identified and controls implemented.

d. First-line supervisors are critical to implementing the controls. All supervisors have to be trained and understand the safety and health hazards to which employees under their immediate direction and control may be exposed.

e. It is also important to coordinate with adjacent units and organizations to ensure they understand the hazards identified and the controls to be implemented, especially if they will encounter the same hazards or play a role in implementing the controls.

Chapter 6
Step 5 – Supervise and Evaluate

6–1. Supervision and evaluation

Step 5 of risk management ensures that risk controls are implemented and enforced to standard. It provides the means of validating the adequacy of the selected control measures in supporting objectives and desired outcomes. Like other steps in risk management, supervision and evaluation must occur throughout all phases of any operation or activity.

6–2. Supervision

a. Supervision ensures subordinates understand how, when, and where controls are implemented and ensures that controls are implemented, monitored, and remain in place. Supervision is paramount to ensuring that complacency, deviations from policies and/or standards, and circumventions of control measures are not allowed to threaten success. Supervision also provides Army leaders with the awareness necessary to anticipate, identify, and assess any new hazards and to develop or modify controls as circumstances unfold.

b. Controls established and implemented for a prolonged period are especially “at risk” to be ignored due to overconfidence or complacency. Supervisors should—

(1) *Focus on process*. Supervisors must hold employees accountable for accomplishing process activities that prevent injuries. Supervisors must reinforce their employees’ efforts and contributions towards preventing injuries.

(2) *Educate*. Supervisors explain the principles and rationale for the controls and demonstrate how the controls work.

(3) *Promote ownership*. Allow employees to participate in the implementation of controls and procedures and take control.

(4) *Set expectations*. Supervisors can facilitate a shift from other-directed to self-directed motivation by initiating a process or action with stated expectations.

(5) *Support and reward*. Support employees following safety procedures and reward them for their efforts.

(6) *Model appropriate safety-related behavior*. Supervisors must model the behavior they expect of their employees. For instance, a supervisor should always wear the appropriate PPE for any area the supervisor is visiting. If hearing protection is required, then the supervisor should be using hearing protection, too.

(7) *Conduct spot checks and unannounced visits*. Supervisors should conduct periodic spot checks and unannounced visits to the various work areas under their direction. During the visits, the supervisor should be observing adherence to safety requirements for that area and checking to assure that controls are still in place.

(8) *Report-in periodically*. Supervisors should periodically report to their supervisors on the status of the controls and how effective they are.

c. Violations of safety standards are required to be reported and recorded as prescribed in DA Pam 385–10.

6–3. Evaluation

Risk management practitioners conduct evaluation during all phases and activities of operations, including after action reports and other assessments. DD Form 2977 provides space for capturing such information and should be maintained with the after action report for record and reference. Evaluation supports several goals, including but not limited to—

a. Determining if risk levels changed during operations.

b. Adapting to changes in the situation.

c. Monitoring effectiveness of controls.

d. Making corrections to control implementation.

e. Improving the application of risk management principles in current and future operations.

6–4. Feedback

An evaluation by itself is not enough; a feedback system - continuous process improvement - must be established to ensure that the corrective or preventive action taken was effective and that any newly discovered hazards identified during the mission and/or activity are analyzed and corrective action taken. Feedback informs all involved as to how the implementation process is working, and whether or not the controls were effective. Feedback can be in the form of briefings, lessons learned, cross-tell reports, benchmarking, or database reports. Without this feedback loop, we lack the benefit of knowing if the previous forecasts were accurate, contained minor errors, or were completely incorrect.

Appendix A
References

Section I
Required Publications

AR 385–10
The Army Safety Program (Cited in paras 1–1, 1–5, 1–5e, 4–6e, table 3–2.)

ATP 5–19
Risk Management (Cited in paras 1–1, 1–5a, 1–5e, 3–5.)

CJCSI 4360.01
Explosives Safety and Munitions Risk Management for Joint Operations Planning, Training, and Execution (Cited in paras 1–5f, 4–6i, 4–6i(1), 4–6i(2), 4–6i(3), table 4–1.) (Available at http://www.dtic.mil/cjcs_directives/cjcs/instructions.htm.)

DA Pam 385–64
Ammunition and Explosives Safety Standards (Cited in paras 4–6e, C–2b(6), C–3a(5), C–3a(6).)

DA Pam 385–65
Explosive and Chemical Site Plan Development and Submission (Cited in para 4–6e.)

DODI 6055.1
DOD Safety and Occupational Health (SOH) Program (Cited in para 1–1.) (Available at http://www.dtic.mil/whs/directives/.)

DODM 6055.09–M
DOD Ammunition and Explosives Safety Standards (Cited in paras C–2b(6), C–3a(5), C–3a(6).) (Available at http://www.dtic.mil/whs/directives/.)

MIL–STD–882
Department of Defense Standard Practice for System Safety (Cited in paras 1–5b, 3–7a, 4–6h.) (Available at https://assist.daps.dla.mil/quicksearch/.)

Section II
Related Publications

A related publication is a source of additional information. The user does not have to read a related reference to understand this publication.

ADP 5–0
The Operations Process

AR 25–30
The Army Publishing Program

AR 70–1
Army Acquisition Policy

AR 95–1
Flight Regulations

AR 385–63
Range Safety

DA Pam 385–10
Army Safety Program

DA Pam 385–16
System Safety Management Guide

DA Pam 385–30
Mishap Risk Management

DA Pam 385–40
Army Accident Investigation and Reporting

DA Pam 385–61
Toxic Chemical Agent Safety Standards

DA Pam 385–63
Range Safety

DODI 5000.02
Operation of the Defense Acquisition System (Available at http://www.dtic.mil/whs/directives/.)

FM 6–22
Army Leadership: Competent, Confident, and Agile

Technical Circular 3–04.11
Commander's Aircrew Training Program for Individual, Crew, and Collective Training

TRADOC Regulation 350–70
Army Learning Policy and Systems

29 CFR 1910.132
Personal Protective Equipment: General Requirements (Available at http://www.gpo.gov/fdsys/.)

Section III
Prescribed Forms

Unless otherwise indicated, DA forms are available on the Army Publishing Directorate (APD) Web site (http://www.apd.army.mil).

DA Form 7632
Deviation Approval and Risk Acceptance Document (DARAD) (Prescribed in para 1–8e.)

Section IV
Referenced Forms

Unless otherwise indicated, DA forms are available on the APD Web site (http://www.apd.army.mil); DD forms are available on the Office of the Secretary of Defense Web site (http://www.dtic.mil/whs/directives/infomgt/forms/formsprogram.htm).

DA Form 2028
Recommended Changes to Publications and Blank Forms

DD Form 2977
Deliberate Risk Assessment Worksheet

Appendix B
DD Form 2977 Instructions

B–1. DD Form 2977

DD Form 2977 is the Army's standard form for documenting risk assessment and approval and provides a tool for units to logically apply the five steps of risk management. It is available in both hard copy and electronic form and may be filled out electronically or free-hand. DD Form 2977 is designed to be used as a living document as changes occur, or new information is gleaned, during the mission and/or task being assessed.

B–2. Instructions for completing DD Form 2977

a. Page 1 provides areas for identifying the event or operation, preparer information, an area to capture information used in the five-step process, identification of the overall residual risk level, and approval authority information. Block

1 (Mission/Task Description) should include the date(s) of the mission, block 2 (Date) is to be completed with the date the DD Form 2977 was prepared.

b. Page 2 provides a standard risk assessment matrix, an area for review (used for on-going operations), an area to capture feedback and lessons learned, and an area for additional comments or remarks.

c. Page 3 provides basic instructions for completing each block of the form.

Appendix C
DA Form 7632 Instructions

C–1. DA Form 7632

a. DA Form 7632 is a four-page automated form for documenting risk management and acceptance. Use of this form is mandatory for deviations from AE or chemical agent safety standards.

b. Page 1 of the form contains information necessary for the approval authority to decide whether to approve the deviation and accept the associated risk, including location information, violation information, and documentation of deviation approval and risk acceptance. Page 2 is a worksheet used to document the risk assessment and should be completed before page 1.

c. When used for deviations involving AE or chemical agent, the Ammunition and Explosives Worksheet, found on pages 3 and 4 of the DA Form 7632, must be completed. This worksheet provides for documentation of information on the potential explosion site (PES), ESs, and potential consequences from AE or chemical agent incident and should be completed before page 1.

C–2. Completing the DA Form 7632

a. Site information. This section on page 1 identifies the site the DA Form 7632 covers. Dropdown menus are provided to help with standardization.

(1) Block 1a - Country. Enter the country where the site is located. The default is set to United States.

(2) Block 1b - State. Enter the state where the site is located or select not applicable for sites outside the United States and its territories.

(3) Block 2 - Service. Select the Service responsible for submitting the deviation.

(4) Block 3a - Installation Type. Enter the type of installation on which the site is located (for example, Fort, Base, Forward Operating Base). Select “other” for sites not on an installation.

(5) Block 3b - Installation Name. Enter the name of the installation, if applicable. For example, enter “Hood” if Fort Hood is the installation. There is no need to put “Fort Hood” in this block when “Fort” was entered in block 3a.

(6) Block 3c - Type of Site. Enter the type of the site on which the deviation occurs. This block should convey the nature of the operation involved (for example, hospital, dining facility, ammunition holding area, ammunition turn-in, driver training, and so forth).

b. Deviation information. This section on page 1 provides all the violation information at a glance and allows the approval authority to see all the critical information on one page. A portion of the blocks on page 1 will auto populate from page 2.

(1) Block 4 - Deviation number. This is the originator’s unit identification code (UIC), the type of deviation (see block 7), followed by the 4–digit year, 2–digit month, 2–digit day (see block 10) and a sequential alpha character for each deviation of the type prepared that day. For example, for the second event waiver (EW) initiated by the activity with UIC W4QUAA on 10 April 2013, the individual preparing the DA Form 7632 would enter “W4QUAA–EW–20130410–B.” (There are several methods for determining the UIC. The submitter of the originating unit can find their UIC in block 44 on SF–50 actions. Another way is by logging into Army Knowledge Online and going to “My Account.” Select “Account Information” and scroll down to “Total Army Personnel Record” and locate the UIC. It is possible the analyst may not be associated with the originating unit and will need to find the unit’s UIC. The analyst can go to the Web site below and submit a System Access Request to gain access to UIC search system at https://www.dmdc.osd.mil/appj/uicss/.) The Deviation number will automatically be inserted on the top of each sequential page of the DA Form 7632 to ensure continuity of the document.

(2) Block 5a - Effective Date. No data entry required. This block will auto populate from block 16a (Date) and will also be automatically inserted on the top of each sequential page.

(3) Block 5b - Expiration Date. No data entry required. This block will auto populate from block 16b (Expiration Date) and will auto populate the Expiration Date block on the top of each sequential page.

(4) Block 6 - Deviation From. Choose the appropriate type of standards from the dropdown list. Enter the type of standard from which the activity will deviate.

(5) Block 7 - Type of Deviation. Enter whether the deviation is an EW, waiver (W), exemption (E), or Secretarial Certification.

(6) Block 8a - Number/Title and Paragraph of Requirement. Enter the title, number, and paragraph of the requirement not being met. For example, Ammunition and Explosives Safety Standards, DA Pam 385–64, paragraph 17–2f(2). When the deviation involves a violation of Department of Defense Manual (DODM) 6055.09–M, include the appropriate reference for that document as well (for instance, DOD Ammunition and Explosives Safety Standards, DODM 6055.09–M–V1, paragraph V1.E8.2.1).

(7) Block 8b - What we need to do that deviates from block 8a. Provide a synopsis of the risk being taken. This is a synopsis of block 24.

(8) Block 8c - Operational, Strategic or Compelling Reason for Deviation. Explain the operational, strategic, or compelling reason to justify violating the safety standards identified in block 8a.

(9) Block 9 - Potential Consequences of Deviation from Approved Standards. These numbers quantify the potential consequences of the risk being accepted and are based on the residual risk after control measures on page 2 have been implemented. Enter the anticipated numbers for fatalities, additional injuries, and the dollar loss to equipment and facilities due to the deviation, based on the worst case scenario.

(10) Block 10 - Date Deviation Initiated. Enter the date the safety professional and/or analyst created this DA Form 7632.

(11) Block 11 - Residual Severity. Identify the residual severity after controls identified on page 2 have been implemented.

(12) Block 12 - Residual Probability. Identify the residual probability after controls identified on page 2 have been implemented.

(13) Block 13 - Residual Level of Risk. No data entry required. The residual level of risk will be automatically calculated based on the severity and probability entered in blocks 11 and 12.

(14) Block 14a - Safety Professional/Analyst. Enter the name and POC information of the safety professional and/or analyst that conducted the risk assessment. This will allow the "Reviewed By" official to contact the safety professional and/or analyst if questions arise.

(15) Block 14b - Analyst Signature. Signature of the safety professional and/or analyst that conducted the risk assessment. Do not sign until the risk analysis has been completed.

(16) Block 14c - Submitter's Signature. Enter the name and POC information, if different than block 14a.

(17) Block 14d - POC Signature. Signature of the submitter, if different than block

(18) Block 14e - Reviewed By. This section lists offices that have reviewed the risk assessment and have concurred or non-concurred. Routing for the DA Form 7632 should not be assumed to be through the garrison commander only. Routing for approval and proper awareness should include the garrison commander (for coordination with safety, master planning, Department of Public Works, security, fire and emergency services, environmental, legal, and so forth), senior commander (overall responsible for the installation), the higher headquarters of the unit responsible for the mission or operation, and any exposed units (to include other Services and/or agencies and non-DOD entities). See example in figure D–2. Enter the date, whether they concur with approving the deviation and accepting the associated risk, organization, printed name and title of the person reviewing, and their signature. Comments should be attached, as necessary, and the safety professional and/or analyst should consider changing the original risk assessment, if necessary, based on these comments. If a reviewer does not concur, they must select the attachment block to provide comments for their non-concurrence. If additional space is needed to document DA Form 7632 routing, create and attach additional (separate) page 1 documents. These "continuation pages" will have blocks 1 through 4 completed and "CONTINUATION OF BLOCK 14e" entered in block 8a.

c. Deviation Approval/Risk Acceptance. The section on page 1 identifies the person approving the deviation and accepting the associated risk. The person signing must be authorized to accept the risk in accordance with table 4–1.

(1) Block 15a - Army HQ. From the dropdown select the Army Headquarters (HQ) - Headquarters, Department of the Army (HQDA), ACOM, ASCC or DRU (or COCOM for combatant command, if appropriate) - the acceptance authority falls under.

(2) Block 15b - Unit/Comm. Enter the specific unit and/or command the approval authority is assigned.

(3) Block 16a - Date. Date the approving authority signs the document accepting the risk. This date will automatically populate the "Effective" date in block 5a and the top of each sequential page.

(4) Block 16b - Expiration Date. To be completed by approval authority. Enter the date the deviation will expire. The expiration date is calculated by using block 16a and the duration chosen from blocks 21a through 21d. This date should be consistent with the "Duration of Deviation" selected in either block 21a, 21b, 21c, or 21d. The Expiration Date will auto populate block 5b and the top of each sequential page once block 16b has been populated. For example, for effective date 20131202 (block 16a) and duration of 1 month to 1 year (block 21b), 12 was selected from the dropdown. The expiration date would be 12 months from the effective date. The deviation would expire on 20141201. If the deviation is greater than 5 years enter "permanent" in the space provided for the expiration date.

(5) Block 17 - Rank/Title. Rank and title of the approving authority. For example, Major General, USA, 4th Infantry Division, Commanding.

(6) Block 17a - Printed Name. Printed name of the approving authority.

(7) Block 17b - Signature. Signature of the approving authority. Electronic signature capability is provided.

(8) Block 17c - Comment. Comments should be attached, as necessary. If an approving authority comments and/or does not accept the assessed residual risk, then those developing the risk assessment should work together with the approving authority to mitigate and manage the risk to meet mission requirements. If more room is needed for comments, attach a continuation sheet and check the “attachment” block to indicate that something is attached.

d. Risk Assessment Worksheet – page 2. The Deviation number is an installation specific number for tracking purposes and will auto populate from block 4. The effective and expiration dates (block 5a) will auto populate from blocks 16a and 16b.

(1) Block 18 - Current Situation. Provide a description of the situation that necessitates this deviation. For example, briefly describe the status of the planned operation, the ongoing activity that is unsustainable and needs to change, and/or the current deviation, as applicable. Use a continuation sheet, if necessary, and check the “attachment” block indicating that something is attached.

(2) Block 19 - Hazard Category. From the dropdown, enter the broad category of the hazard that is being created by the deviation (for example, fire, weather, explosion).

(3) Block 20 - Specific Hazard. Enter a brief description of the specific hazard being created by deviating from requirements (for example, fire due to linking extension cords).

(4) Block 21 - Duration of Deviation. Choose one block to document the period of the deviation and, with the exception of block 21d, select a duration from the dropdown menu in the appropriate block (for example, block 21a, 21b, or 21c). If the deviation is permanent or greater than 5 years, enter “permanent” in the space provided or the specific number of years, if known. The expiration date (block 16b) will be calculated by the effective date (block 16a) and the specific duration entered in block 21a, 21b, 21c, or 21d.

(5) Block 22 - Deviation Approval Authority (or equivalent). Select the appropriate approval authority level in accordance with table 4–2. Military positions are listed in the drop down with the Army civilian equivalent. Army civilian equivalent grades per table 4–1 are authorized.

(6) Block 23 - Mission Impact of Not Accepting Risk. Describe the impact on the mission if the deviation and risk are not accepted (for example, mission must be cancelled, mission must be postponed until hazard can be corrected, or mission violates Army requirements). Use a continuation sheet, if necessary, and check the “attachment” block indicating that something is attached.

(7) Block 24 - What we need to do that deviates from block 8a. Provide a detailed description of the action that deviates from the safety standards identified in block 8a. A synopsis of this information will be provided in block 8b. If more room is needed for a detailed explanation, attach a continuation sheet and check the “attachment” block to indicate that something is attached.

(8) Block 25 - Control Measures. List the control measures that will be implemented to reduce the initial risk to a residual risk. Include milestones of when controls will be implemented if not implemented before the DA Form 7632 is signed. If more room is needed for explanation, attach a continuation sheet and check the “attachment” block to indicate that something is attached.

(9) Block 26 - Permanent Corrective Actions (with milestones). Permanent measures may or may not be possible. Provide milestones for any permanent actions that will be taken. For military construction projects, provide the project number and estimated cost. If more room is needed for explanation, attach a continuation sheet and check the “attachment” block to indicate that something is attached.

(10) Block 27 - Alternatives Considered. List the alternative solutions considered and the reason these were not used. Explain the reason, if an appropriate one is not listed in drop down box. Explain if no alternative solution is available. (For example, the host nation directed which port or berth to use.) Use a continuation sheet, if necessary, and check the “attachment” block indicating that something is attached.

(11) Block 28 - Attach any Supporting Documents. Check this block if supporting documents (other than the continuation pages from the above sections) are attached so the reviewers know to look for them (for example, photos, maps, drawing).

C–3. Additional considerations when completing the DA Form 7632 when deviations involve ammunition and explosives or chemical agents

When a deviation involves AE or chemical agent, complete the Risk Assessment Worksheet (page 2) and the Ammunition and Explosives Worksheet (page 3) of DA Form 7632 before completing page 1. Block 9 - Potential Consequences of Deviation from Approved Standards (block 9a (Fatalities), block 9b (Injuries), and block 9c (Equip/Fac Loss) will auto populate once blocks 39a through 39c have been populated if AE is the source of the risk. The Ammunition and Explosives Worksheet is required when a deviation involves AE or chemical agent. Information needed to populate this worksheet can be found at various organizations, but not limited to: the safety office, Department of Public Works (DPW), master planner, fire department, Director of Logistics, security and/or Military Police, property book office, and so forth. For technical assistance with this worksheet, contact the U.S. Army Technical Center for Explosives Safety, 1 C Tree Road, Building 35, McAlester, OK 74501 at DSN: 956–8737, Commercial: 918–420–8737 or at usarmy.mcalester.usamc.list.dac-es-personnel@mail.mil or via Ammo Help located under the “DAC” tab at https://mhp.redstone.army.mil/MhpMain.aspx.

Note. The deviation number, effective, and expiration dates will auto populate onto this page after completion of page 1 of the DA Form 7632.

a. Information on the potential explosion site.

(1) Block 29a - PES Name. Enter name of the PES (for example, Ammunition Supply Point #1, Joint Explosive Ordnance Disposal Rapid Response Vehicle Parking).

(2) Block 29b - PES Function. Describe the function of the PES (for example, unit storage, explosives loaded vehicle parking area).

(3) Block 30 - PES Number People. Enter the number of people directly related to the PES.

(4) Block 31 - PES Equip/Fac (value). Enter the sum value of the equipment and facilities at the PES.

(5) Block 32 - Required Blast Distance. Enter the calculated blast distance based upon the NEW for the most hazardous hazard division and mixing rules. (See DA Pam 385–64 and DODM 6055.09–M.) The amount of NEW is the highest expected during the requested timeframe.

(6) Block 33 - Required Fragment Distance. Enter the calculated fragment distance based upon the NEW for the most hazardous hazard division and mixing rules. (See DA Pam 385–64 and DODM 6055.09–M.)

(7) Block 34a-f - Hazard Division. Enter the NEW by hazard division.

(8) Block 35a - QD arcs exceed the installation boundary? Are other Services affected? Was coordination made? Provide other coordination documentation, as necessary. Why coordination was not made. Coordination paperwork attached? Check yes or no to indicate whether the arcs exceed the installation boundary, affect other Services, or if other coordination documents are available. State why coordination was or was not made. Check the “attachment” block to indicate that something is attached, if needed.

(9) Block 35b - Is this deviation associated with a hybrid or risk-based safety submission? Indicate yes or no if deviation is associated with an approved explosives safety site submission. The DA Form 7632 will be included in the explosives safety site submission as a supporting document.

(10) Block 35c - If yes, provide site plan number. Provide site plan number, as necessary. This is an installation specific number for their tracking purposes. For example, MCAAP–SP–2013–01. MCAAP is McAlester Army Ammunition Plant, SP indicates site plan, 2013 is the year, and 01 is the sequence number of site plans that installation has for that year or an alpha and numeric format similar to block 4 above.

b. Information on exposed sites. This section lists ESs to the PES and provides estimates of expected loss in the event of an accident. Block 36 – Exposed Sites. List the ES facility number and description of all facilities within inhabited building distance (IBD) of the PES. Enter the required and actual distances between the PES and ES. Next, enter the number of people at the ES and calculate the estimated dollar value of the ES facility and/or equipment at the ES. Then, enter the type of exposure (that is, quantity distance) relationship required between the PES and ES (for example, IBD, Public Traffic Route distance, and so forth). Next, annotate whether the ES is on or off the installation. Then, calculate the expected number of fatalities, injuries, and loss to equipment and facilities for the ES. Calculation of expected loss can be determined by using software, such as the Department of Defense Explosives Safety Board approved software Automated Safety Assessment Protocol–Explosives (ASAP–X) tool. The expected number of fatalities, injuries, and loss to equipment and facilities must be calculated twice: for each ES at the required distance and again for each ES as sited. The information entered in block 36 will be broken down in different categories in the following Expected Potential Consequences section. The violation yes/no block will auto populate based on the required and/or actual feet listed in the Distance Required and/or Actual Column. If the actual distance is greater than the required distance there will be “no” violation. The Violation Column can be manually changed, if needed. Repeat this procedure for each ES. Use a continuation sheet, if necessary, and check the “attachment” block indicating that something is attached.

c. Expected potential consequences. This section uses information from block 36 to calculate potential consequences. The different types of consequences have been calculated to reflect the impact of an incident assuming total loss of the people, equipment, and facilities at the PES.

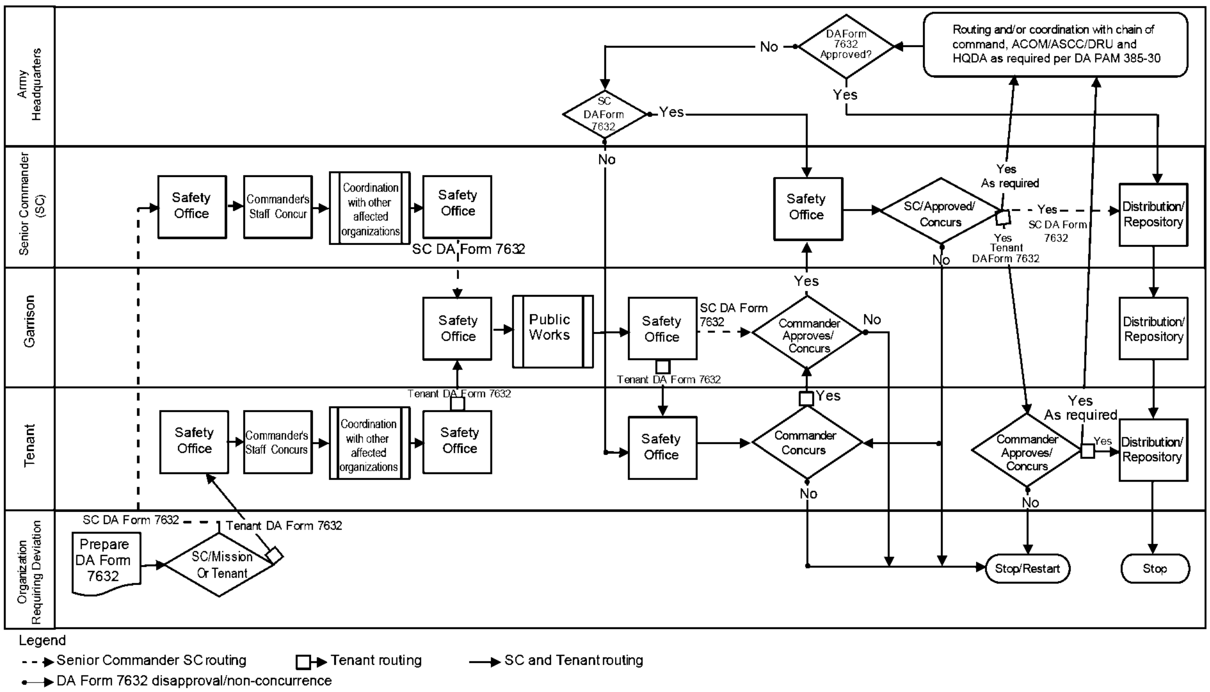
(1) Blocks 37a through c - Potential Explosion Site (PES). These numbers reflect the fatalities, injuries, and dollar loss of equipment and facilities at the PES. These numbers will auto populate and will match (assuming 100 percent loss) those entered in blocks 30 and 31. The default can be manually overridden if that is not the reality of the situation due to protective construction, testing, and so forth. For example, there could be three fatalities and two injuries associated with the PES due to protective construction versus five fatalities (100 percent loss).

(2) Blocks 38a through c - Potential Losses for Exposed Sites (ES) Meeting Criteria. These numbers reflect the potential loss for all ESs listed assuming that all meet the required distance. The values for all ESs listed that have “No” violation in Block 36 are to be summed and manually entered in blocks 38a through c based on the “at required distance” fields from block 36. These blocks may require manual input to include the totals from any continuation sheet attachments if additional space for block 36 was needed.

(3) Blocks 39a through c - Potential Loss Being Accepted for Deviating from Approved Standards. These numbers reflect the increased potential loss for ESs that are in violation of the required distance but do not include losses

entered in block 38. These fields represent the additional consequences associated with the PES and the violations being accepted. These numbers come from the difference in the “as sited” and the “at required distance” fields of block 36 for ES sites listed that have the answer “Yes” violation in block 36. Blocks 39a through c should include the totals from any continuation sheet attachments, if additional space for block 36 was needed. These blocks require manual input and will auto populate blocks 9a through c.

(4) Blocks 40a through c - Total Potential Loss. These numbers will auto populate by summing blocks 37a through c, 38a through c, and 39a through c and reflect the total potential loss if an incident were to occur at the PES.



Notes:

[1] Risk acceptance, per table 4–1, may occur at various stages of this process, depending on the risk level.

[2] The SC lane and the term “SC DA Form 7632" encompass DA Forms 7632 initiated by any local activity falling under the SC’s command, including both garrison and mission organizations.

[3] The “Safety Office” in the SC lane refers to the SC’s designated safety office.

Figure C–1. Example of DA Form 7632 routing

Appendix D
Application of Risk Management to Army Learning Policy and Systems

D–1. Army Learning Policy and Systems

The instructional system design process used for developing Army learning products is analysis, design, development, implementation, and evaluation (ADDIE). This spiral approach is used as the basis for the entire Army Learning Policy and Systems. The purpose of the Army Learning Policy and Systems is to support the Army by regulating practices in effective learning management and specifying required enabling systems. The requirements of the Army Learning Policy and Systems program are discussed in detail within the United States Training and Doctrine Command (TRADOC) Regulation 350–70 and its associated TRADOC pamphlets. TRADOC is the Army’s proponent for structured training. Such policies and systems apply to all Army organizations (TRADOC and non-TRADOC alike) that produce, implement, and/or evaluate learning and learning systems. The major concern of all commanders is to ensure their Soldiers, Army civilians, and units are trained to perform their mission to standard and survive. To ensure mission-focused training, Soldiers, Army civilians, staff, and units must perform under realistic conditions. Risk management balances benefits against potential losses during this training. It provides commanders and leaders with the tools to accomplish realistic training and education while preserving the scarce resources of personnel, time, and equipment. When used properly, risk management is a training and education enabler. In this chapter we will present risk management application into the Army Learning Policy and Systems.

D–2. Learning product requirements

In developing learning products, institutions must—

a. Extend learning beyond the schoolhouse in a career-long learning continuum through the use of current and emerging network technologies.

b. Design learning to be more facilitated, team-based, and learner-centric.

c. Leverage technology to provide engaging, relevant, and rigorous resident, distributed, and mobile learning, and social learning activities.

d. Leverage opportunities to implement technologies to engage and appeal to digital learners.

e. Institutionalize a progressive and sequential learning process throughout a Soldier or Army civilian’s career to develop a deepening of cognitive, interpersonal, and problem-framing and/or solving skills essential for personal adaptability.

f. Design the learning system to expand beyond the confines of “brick and mortar” to deliver learning products to Soldiers or Army civilians at the point of need.

g. Implement blended learning to balance quality face-to-face learning experiences with technology-enabled learning products.

h. Employ learning strategies that foster problem-solving skills needed to enhance adaptability.

i. Continuously evaluate the entry phase characteristics and perspectives of incoming Soldiers and Army civilians and adjust learning curricula to achieve desired outcomes at all levels of the learning system.

j. Incorporate deliberate strategies to ensure required skill levels, knowledge, and abilities transfer from the institutional environment to the operational environment.

D–3. Army Learning Policy and Systems focus

The Army Learning Policy and Systems uses ADDIE as a systematic, spiral approach to develop learning programs used to making collective, individual, and self-development training and education decisions for the Army. The Army Learning Policy and Systems determines—

a. Whether or not training or education is needed.

b. What is to be trained.

c. Who gets the training or education.

d. How well and where the training or education is presented.

e. The training and education support and resources required to produce, distribute, implement, and evaluate those products.

D–4. Training Development Capability

All developers must use the Combined Arms Command approved automated development system throughout the developmental process. The current Training Development Capability system is part of the required resourcing processes, allows for the revision of related information as changes occurs, and provides a means of sharing information to reduce redundancy. This system is currently Web-based and allows training and education developers the flexibility needed to rapidly gather expertise, integrate current doctrine into their training products, and staff products for approval in an efficient digital format. The underlying process of Training Development Capability is the five-step ADDIE process and requires a great deal of communication and coordination. Figure D–1 is a graphic representation of five-step process integration.

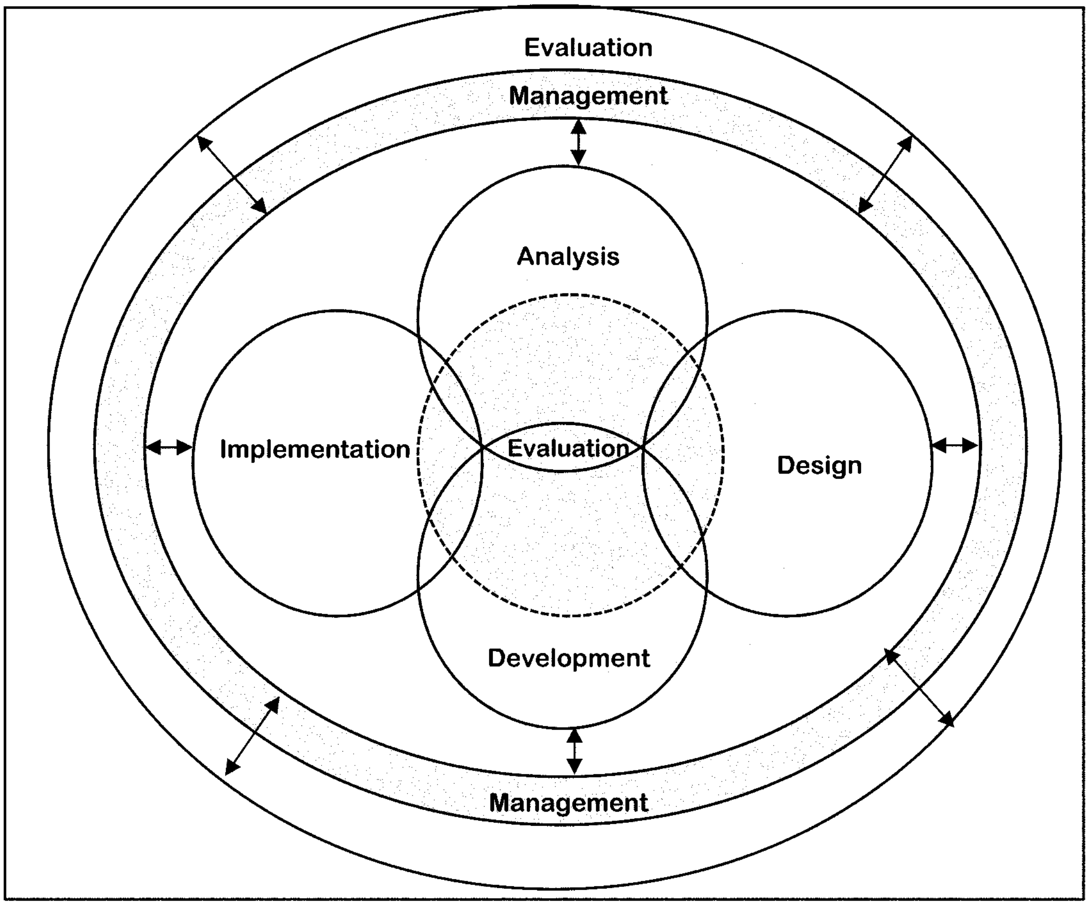
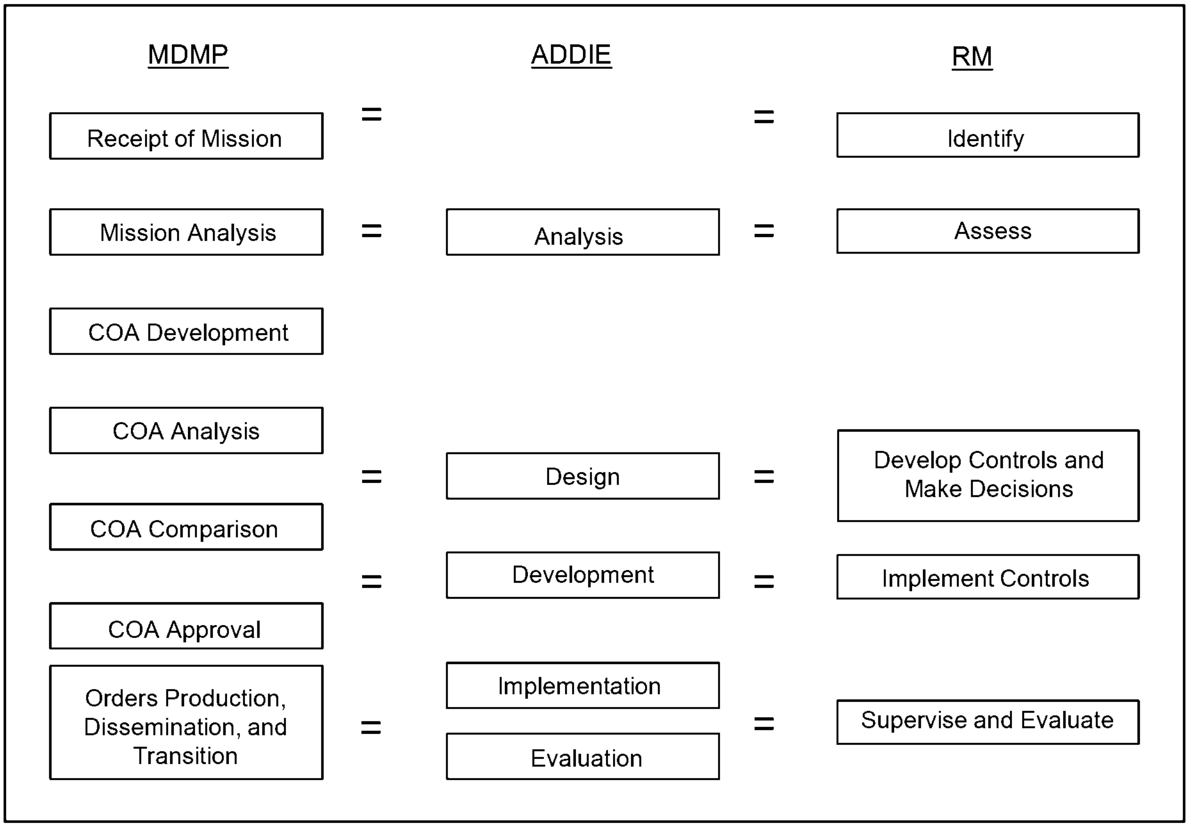


Figure D–1. The analysis, design, development, implementation, and evaluation process

D–5. Evaluation

Just as with the risk management process, evaluation is continuous throughout the ADDIE process. Feedback for corrective actions is critical. Evaluation permeates all phases. It is the cement that ensures training, education, and the required training products are effective in producing trained units and individuals. Products are evaluated either formally (product validation) or informally to determine currency, efficiency, and effectiveness. The entire process must operate within a given set of resources. The risk management process runs simultaneously and continuously to ensure training and education remains within the specified level of risk allowed for each event. The evaluation of risk management actions and the overall efficiency and effectiveness of the training are intertwined and risk management must be addressed as a part of the ADDIE process, as a whole. Figure D–2 shows the relationship between the military decisionmaking process, ADDIE, and risk management. While this graphic is not a perfect representation of the alignment, it provides a general diagram of the concepts and association of the three commonly used processes.



Legend for Figure D–2;
MDMP — military decisionmaking process
RM — risk management

Figure D–2. Analysis, design, development, implementation, and evaluation, the military decisionmaking process, and risk management

D–6. Risk management integration into training and education

a. Commanders and leaders are required to make informed risk decisions. This ensures that training and education is conducted realistically and in a manner that protects the well-being of the Soldiers and Army civilians being trained. This enables individuals, leaders, and units to recognize and mitigate hazards to improve survivability and to win over the full range of military operations.

b. Training and education developers and trainers provide safe training and education to achieve force protection by designing, developing, and implementing realistic, viable training and education that—

(1) Does not unnecessarily jeopardize lives and equipment.

(2) Eliminates or minimizes the risks involved in relation to the training and education benefits.

(3) Includes controls to eliminate or reduce the risk or hazard.

(4) Conserves and preserves resources.

(5) Complies with Federal, state, and local laws, regulations, and restrictions.

(6) Integrates safety, risk management, and force protection considerations into training, education, and training materials where appropriate.

c. Proponent training and education developers should ensure all products—

(1) Include appropriate safety, risk, and protection statements, cautions, notes, and warnings.

(2) Identify training or education risk and assign a risk level to every proponent lesson.

(3) Are staffed through the appropriate safety office director, manager, or resident safety professional for subject matter review in accordance with command guidance.

(4) Include controls necessary to minimize or eliminate hazards during training or education to include a maximum instructor to student ratio, as well as risk management procedures to be followed if the maximum ratio is exceeded.

(5) Address risk management and the risk management process as it applies operationally to the training or education subject.

d. The training development process fixes responsibility, institutionalizes operational safety, and leads to decision-making at the command level appropriate to the identified level of risk. Using risk management in the training-development process ensures the following:

(1) Safe training or education.

(2) Fewer injuries and deaths.

(3) Reduced incidents of lost time.

(4) Lower costs (facility, training, and equipment repairs).

e. Risk management is never complete. It is a continuous cycle that requires everyone be constantly alert to training risks and to take immediate action to eliminate them or reduce their severity. Safety, risk management, and accident prevention are commander's, manager's, and individual's responsibilities. Proponent training and education developers, trainers, educators, and subordinate personnel should use the generic risk management information contained in training support products to begin their review of and update to hazards, as well as the controls to adjust for current conditions. Trainers and educators need to make corrections to their risk management worksheet and processes as they relate to their subject training. Trainers and educators rely on the quality products of developers. The developers rely on feedback from the trainers, educators, safety professionals, and other subject matter expert input. The Soldier or Army civilian receiving the training or education relies on the entire team to provide quality training or education.

Appendix E
Application of Risk Management to Other Areas

The death of a Soldier in combat or due to an accident can have a devastating effect on a unit's morale and effectiveness. The effects of criminal acts, suicide, sexual assault, domestic violence, substance abuse, child abuse, and other high risk reckless behaviors can also cripple an organization's morale and destroy its combat effectiveness. Commanders and leaders must establish and maintain a command environment that fosters cohesion, team work, and performance to standard while caring for the well-being of the individual. Previous chapters discussed the application of risk management in tactical and non-tactical situations, in the training development process, and as a life skill for individual activities. Commanders and leaders can also use the risk management process to identify behaviors or activities that may present hazards to a unit's morale and impact combat effectiveness. This chapter provides examples on how risk management will be applied to mitigate a number of these hazards in some of the appropriate areas.

E–1. Leadership

a. Command issues. The principles of risk management become indispensable in addressing issues that impact Soldiers and Army civilians both on and off the battlefield. Effective risk management is on-going and cyclic. The risk management process is integrated into the development of all SOPs and the development process for all policies that address issues of behavior, health, and criminal activity. The following paragraphs discuss risk management application in the areas of sexual assault prevention, suicide prevention, and PMV accident prevention.

b. Command emphasis.

(1) By applying the principles of risk management when identifying hazards associated with suicide, sexual assault, and PMV accident prevention, commanders can take the initiative to identify and mitigate risks associated with these hazardous behaviors and situations before they impact on our units. This in no way implies these are the only applications for risk management. This five-step process can be applied across the full spectrum of human activity to identify hazards, assess risk, and make decisions.

(2) The principles of risk management as a decisionmaking tool are universal in application. The repeated use of the systematic risk management process reinforces application of the five steps to identify, assess, and control hazards and to make informed risk decisions in any situation. The risk management process is integrated into the development of SOPs as well as the development of policies that address issues of behavior, health, and criminal activity.

E–2. Sexual harassment and assault prevention

a. The prevention of sexual harassment and assault is both a command and an individual responsibility. Sexual assault destroys teamwork, undermines the good order and discipline of the military, destroys unit morale, and impacts personal combat readiness. Effective risk management identifies the potential hazards, conditions, or situations that may lead to this behavior. Early identification of conditions conducive to such behavior and active intervention by leadership reduces the likelihood of individuals attempting sexual assault or becoming a victim of a sexual assault. The principles of risk management can play a pivotal role by assisting the commander with tools to enhance policy awareness and training. By conducting command climate assessments, complaints processing awareness briefings, and overall assistance concerning the prevention of sexual harassment, commanders can mitigate the risks associated with sexual harassment and assault. Individuals must be educated on how best to avoid being a sexual assault victim. Once armed with this knowledge and ability, individuals can avoid situations that may put them in danger or may lead to their harassment or assault.

b. The three tiers of self-protection include being alert, prepared, and assertive. See figure E–1 for a graphic representation of these protection methods. Trust your instincts; if a place or person feels unsafe, it probably is. Watch for signs of trouble such as strangers in private areas or persons loitering in places where they shouldn't be. Utilize real time risk management in order to assess the risks, develop controls, and implement those controls in order to mitigate the risks. If you sense trouble and have very little time, it may be best to get to a safe place as soon as possible. If you feel you are in danger, attract help any way you can. Implementing controls is key. Taking steps such as traveling with a buddy, staying in groups, staying sober, educating yourself about date rape drugs, walking only in lighted areas after dark, and keeping the doors to homes, barracks, and cars locked are all good ideas. However, the best control measures are useless unless they are implemented.

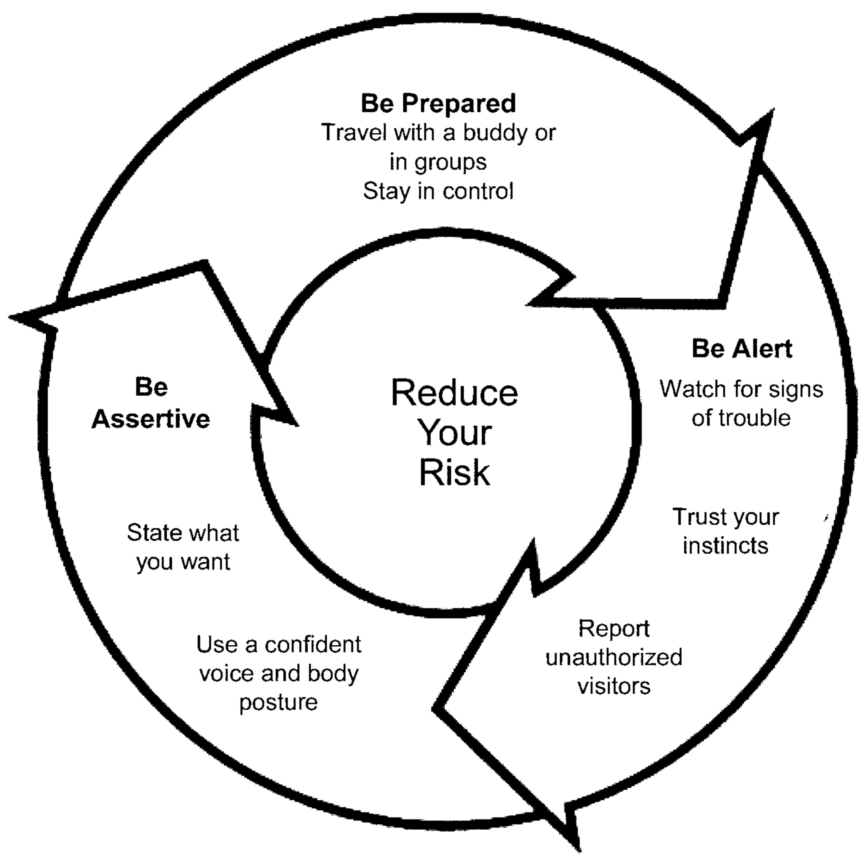


Figure E–1. Sexual assault risk reduction

E–3. Suicide prevention

a. Each year the Army needlessly loses Soldiers and Army civilians to suicide. Suicides occur across every segment of the force. Suicide prevention, like all leadership challenges, is a commander's program and there is leader responsibility at all levels. Suicide is a highly complex human tragedy. There is no typical profile of deaths by suicide. Suicide poses a significant challenge to the readiness of our force. The principles of risk management and the five-step process are relevant and critical in identifying, assessing, and mitigating suicide risk to personnel. The role of Army leadership in suicide prevention cannot be overemphasized. Leaders, as well as fellow Soldiers, Army civilians, and Family members are the first line of defense to recognize personnel who are experiencing life stressors. They can take appropriate actions to prevent further loss of life and utilize numerous support resources to assist personnel in lowering their risk level. It is important for all commanders and leaders to recognize that mental wellness is a key component for overall individual readiness and fitness.

b. Commanders and leaders should make use of tools that provide a comprehensive, continuous, and standardized process to assess the well-being of their Soldiers and Army civilians, ensure intervention strategies are in place to assist those individuals, and significantly reduce high risk behaviors. Tools provided by the Army and major commands to assist commanders include:

(1) The Army Readiness Assessment Program (ARAP). ARAP is a tool that addresses root causes of accidental loss by focusing on organizational safety climate and culture. ARAP is an online assessment, filled out by employees and Soldiers anonymously, that captures unit posture on command and control, standards of performance, accountability, and risk management. ARAP provides battalion-level commanders with data on their formation's readiness posture.

(2) The United States Army Soldier Leader Risk Reduction Tool may be found at www.preventsuicide.army.mil. This tool may be used in conjunction with appendix B of Field Manual (FM) 6–22 to counsel individuals. These tools should be used during developmental counseling sessions. Additional information on suicide prevention training, current guidance, and an expanded commander's toolbox may also be found at this site. Civilian employees may contact their Occupational Health Clinic or their local Installation Employee Assistance Office for additional information.

E–4. Private motor vehicle accident prevention

PMV accidents have historically been the leading cause of accidental death for Soldiers. Every Soldier has an individual responsibility to prevent accidents. Commanders and leaders must also be vigilant in the identification of high-risk behavior. Risk management assists commanders and leaders in recognizing those hazards, behaviors, and/or situations that may lead to tragedy. The Director of Army Safety has prepared a number of tools to help leaders manage PMV risk.

a. The Travel Risk Planning System (TRiPS) is an automated trip planning tool that incorporates the principles of Risk Management and facilitates a dialogue between supervisor and subordinate prior to privately owned vehicle travel.

b. These tools are available through the U.S. Army Combat Readiness/Safety Center at https://safety.army.mil.

Glossary

Section I
Abbreviations

ACOM
Army command

ADDIE
analysis, design, development, implementation, and evaluation

ADP
Army doctrine publication

AE
ammunition and explosives

APD
Army Publishing Directorate

AR
Army regulation

ARAP
Army Readiness Assessment Program

ASA (IE&E)
Assistant Secretary of the Army (Installations, Energy and Environment)

ASAP–X
Automated Safety Assessment Protocol-Explosives

ASCC
Army service component command

ATP
Army techniques publication

AWSSRB
Army Weapon System Safety Review Board

CFR
Code of Federal Regulations

CG
commanding general

CJCSI
Chairman of the Joint Chiefs of Staff instruction

CO
commanding officer

COA
course of action

COCOM
combatant command

DA
Department of the Army

DA Pam
Department of the Army pamphlet

DARAD
Deviation Approval and Risk Acceptance Document

DD
Department of Defense (form)

DOD
Department of Defense

DODI
Department of Defense instruction

DODM
Department of Defense manual

DPW
Department of Public Works

DRU
direct reporting unit

DSN
Defense Switched Network

E
exemption

EH
extremely high

ES
exposed site

EW
event waiver

FM
field manual

GO
general officer

GS
general schedule

H
high

HQ
headquarters

HQDA
Headquarters, Department of the Army

IBD
inhabited building distance

JFLCC
Joint Forces Land Component Commands

JTF
joint task force

L
low

M
medium

MDMP
military decisionmaking process

MIL–STD
Military standard

NEW
net explosive weight

O
officer

OPORD
operations order

OPTEMPO
operating tempo

PES
potential explosion site

PM
program manager

PMV
private motor vehicle

POC
point of contact

PPE
personal protective equipment

QD
quantity distance

RAC
risk assessment code

RM
risk management

SA
situational awareness

SC
senior commander

SES
senior executive service

SF
standard form

SOH
Safety and Occupational Health

SOP
standing operating procedure

SP
site plan

TRADOC
U.S. Army Training and Doctrine Command

TRiPS
Travel Risk Planning System

UIC
unit identification code

USATCES
U.S. Army Technical Center for Explosives Safety

W
waiver

Section II
Terms

Army Weapon System Safety Review Board
Focuses on the safety of Joint Service weapon systems. The AWSSRB represents Army in Joint weapon safety reviews; provides technical expertise to the Office of the Director of Army Safety, the Deputy Assistant Secretary of the Army (Environment, Safety and Occupational Health) and other Army Staff regarding weapon system safety related policy, standards, and technical issues; supports the DA System Safety Council in the identification and resolution of system safety issues; supports PMs; and interfaces with other Army safety review boards for Joint systems.

Asset
Something of value. Assets include but are not limited to Soldiers, personnel, facilities, equipment, operations, data, the public, the environment, equipment, and systems.

Exemption
A written authorization granted by the proper Army authority for strategic or other compelling reasons that permits a long-term deviation from mandatory Army safety requirements.

Fault
An abnormal undesirable state of a system, a system element, or process induced by the presence of an improper command (or absence of a proper one) or a failure (see definition below). All failures cause faults; not all faults are caused by failures. A system which has been shut down by safety features has not faulted.

Failure
Loss of functional ability to perform as intended (for example, relay contacts corrode and will not pass rated current closed; the relay coil has burned out and will not close the contacts when commanded—the relay has failed; a pressure vessel bursts—the vessel fails; or operator does not perform as required). A protective device that functions as intended has not failed (for example, a blown fuse).

Frequency
Rate of mishap occurrence. Frequency is sometimes substituted for probability as a component of risk (for example: loss events per 100 operating hours).

Hazard
A condition with the potential to cause injury, illness, or death of personnel; damage to or loss of equipment or property; or mission degradation.

Hazard analysis
Refers to a number of methods for identifying process hazards, measuring their relative consequences, and deriving recommendations.

Hazard list
A simple listing of hazards that may exist in the activity under evaluation. The possible hazards are listed by possible source without regard for the mechanism, outcome, or any consideration of likelihood of being present.

Hazard matrix
An analysis technique where a table is developed listing potential hazards versus potential failures areas in the activity being evaluated. Examples of hazards are corrosion, fire, impact, shock, and so on. Examples of potential failure areas are mechanical, personnel, or procedural.

Hazard scenario
A postulated sequence or development of events in which the existence of a hazard has the potential for causing a mishap.

Maximum credible event
The most disastrous maximum credible loss identified for a given system or operation. In AE and chemical agent hazards evaluation, the maximum credible event due to a hypothesized accidental explosion, fire, or toxic chemical agent release (with explosives contribution) is the worst single event that is likely to occur from a given quantity and disposition of AE. The event must be realistic with a reasonable likelihood of occurrence considering the means of initiation, explosion propagation, burning rate characteristics, and physical protection given to the items involved. The maximum credible event evaluated on this basis may then be used as a basis for effects calculations and casualty predictions.

Maximum credible risk
The risk associated with the hazard which is the most severe and the most credible.

Military decision making process
An interactive planning methodology to understand the situation and mission, develop COAs, and produce an operation plan or order (see ADP 5–0).

Mishap
An unplanned event or series of events resulting in death, injury, occupational illness, damage to or loss of equipment or property, or damage to the environment.

Mishap probability
Likelihood of mishap occurrence over a specified exposure interval. Probability is expressed as a value between zero and one. Probability is a component of risk and has no dimension but must be attached to an interval of exposure (for example, 1 operating year, 1 million vehicle miles).

Negligence (law)
Failure to exercise the degree of care considered reasonable under the circumstances, resulting in an unintended injury to another party. Negligence uses the “reasonable person” standard. In cases involving negligence, which is an unintentional injury, the law asks whether or not a reasonable person in the position of the defendant would have anticipated and guarded against the risks inherent in his or her conduct.

Probability
In risk analysis, the likelihood that an event will occur. There are five categories (with associated codes) of probability: frequent (A), likely (B), occasional (C), seldom (D), and unlikely (E).

Residual risk
The risk associated with a hazard that remains after implementing all planned countermeasures or controls to eliminate or control the hazard. The residual risk can also be the initial risk.

Risk
Probability and severity of loss linked to hazards.

Risk assessment
The process of identifying and characterizing hazards, analyzing them for their potential mishap severity and probability (or frequency) of occurrence, and prioritizing them for risk mitigation actions. The first two steps of the risk management process.

Risk category
A specified range of risk associated with a given level (high, serious, medium, low) used to prompt specific action, such as reporting hazards to appropriate management levels for risk acceptance.

Risk control hierarchy
Prioritized ranking of methods for controlling risk, arranged by order of effectiveness: (1) elimination; (2) substitution of less hazardous materials, processes, operations, or equipment; (3) engineering controls; (4) warnings; (5) administrative controls; and (6) PPE.

Risk decision
The decision to accept or not accept the risk(s) associated with an action; made by the commander, leader, or individual responsible for performing that action and having the appropriate resources to control or eliminate the risk's associated hazard.

Risk management
The process for managing risk, continuously applied across the full spectrum of Army training and operations, individual and collective day-to-day activities and events, and base operations functions to identify and assess hazards, develop and implement controls, and evaluate outcomes. The process of identifying and providing recommendations on whether to resolve or to accept accident-producing hazards associated with a mission; the design of a system, facility, equipment, or processes; and their operation.

Secretarial Certification
A written authorization granted by the Assistant Secretary of the Army for Installations, Energy and Environment for strategic or other compelling reasons that permits long-term noncompliance with mandatory Army safety requirements.

Severity
The expected consequence of a mishap in terms of degree of injury, property damage, or other mission impairing factors (loss of combat power and so on). There are four categories (with associated codes) of severity: catastrophic (I); critical (II); moderate (III); or negligible (IV).

Tolerable risk
The level of risk associated with a specific hazard below which a hazard does not warrant any expenditure of resources to mitigate.

Troop leading procedures
A dynamic process used by small unit leaders to analyze a mission, develop a plan, and prepare for an operation (see ADP 5–0).

Unnecessary risk
A risk that can be reduced or eliminated without adversely affecting the successful accomplishment of the mission.

Waiver
A written authorization granted by the proper Army authority for strategic or other compelling reasons that permits a temporary deviation from mandatory Army safety requirements.

Section III
Special Abbreviations and Terms
This section contains no entries.

TM 3-305

WAR DEPARTMENT TECHNICAL MANUAL

USE OF CHEMICAL AGENTS AND MUNITIONS IN TRAINING

WAR DEPARTMENT • 2 JUNE 1944

WAR DEPARTMENT TECHNICAL MANUAL

TM 3-305

This manual supersedes TM 3-305, Use of Smokes and Lacrimators in Training, 5 July 1940, including C 1, 17 November 1943 and C 2, 10 February 1944; and Section V, Training Circular No. 75, War Department, 1943.

USE OF CHEMICAL AGENTS AND MUNITIONS IN TRAINING

WAR DEPARTMENT • 2 JUNE 1944

United States Government Printing Office
Washington: 1944

WAR DEPARTMENT,
WASHINGTON 25, D. C., 2 June 1944.

TM 3–305, Use of Chemical Agents and Munitions in Training, is published for the information and guidance of all concerned.

[A.G. 300.7 (23 Mar 44).]

BY ORDER OF THE SECRETARY OF WAR:

G. C. MARSHALL,
Chief of Staff.

OFFICIAL:

J. A. ULIO,
Major General,
The Adjutant General.

DISTRIBUTION:

As prescribed in paragraph 9a, FM 21–6: R & H (3); Bn 1–7, 17, 18, 19, 44 (5), 9, 11 (2); C 3, 19 (2).

For explanation of symbols, see FM 21–6.

CONTENTS

Figure 1. Gas obstacle course. (See Chapter 2, Section IV.)

This manual supersedes TM 3–305, Use of Smokes and Lacrimators in Training, 5 July 1940, including C 1, 17 November 1943 and C 2, 10 February 1944; and Section V, Training Circular No. 75, War Department, 1943

CHAPTER 1

GENERAL

1. Purpose and Scope

This manual is published for officers and noncommissioned officers charged with training troops in defense against chemical attack and in the tactical use of chemical agents. It suggests model exercises involving all principal types of agents in both offensive and defensive situations. The manual supplements FM 3–5 and 21–40, as they pertain to training.

2. Use

a. The exercises are intended to supplement classroom instruction. They have been designed to make the greatest possible use of group performance. A sufficiently wide range of exercises is included to assist in any chemical warfare instruction program, regardless of its size. Army Regulations 775–10 provides the basis for issue of necessary supplies. Matériel may be requisitioned through normal supply channels.

b. Although all exercises have been used successfully as outlined, instructors are encouraged to modify them to fit their own training situations (except in the case of the gas chamber exercise). When possible, exercises should be expanded rather than shortened. Battlefield realism should be sought to condition men for chemical offense and defense in actual combat. Therefore it is urged that these exercises be incorporated into maneuvers and other comprehensive field training projects. Such adaptation is recommended especially to chemical staff officers and unit gas officers.

c. Attention is called to the following requirements:

(1) Exercises will be conducted in accordance with training doctrine outlined in FM 21–5, and with official chemical warfare doctrine as prescribed in FM 3–5, 21–40, and other War Department publications.

(2) Except for nontoxic smokes, nontoxic tear gases, and DM candles, all exercises in which live chemical warfare ammunition is used will be conducted under the personal and direct supervision of a chemical warfare service officer. DM candles may be used under the direction of either a chemical warfare service officer or a unit gas officer. These restrictions do not apply, however, to exercises employing the detonation gas identification set, M1 or the instructional gas identification set, M1 and M1A1. (See AR 750–10.)

(3) Chlorine used in training will be released only in the gas chamber.

(4) Commanders will be responsible for precautions in the use of mustard or other persistent gases used for training purposes.

(5) Tear gas will not be released against troops from airplanes or otherwise when it will cause discomfort or inconvenience to persons not involved in the training, or where the gas will cross highways not closed to traffic.

CHAPTER 2

TRAINING IN DEFENSE AGAINST GAS ATTACK

Section I.

GAS CHAMBER EXERCISE

3. Purpose

All personnel must be given this exercise to establish their proficiency in adjustment of the gas mask. The exercise is conducted in four phases and uses chloracetophenone (CN) and chlorine (Cl). The purpose is fivefold:

a. To test efficiency of the mask.

b. To establish confidence in it.

c. To teach respect for gas mask drill.

d. To provide experience with war gases in field concentrations.

e. To test proficiency of the individual in use of the mask.

4. Gas Chamber

Any reasonably airtight room or inclosed space of moderate size will suffice, provided it is 100 to 200 yards away from other activity. (See fig. 9.) A standard two-room chamber may be built by the Corps of Engineers from their Drawing No. 1600–150. A two-room building of rough timber covered with tar paper is also satisfactory if each room is about 25 feet square and fitted with two doors. A pyramidal tent may be used if earth is banked around the outside to prevent gas from leaking out under the wall. After use, such tents should be turned inside out and aired several days before being returned to storage.

5. Matériel

The chloracetophenone concentration is built up by heating CN capsules. To provide chlorine, a portable chemical cylinder M1A2 (TM 3–315) is customarily used, but a commercial cylinder also may be employed. Commercial chlorine is usually obtainable in 25-, 50-, or 75-pound cylinders. When possible, unit plans and training officers should pool their requisitions for chlorine with those of nearby units. To determine the amount of chlorine needed, allow ½ pound for each 100 men or for every 1,500 cubic feet of space in the chamber.

6. Supervision

A chemical warfare service officer will supervise and will arrange to have an ambulance present. Another commissioned officer and a responsible non-commissioned officer will be safety officer and assistant, respectively. Before the exercise they must make certain that each man knows gas mask drill, with emphasis on adjusting and clearing the facepiece. They should inspect the fit of each mask and divide the group into squads of size corresponding to the capacity of the chamber.

7. General Outline

The exercise will be divided into four phases as outlined in figure 2.

a. PHASE ONE. (1) A concentration of CN is developed by placing capsules on an inverted tin can generator, heated over a candle. (See figs. 3 and 4.) Originally, one capsule is used for every 1,000 cubic feet in the chamber. More are added as needed to maintain an effective concentration. Under no circumstances will a CN pot be used: burning it in a confined space would generate carbon monoxide.

(2) After phase one has been explained, an officer or noncommissioned officer wearing a diaphragm mask (if available) takes his place inside the chamber. In succession, masked squads are ushered into the chamber and the door closed behind them. Each squad stays 1 or 2 minutes to determine proper fit and adjustment of masks. Meanwhile the officer explains the protection being provided by their masks.

(3) On leaving the chamber the men move upwind, keeping masks adjusted. They are inspected by the officer in charge, who checks the fit of each mask before ordering the wearer to remove it. Each man is then examined for signs of lacrimation and asked whether his mask was comfortable. If a trainee reports that his eyes were affected by gas while in the chamber, this may indicate a poorly fitting or defective mask. Corrective measures are taken and the trainee repeats the test until a satisfactory fit is obtained.

(4) Upon removal of facepieces after this and other phases of the exercise (except the third), facepieces are slung over the shoulder to air.

b. PHASE TWO. (1) This phase establishes confidence in protection afforded by the mask. Properly masked, each squad enters a chamber in which there is a strong concentration of CN. After about 1 minute the men take position across the room from the exit. Each man in turn then unmasks and walks toward the door. A masked officer or noncommissioned officer is stationed there to help him out, first making certain he has felt an eye effect. To avoid needless loss of CN concentration, the door is kept open as short a time as possible.

(2) After each CN phase, troops should be warned not to rub their eyes, since this will cause painful swelling if the eyes have been affected. The men should move upwind, separate, and face into the breeze. Any painful effects will disappear within a few minutes. If the weather is hot, men should be allowed to wash with soap and water as soon as possible to avoid skin irritation.

c. PREPARATIONS FOR PHASES THREE AND FOUR. (1) If the same room is used for all four phases, it must be cleared of CN fumes before the chlorine concentration is set up. Preparations for use of chlorine will be supervised by the safety officer or the officer in charge. All personnel handling the cylinder should wear rubber gloves and gas mask.

(2) The following restrictions on use of chlorine in the gas chamber exercise must be observed:

(*a*) It must be used only under the personal supervision of a commissioned officer of the Chemical Warfare Service.

Phase	Agent	Position of mask when entering chamber	Action taken in chamber	Position of mask when leaving chamber	Reason for step
1	CN	Adjusted	Remain briefly	Adjusted	Test efficiency, fit, and adjustment of mask. Dispel fear of gas.
2	CN	Adjusted	Remain briefly and remove facepiece	Removed	Prove presence of gas. Establish confidence in mask.
3	Cl	Adjusted	Test for gas and clear facepiece	Adjusted	Practice in testing for gas. Teaching importance of clearing facepiece.
4	Cl	Facepiece in carrier	Adjust mask	Adjusted	Simulate actual field conditions. Give practice in adjusting mask in toxic concentration.

Figure 2. Phase chart for gas chamber exercise.

744585°—47——2

Figure 3. Preparing CN generator: Inverted tin can, punched at sides, is placed over lighted candle.

Figure 4. Placing CN capsules on tin can generator. Holes in can provide oxygen for candle burning inside.

(*b*) Gas will be released only inside the chamber.

(*c*) No person will be allowed alone in the chlorine chamber when a concentration of the gas is present.

(*d*) No person will be allowed to participate in the chlorine exercise until the efficiency of his mask has been tested in a CN concentration.

(3) To prepare a chamber, the chemical cylinder filled with chlorine is first placed on end in the chamber; the cap is removed, and the valve "cracked." If a commercial cylinder is used it is cracked by placing a wrench over the square on the end of the valve stem and tapping the wrench handle until the wrench may be moved freely by hand. The valve is then turned back handtight.

(4) To build up a concentration of chlorine, the hand wheel or wrench is opened 2 seconds for every 1,000 cubic feet of space in the chamber. How far it should be opened depends on the temperature. In extremely hot weather one-half turn or less will suffice, while in extremely cold weather one full turn or more may be necessary. To obtain equal distribution of chlorine throughout the room, fan the air with a large piece of cardboard. The safety officer then tests for gas. If his throat becomes irritated, or if there is an immediate tendency to cough, the concentration is too high and the chamber must be partially ventilated.

(5) To maintain a satisfactory concentration during the exercise the instructor should test for gas periodically, releasing additional chlorine if necessary. Ordinarily a 2-second discharge every 30 minutes will suffice.

d. Phase three. The command GAS! is given to each squad in turn as it comes to the chamber. Squad members then adjust facepieces and enter. Inside, they test for gas, clear facepieces, and remain 1 to 2 minutes to test the efficiency of their masks in a toxic concentration. Upon leaving, masks are removed and replaced.

e. Phase four. (1) Men are carefully instructed in advance about procedure in this phase. With masks in carriers and holding their breath as instructed, members of one squad enter the chlorine-filled chamber. Each man goes far enough into the room to leave the doorway unobstructed. Still holding his breath, he then adjusts his mask and

Figure 5. "Cracking" valve on chemical cylinder in chlorine chamber. Valve is kept open 2 seconds for every 1,000 cubic feet of space in the chamber.

clears his facepiece. The squad remains masked in the chamber 2 or 3 minutes. The group leaves, still masked, and another squad enters.

(2) The assistant safety officer or instructor inspects each man as he emerges, checking for proper adjustment of the mask and evidence of gassing. Special attention should be given to eye irritation, choking, coughing, and nasal excretion. Men so affected will repeat the entire exercise when effects of the first gassing have disappeared and after they have received additional instruction in adjustment of the mask.

(3) The officer in charge has the following special responsibilities whenever chlorine is used:

(*a*) Arranging in advance for personnel to wear fatigues or old clothing. (Chlorine will bleach most organic dyes, particularly if clothing is damp. Moreover, chlorine odor persists in clothing for several hours.)

(*b*) Seeing that men remove jewelry, insignia, watches, and glasses with metal rims before entering the chamber. (An officer or noncommissioned officer, preferably from the trainees' own unit, should receive this material and see that it is properly returned at the end of the exercise. Gas mask eyeglasses M1, need not be removed, however, since the rims are made of noncorrosive metal.)

(*c*) Checking the fit of masks worn by assistants.

(*d*) Supervising preparation of the chamber.

(*e*) Standing by outside the chamber when trainees enter with masks in carriers.

(*f*) Opening the chamber for ventilation after the exercise, and making certain it is ventilated properly.

(*g*) Supervising return of matériel.

(*h*) Inspecting the chlorine cylinder for leakage after the exercise.

Figure 6. Officer examines trainees for tear effect at end of the first phase.

Figure 7. Man "cries" as he leaves CN chamber with mask removed during second phase.

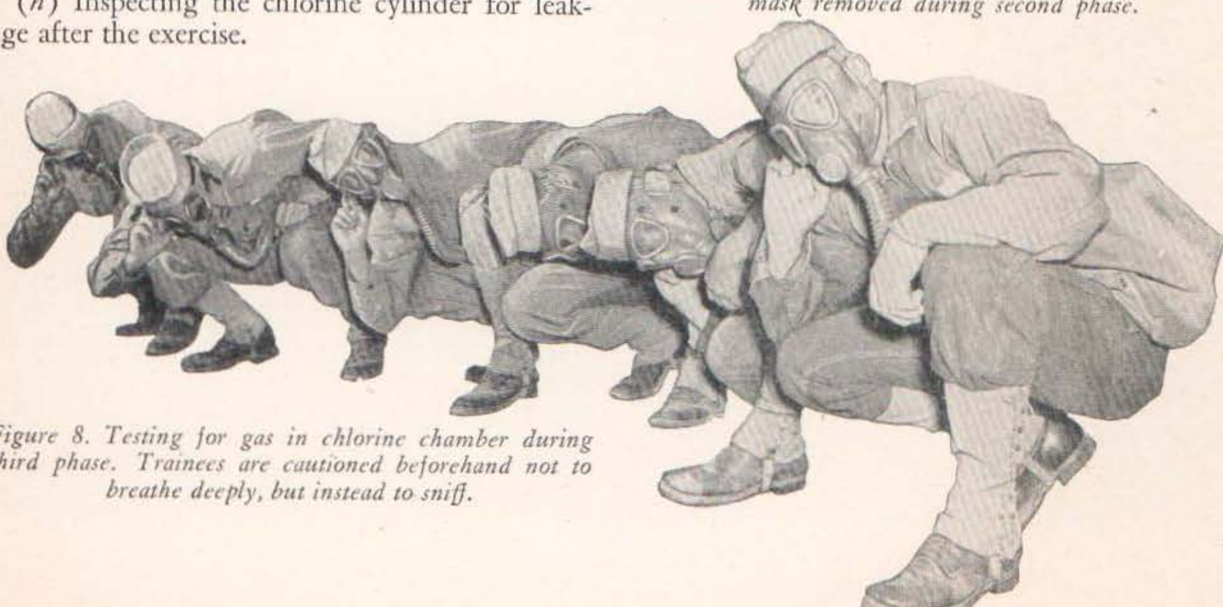


Figure 8. Testing for gas in chlorine chamber during third phase. Trainees are cautioned beforehand not to breathe deeply, but instead to sniff.

Figure 9. Pyramidal tent used as improvised gas chamber. Earth banked around outside prevents gas from leaking out under wall.

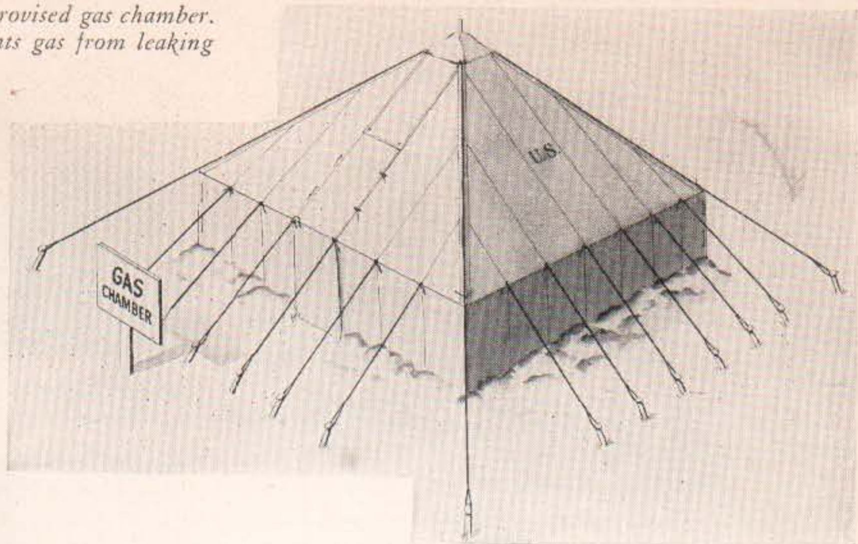
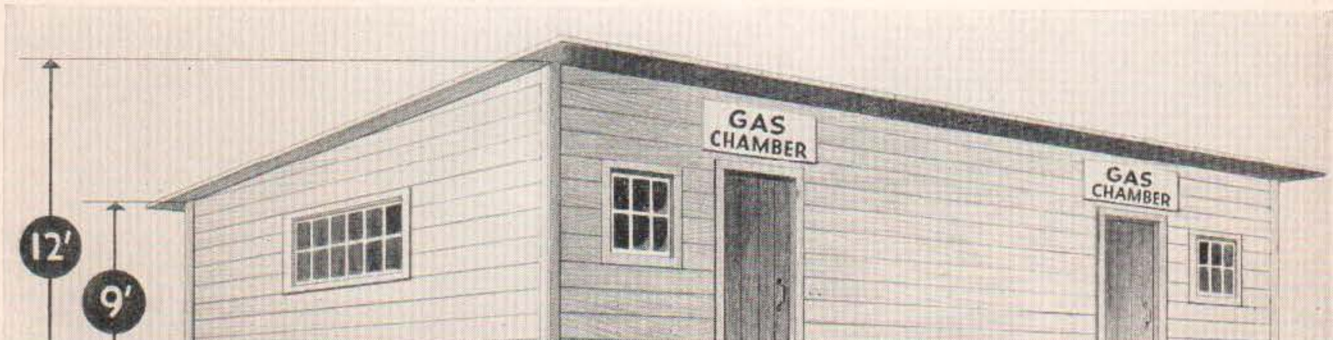


Figure 10. At left, standard two-room chamber built from Corps of Engineers drawing No. 1600–150.

Figure 11. Below: Improvised two-room gas chamber. If one-room building is used it must be cleared of CN fumes after the second phase before chlorine concentration is built up.



Section II.

IDENTIFICATION OF WAR GASES

8. Purpose

a. The sense of smell as a means of identification of war gases has several shortcomings. First, the enemy mixes gases to "mask" the odor. Second, impurities in mustard gas may cause an odor to linger after the gas itself has disappeared. Third, the sense of smell becomes dulled with exposure, so that even harmful concentrations become imperceptible. Finally, there are conditions under which certain blister gases may have almost no detectable odor. Standard detection devices provide the only conclusive means of identification.

b. Nevertheless every soldier should become proficient in identification of gases through odor and other sensory reactions, since other means may not be available. Many gases affect senses other than smell. For example, lewisite irritates the nasal passages, phosgene irritates the throat, and chlorpicrin produces tears. The exercises outlined below involve two specially designed kits, one for indoor instruction and the other for field exercises.

9. Instructional Gas Identification Set M1

The "sniff set" consists of seven wide-mouthed 4-ounce bottles, each with a stopper ground to fit. (See fig. 13.) Each bottle is packed in a sawdust-filled metal container. The containers are in turn packed in sawdust-filled compartments of a wooden case 30 inches long, 14¼ inches wide, and 11 inches high. One compartment is empty. Four bottles in the M1 set contain about 50 cubic centimeters (3.7 cubic inches) of granular activated charcoal saturated with a gas. Two of these bottles contain mustard gas, one chlorpicrin, and the fourth lewisite. The remaining three bottles contain solids without charcoal, one adamsite, a second chloracetophenone, and the third solid triphosgene. Solid triphosgene decomposes upon contact with the air to give off pure phosgene.

Figure 12. Mustard gas smells like garlic or horseradish—to some people!

CAUTION: Stoppers must be kept tight except when the bottles are being used, otherwise the contents will be exhausted prematurely. When contents of bottles are expended a requisition for replacements should be made through normal supply channels.

Figure 13. Instructional gas identification set, MI, showing method of packing.

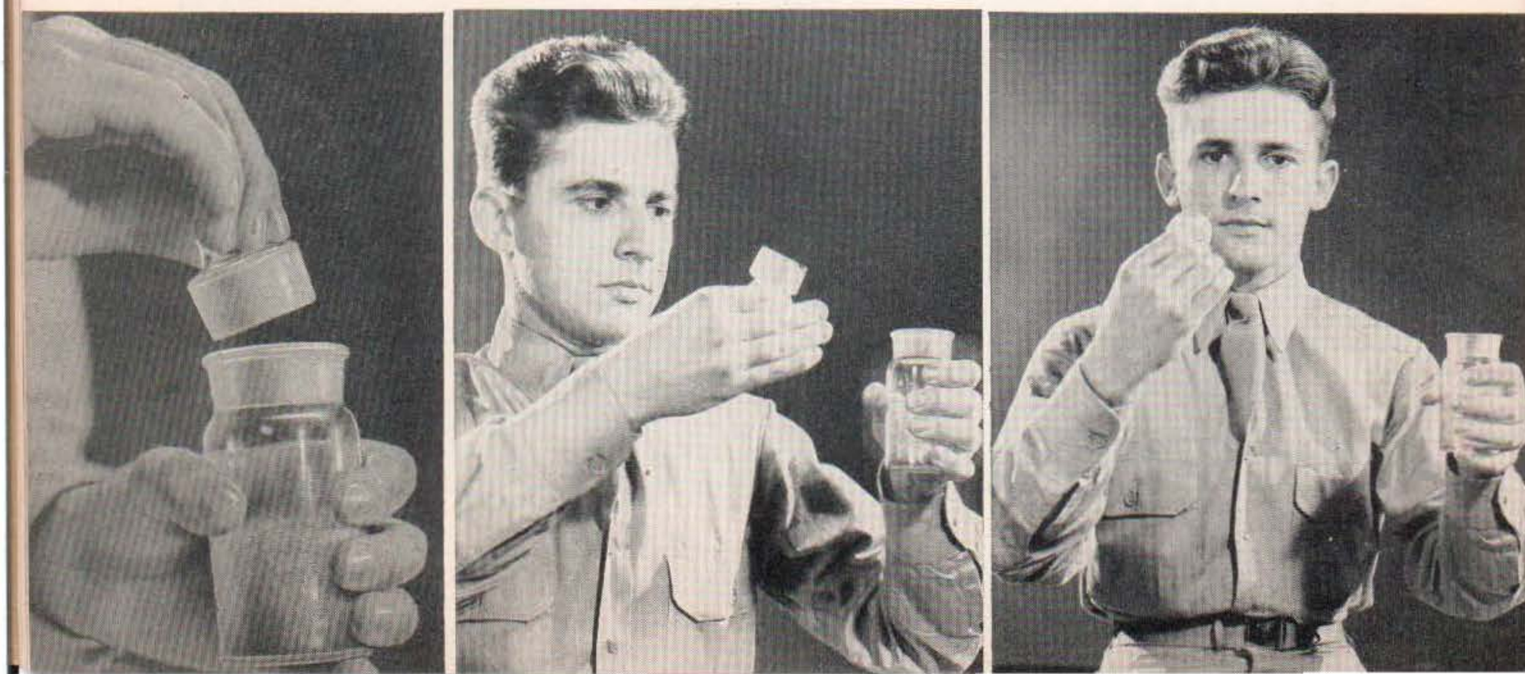
10. Use of Instructional Sets

a. The set is primarily used for indoor instruction prior to a field exercise with the detonation gas identification set. Trainees should not smoke immediately before or during the exercise. Instructors should pass around each bottle individually, with sufficient interval between bottles; otherwise the trainees' senses of smell will be dulled.

b. Directions for use: Holding the bottle at arm's length, remove the stopper. Using the open palm of the hand which holds the stopper, fan air across the mouth of the bottle toward the nose. Sniff—do not oreathe normally or inhale deeply. If the odor is not detected, bring the bottle closer. Another method is to wave the stopper back and forth several inches in front of the nose. Take care not to break the bottles or spill the contents; dangerous burns may result.

c. Use of the sniff set should be preceded by an explanatory talk. After trainees have been warned about the danger of dropping or spilling, and instructed in the proper method of sniffing, the bottles may be passed around. To introduce com-

Figure 14. Procedure for using "sniff set." First remove stopper, touching only the handle portion. Then fan with open palm across top of bottle towards nose. Alternate method (right) is to wave stopper in front of nose, as near as necessary to detect odor.



petition, a contest may be arranged: Cover the labels on the bottles and assign each sample a number. After sniffing each bottle the trainee writes down the number of the bottle and the war gas he believes it contains.

d. Thorough instruction should be given with the sniff set before beginning instruction with the detonation set. The cost of each use of a bottle is negligible, compared with the cost of a tube in the detonation set.

11. Detonation Gas Identification Set M1

(figs. 15, 16, and 17)

a. This set is for field identification tests of war gases. It consists of 48 sealed 1-ounce pyrex glass tubes, 1 inch in diameter and 7½ inches long. There are 12 tubes each of mustard gas, lewisite, chlorpicrin, and phosgene. Mustard gas and lewisite are 5-percent solutions in chloroform; the chlorpicrin is a 50-percent solution, and the phosgene is undiluted. Each tube comes in an individual cardboard container. For shipment the 48 tubes and individual containers are packed 12 to a multiple metal container. Four multiple containers, in turn, come in a steel shipping container with a flanged and bolted top. The steel container must be returned when replacements are required.

b. An accessories set M1, is provided for operation of the detonation gas identification set. Its contents are shown in figure 18.

12. Preparation and Use of Detonation Set

a. Personnel handling detonators and blasting equipment will observe safety precautions outlined in FM 5–25. Gases are fired one at a time, using as many tubes as required by the size of the class. Normally one tube is enough for about 25 men. Shallow holes are dug as shown in figure 15. The holes should be 10 to 20 yards apart, with the line of holes at right angles to the wind direction.

b. To prepare for firing, No. 8 detonators are fastened to each tube with adhesive plaster. (See figure 19.) One detonator is used with each phosgene, chlorpicrin, and lewisite tube, and two with mustard gas tubes. *Phosgene tubes are always fired in the regular cardboard shipping containers to avoid an explosion from increased gas pressure formed by heat or low atmospheric pressure.* Tubes are laid in the holes with detonators underneath, so that explosion will throw the liquid filling into the air and produce a better cloud of vapor.

c. The setup is wired in series to a blasting machine placed about 25 yards upwind from the firing line. If a blasting machine is not available, detonators may be fired with batteries. For this purpose individual cells are wired in series and detonators in parallel.

d. An assistant should handle mechanical details for the instructor. A wind indicator is set up and the class placed downwind, normally 30 to 35 yards from the emplacement. This distance may be modified: On a calm day it may be only 20 to 25 yards; on a windy day 40 to 50 yards. Since glass and liquid spray may be thrown as far as 15 yards when the tubes explode, no persons or animals should be allowed within this danger radius. Before each gas is fired the instructor will instruct trainees:

(1) To breath deeply.

(2) To exhale partially.

(3) If the wind is shifting, to walk into the cloud when the gas is fired.

(4) To take a sniff—just enough to recognize the odor.

(5) To walk out of the cloud to the flank and then exhale.

e. If a gas is not recognized by this method students may sniff a spadeful of soil from the detonation hole. When blister gases are being identified in this way, the soil must first be carried at least 15 yards downwind in order that trainees' shoes may not become contaminated. (After the demonstration, the area should be restricted for at least 1 day to prevent injury from contaminated vegetation. Broken glass and detonator wires should be raked up and buried.)

f. Normally, four gases are detonated in succession, with an interval between gases. For effective instruction the name of the gas should not be announced before it is fired, although the men should be told in advance which four war gases will be used. If the four gases are fired several times during the exercise, the firing sequence should be changed. Men should be taught to scorn the easy method of exchanging identifications with their fellow trainees. It should be made clear that any man who "cribs" in this test is cheating only himself. Each man should be provided with a card (fig. 20) on which to mark the name of each gas as it is fired and state the odor he perceived. These cards are collected after the exercise and checked against the actual sequence of firing to determine the standard of proficiency attained. Men who fail to identify the gases should go through the exercise again. It should be made clear to them that this is an opportunity, not a penalty, for their lives may later depend on their individual judgment.

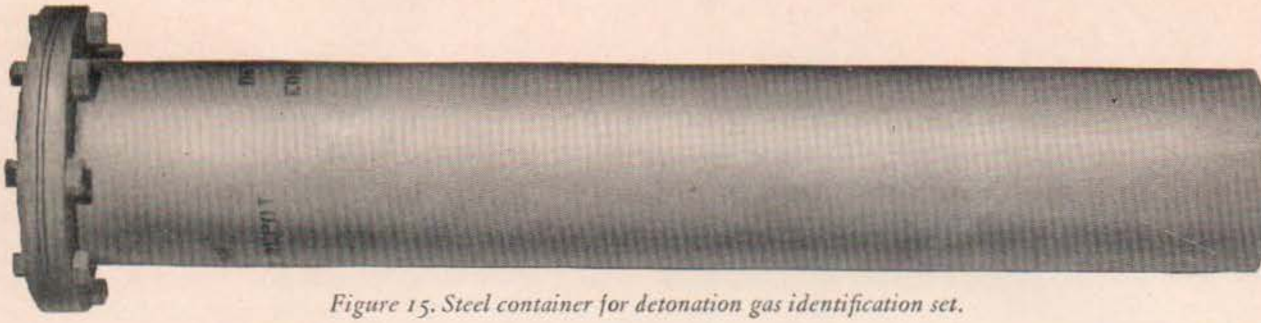


Figure 15. Steel container for detonation gas identification set.

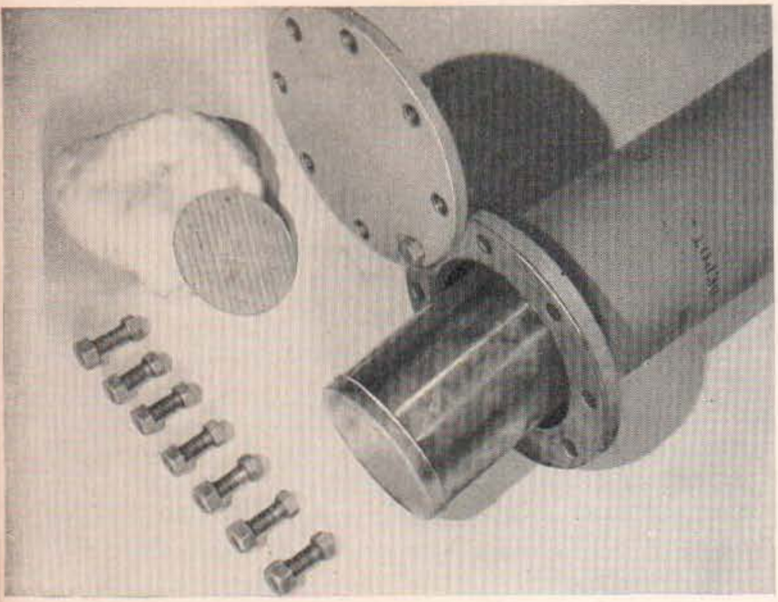


Figure 16. Five multiple containers are packed inside steel container. Always leave one lid bolt attached to steel tube so lid may be closed quickly in an emergency.

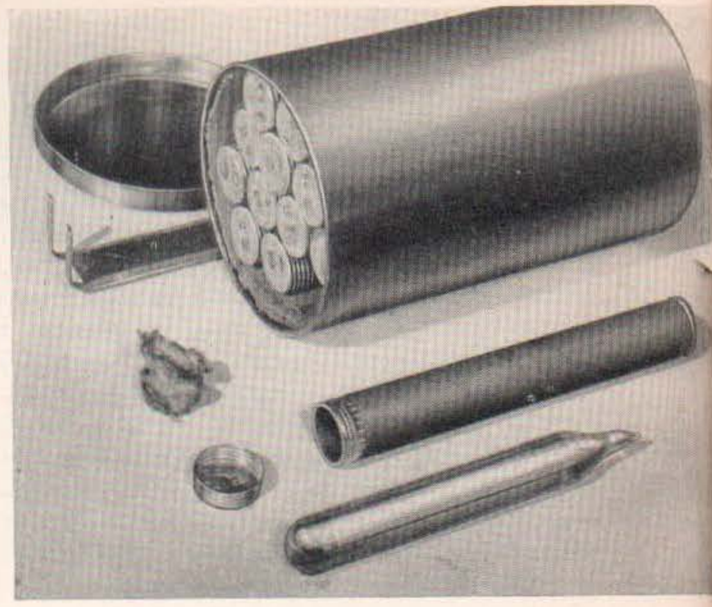


Figure 17. Twelve tubes are packed in each multiple container. Cotton wad fits in end of each cardboard tube. Strip of adhesive plaster is placed in each can for attaching detonators.

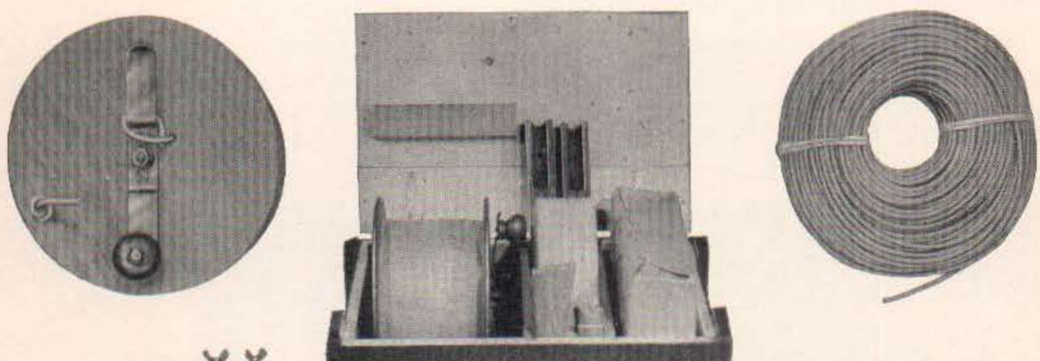


Figure 18. Accessories kit for detonation gas identification set includes items shown: 1,000 feet of No. 18 B and S gage firing wire, 500 feet on a reel and 500 feet coiled; a 10-cap blasting machine; 8-inch side-cutting pliers; two handles for the reel, and screws to hold the handle in place. These accessories are packed in a compartmented box 23 inches long, 14½ inches high, and 13½ inches deep. All items except handles are treated and/or wrapped to protect against water and rust.

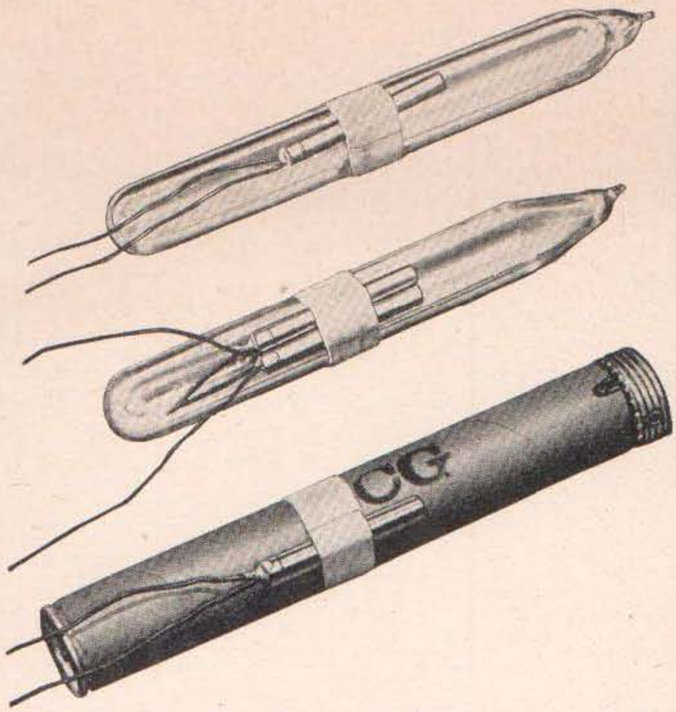


Figure 19 (above). *Attaching detonators with adhesive plaster. Top: One detonator for chlorpicrin and lewisite. Center: Two for mustard gas. Bottom: One for phosgene, which is fired in container.*

AGENTS IDENTIFICATION CARD

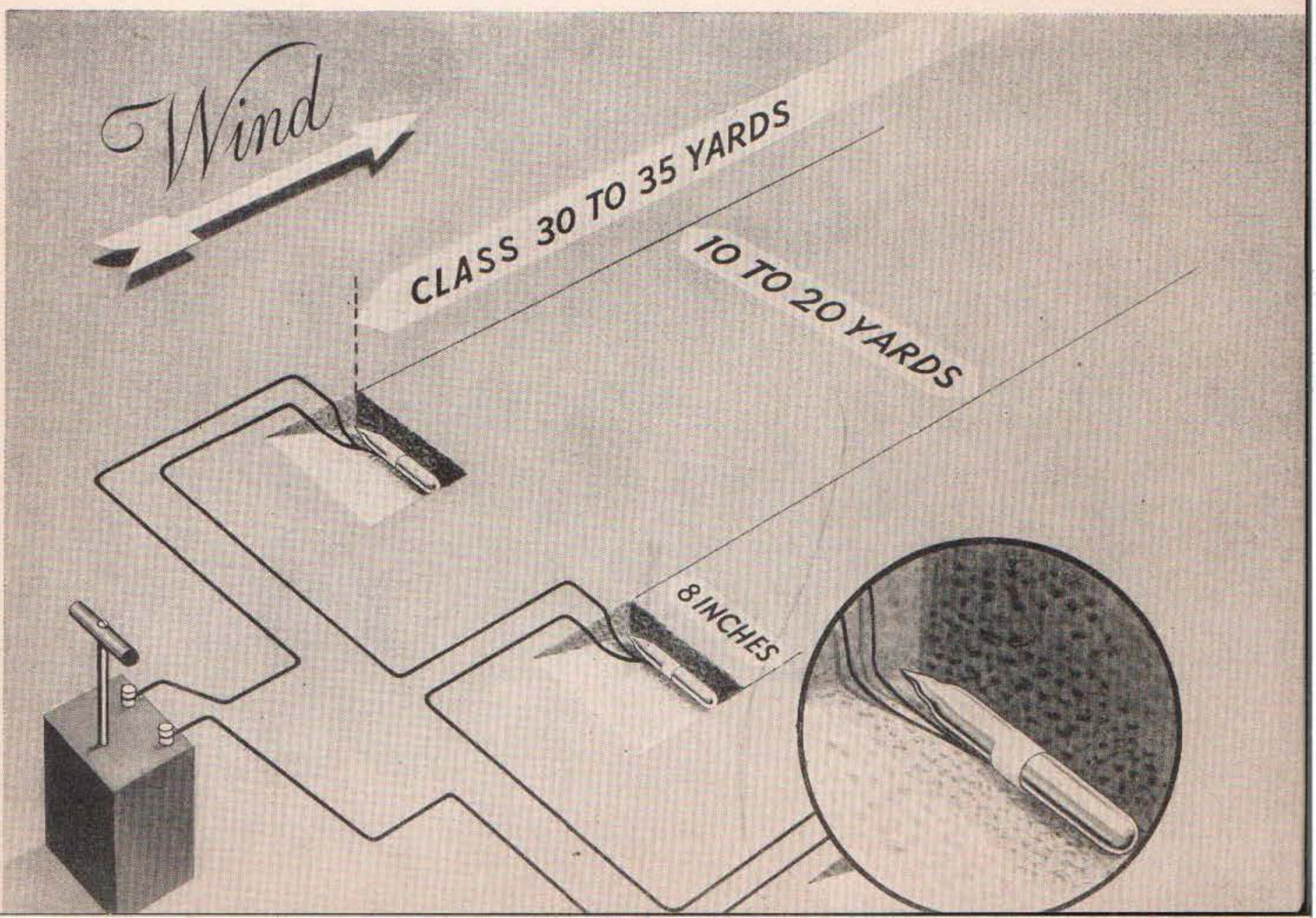
NAME ______________________________

(NOTE: Place your name on above line. As each agent is fired, write your identification under "Agents" column. Beside it, under "Odor" column, state the smell impression YOU received. Do NOT compare notes with other students. Hand in your card at end of exercise.)

AGENT	ODOR
1.	
2.	
3.	
4.	
5.	
6.	
7.	
8.	
9.	
10.	

Figure 20. Agents identification card.

Figure 21 (below). Diagram of installation.



Section III.

GAS OBSTACLE COURSE

13. General

The gas obstacle course provides training in chemical reconnaissance and defense against chemical attack under simulated combat conditions. It is designed for unit gas officers and noncommissioned gas officers, but may be modified for general use by removal of elements applying solely to chemical reconnaissance. Size and scope of the course need be limited only by the resources and ingenuity of the training organization. It is recommended, however, that gas obstacle courses be designed to confront the trainee with as many problems as possible in defense against chemical attack. Suggested features include:

a. Collective protection, using a gasproof shelter.

b. Individual protection, including personal decontamination, and use of the gas mask and protective clothing. (Every effort should be made to teach conformity with doctrine and to emphasize the importance of common sense in preventing injury.)

c. Chemical reconnaissance, including identification of gases, use of detector devices, sampling of contaminated earth, examination of enemy shell, and investigation of abandoned enemy installations. (Emphasis should be placed on caution in reconnaissance; trainees should be warned to examine no matériel not of a chemical nature. Booby traps which explode remote detonators may be used to check their obedience to this warning, as well as to provide useful booby-trap training.)

d. Troop movement in smoke.

e. Battlefield realism, including liberal use of barbed wire entanglements, simulated small arms and artillery fire, destroyed and abandoned enemy matériel, and signs printed in the enemy language —such as markers pointing to enemy aid stations, signs indicating enemy command posts, gas warning signs, order for withdrawal of chemical battalion, etc.

f. Field decontamination of personnel. (This is an essential feature after the exercise if blister gases are used.)

14. Description

The following outline describes each station on the model gas obstacle course developed by the Chemical Warfare School at Edgewood Arsenal, Md. The entire course, about ½ mile long, is marked off with boundary fences on either side. Signs are posted to guide trainees from one station to the next and to warn of contaminated terrain and matériel.

a. Preliminary. Trainees are divided into squads of 8 to 12 men, each under a squad leader. Uniforms consist of full permeable protective

Figure 22. Marking capacity on gasproof shelter after estimating size.

Figure 23. Dry mix of earth and bleach is prepared in shuffle box.

clothing, gas masks, and shoes treated with impregnite. No packs or rifles are carried. Every man receives a sheet of instructions describing the course briefly and telling what he should do at each station. He also receives a form on which he will list the chemical agents and matériel encountered at each station, a supply of detector paper, a map of the area, and a small wide-mouthed bottle with which to remove a sample of contaminated earth from one of the shell holes at station five. The bottle has a blank label, and waxed paper is provided for wrapping it. Instructors and safety officers are on duty at each station to give trainees specific instructions before they start.

b. Station one. An underground gasproof shelter is used on this station. It is unventilated. The squad examines it, determining its capacity by pacing off width and length and by estimating ceiling height. The shelter's man capacity for 2 hours is then computed. This information is marked on a sign at the entrance. A gas alarm is then sounded and the squad is ordered to prepare the shelter for occupancy, observing all rules outlined in FM 21–40.

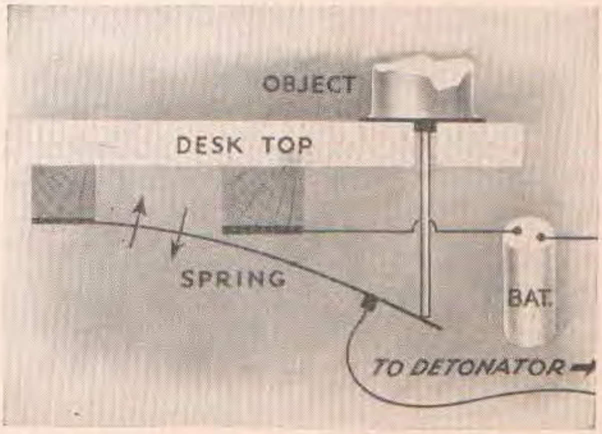
c. Station two. (1) This is a short assault or infiltration course about 150 yards long. Trainees are directed to crawl forward and conceal themselves in fox holes a few yards beyond the starting line. They wait here a few seconds until a charge of explosive (1 pound or less) is detonated about 20 yards to the front, to indicate completion of simulated artillery preparation fire. They then advance by short bounds under simulated artillery and small arms fire. This is achieved by the deto-

Figure 24. GAS! Sentry masks and sounds alarm. Shelter is readied for occupancy.

Figure 25. Operator on control tower, station two, detonates charges during infiltration. He is masked for protection against flying debris.

Figure 26. Charges are placed in fenced-off areas, each numbered to guide detonation operator.

Figure 27. Design for booby trap, station three.




DUTIES OF SENTRY
1. GIVE ALARM
2. ADJUST MASK
3. LOWER CURTAINS
4. PUT OUT FIRE, CLOSE OPENINGS
5. PREPARE SHUFFLE BOX
6. STAND OUTSIDE ENTRANCE
7. LIMIT OCCUPANCY TO CAPACITY
8. HELP RAISE AND LOWER CURTAINS
9. TEST FOR GAS - GIVE "ALL CLEAR"
10. CLEAR SHELTER
11. PREPARE FOR NEXT ATTACK
GAS PROOF
SHELTER
SHUFFLE BOX
STATION ONE
BOOM
POW
BANG
SNIFF SNIFF
ZING
STATION TWO
HC
HC
HC
ALWAYS TEST FOR GAS BEFORE REMOVING MASK.
BOOM
AMSCRAY BOOBY TRAPS!
POW
IT'S ONLY PS!
STATION THREE
Nebelabteilungen
HM-MM GERMAN RETREAT ORDERS
POW
BANG
WOW WOT MANNER OF WEAPON IS THIS?
OO-OO-OOOO! THAT PS WAS AWFUL!
GAS CG
STATION FOUR

Figure 28.

THIS IS THE FINAL OBJECTIVE
I MADE IT!
BOOM
I'VE LOST MY FOX HOLE!
STATION SEVEN
LAUFEN! HERE COMES DER YANKS!
TO BERLIN
HEAVY? LIGHT? MEDIUM?
CN DM
HC
THIS IS THE MUSTARD WALK
VESICANT CONTAMINATED AREA
STATION SIX
HOLDING BREATH
WHEW! GOT MY MASK ON JUST IN TIME
SMELLS LIKE GARLIC!
PU! THIS IS NO PLACE FOR ME.
CN-DM
STATION FIVE

Figure 29. Trainees advance past enemy "Landungsboot" toward station four.

Figure 30. Squad prepares reconnaissance notes at end of station three.

Figure 31. Detecting gas on infiltration course, station two, trainee puts on his mask.

Figure 32. Scaling the wall while masked is a physical obstacle on station seven.

Figure 33. CN–DM grenades are discharged as men crawl under low entanglement on station seven.

Figure 34. Simulated artillery preparation fire precedes assault on station two.

Figure 35. Instructions are given to squads at start of each station.

nation of firecrackers and low order explosives (obtainable from commercial sources). To prevent injury to personnel, explosive charges are placed in small fenced-off holes scattered along the route of advance. These charges are wired electrically to an elevated control platform. (See figs. 25 and 26.) The officer in charge here has full observation of the assault course at all times and can make certain that no personnel is endangered when he detonates any given charge. (Personnel preparing and detonating explosives will understand and observe safety precautions outlined in FM 5–25.) Trainees are directed to make full use of cover, concealment, and dispersion during the assault.

(2) Advancing a few more yards the group encounters a barbed wire entanglement covered with thick clouds of smoke produced by a mechanical smoke generator M1, (fig. 37) fitted with a special discharge nozzle to release the smoke near ground level thus insuring a better coverage. HC smoke pots M1 may be used if a mechanical generator is not available, or to augment the generator cloud laterally. To discourage unmasking, CN grenades M7, or CN tear pots M1, are discharged so that their gas mingles with the smoke. Men are required to find and pass through gaps in the wire entanglement. Once through it, they assault an "enemy" trench. Examination of matériel in the trench completes the assignment at this station. (See TM 3–300, for information on HC smoke pots and CN grenades.)

d. STATION THREE. This is a simulated abandoned enemy command post identified by German military markers. (See fig. 36.) Students are ordered to enter the command post and make a chemical reconnaissance, touching no object not of a chemical nature. Strategically placed booby-trap trip wires attached to the door or strung across the floor may be used to discharge tubes of chlorpicrin taken from the detonation gas identification set M1. (See par. 11.) Other booby traps, attached to trip wires, field telephones, binoculars, pistols, a file of "secret" documents, etc., are wired to set off detonators placed at remote parts of the room so that particles will not endanger personnel. Figure 27 shows construction of an improvised booby-trap device.

e. STATION FOUR. This is an area recently "shelled" by the enemy. Several "duds" (inert shells) are located in "shell holes." The duds are variously banded and marked, and trainees are directed to check them against a list of "known enemy gas shells," recording any not on their list. Each squad has a different list and each list omits one of the shells. Therefore each squad should find a different "unknown shell." During the inspection an instructor upwind from the group discharges a CN grenade, forcing the men to mask. Masked squad members then enter a shack in which a choking gas has been released. By testing for gas, they should identify this as phosgene. The concentration is obtained by breaking a phosgene tube from the detonation gas identification set M1.

f. STATION FIVE. This consists of several simulated shell holes contaminated with lewisite or mustard gas. Here the men check for contamination with detector paper (TM 3–290) and scoop samples of earth into their bottles. Each bottle is signed by the filler, marked with his identification of the gas, wrapped in waxed paper, and de-

Figure 36. Investigation of abandoned enemy command post during reconnaissance on station three.

posited at a designated point near the station. During these operations the group is harassed by CN-DM grenades M6. (See TM 3–300.)

g. STATION SIX. This is divided into two phases. The first is passage of contaminated terrain, a pathway along which chemical land mines filled with lewisite or mustard gas have been exploded. This area is posted with official German gas warning signs. The second phase is one of determining degree of contamination by comparing the amounts of blister gas on four differently spattered pieces of foliage, using liquid vesicant detector paper M6.

h. STATION SEVEN. This consists chiefly of physical obstacles. Trainees first crawl under a low 25-foot barbed wire entanglement. While crawling, they are forced to mask in the prone position when CN-DM grenades are released. At the end of this entanglement are two 6-foot walls which the men scale while still masked. They then test for gas and are allowed to unmask if no gas is present. Advancing, they descend a steep bank to a trench at the edge of a stream. Here an underwater explosive charge is detonated about 20 feet from them. Returning uphill, the men cross another trench, crawl through a concertina entanglement, and then scale an 8-foot wall. This concludes the course.

15. Precautions

The course must be designed and operated under the direction of a chemical warfare service officer. At permanent camps and stations the post safety officer will be consulted regarding all physical and chemical obstacles included on the course. An ambulance or a field aid station must be available whenever the course is being used. Areas contaminated with persistent gas should be posted and restricted as directed by the safety officer.

Figure 37. Mechanical smoke generator, M1, has been modified to place heavy cloud of fog over barbed wire entanglement on station two. Jets have been lowered and turned toward ground.

Figure 38. Emerging from cloud of CN and smoke at end of infiltration course on station two.

Section IV.

OPERATIONS IN CONTAMINATED AREAS

16. Purpose

These exercises are intended to make personnel *respect* blister gases rather than *fear* them. In addition to serving this general psychological purpose, they provide specific training in offensive use of blister gases, in detection, passage through contaminated areas, and decontamination. The exercises may be simplified or expanded in accordance with available facilities.

17. Precautions

A chemical warfare service officer must be present at all times. Since enough protective clothing is seldom available, trainees will wear issue clothing but must be warned to button their garments fully when passing through a contaminated area. Later, garments should be unbuttoned to ventilate. A supply of protective ointment, bleach, soap and water, and a first-aid kit must be kept ready for use. Exercises must be conducted in an isolated area, away from traffic of humans or domestic animals. Contaminated areas should be posted to a distance of 500 yards with large signs reading: "Poison gas—Keep out."

18. Passage Through Contaminated Area

a. GENERAL. This exercise consists of several phases, including filling of chemical land mines, tactical use of blister gases, chemical reconnaissance, detection, and passage through the area. The principal phase, that of passage, is intended to demonstrate that the presence of blister gas need not necessarily prevent troops from advancing, and thus to give soldiers confidence in their ability to cope with such gases in combat. Because protective clothing is not generally available for training purposes it may be necessary to conduct the exercises on terrain less heavily overgrown than that on which blister gas would be used most effectively. Appropriate explanations should be made by the instructor when there is an inconsistency between the training situation and tactical doctrine.

b. EQUIPMENT AND MATERIALS. The following list should be checked in making preparations:

(1) *Personal equipment,* including fatigue uniforms, leggings, well-soled shoes and gas masks.

(2) *Materials for contaminating,* including mustard gas in bulk, land mines, filling and detonating equipment as listed in TM 3–300, and the toxic gas set M1. (See fig. 39.)

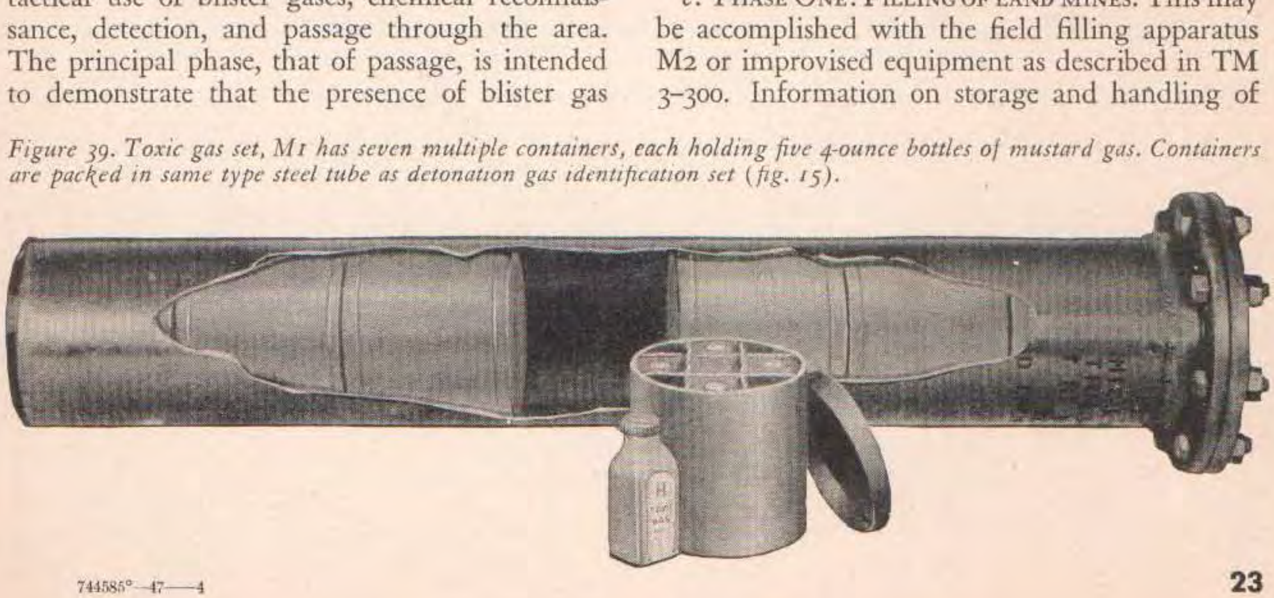
(3) *Materials for detection* as described in TM 3–290.

(4) *Decontaminating equipment and materials* as listed in TM 3–220. (If a power-driven apparatus is used, reference should be made to TM 3–221 or 3–222.)

(5) *First aid materials,* including gas casualty kit, protective ointment, cloths, soap and water.

c. PHASE ONE: FILLING OF LAND MINES. This may be accomplished with the field filling apparatus M2 or improvised equipment as described in TM 3–300. Information on storage and handling of

Figure 39. Toxic gas set, M1 has seven multiple containers, each holding five 4-ounce bottles of mustard gas. Containers are packed in same type steel tube as detonation gas identification set (fig. 15).



dangerous chemicals is given in TM 3-250. Full impermeable clothing and accessories should be worn by personnel engaged in this operation. The remainder of the training group should stand a safe distance upwind and watch the operation. Three mines should be filled.

d. PHASE TWO: TACTICAL USE OF BLISTER GASES. This demonstrates techniques in the creation of a mustard gas barrier. Trainees are shown the method of wiring land mines as explained in TM 3-300 and told about tactical requirements for such barriers as outlined in FM 3-5. Since only three mines are used, and since tactical considerations must be modified to suit training requirements, mines need not be spaced as they would in an actual barrier. After tactical and technical considerations have been explained, the trainees are moved about 200 yards upwind and the mines exploded.

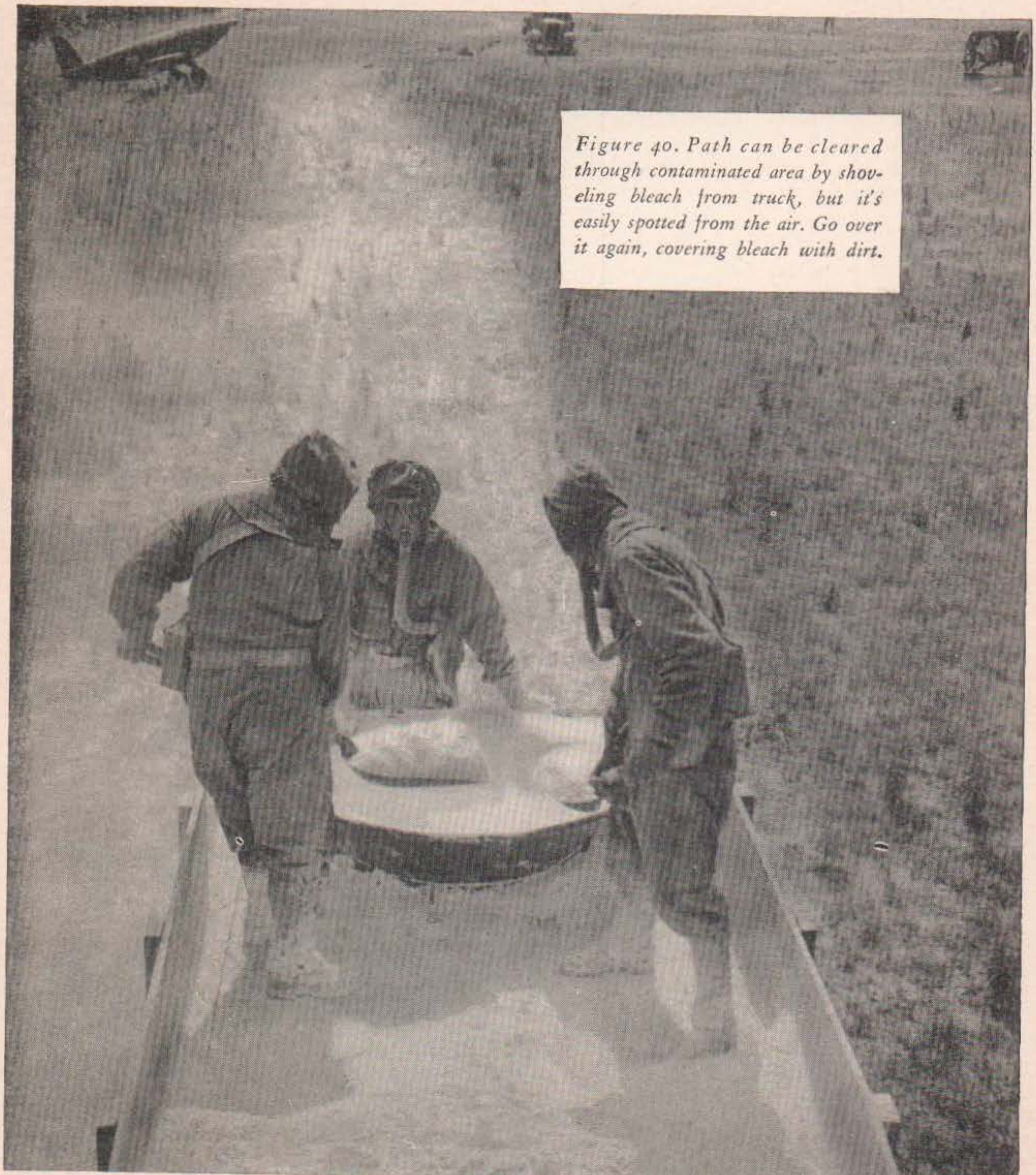


Figure 40. Path can be cleared through contaminated area by shoveling bleach from truck, but it's easily spotted from the air. Go over it again, covering bleach with dirt.

e. PHASE THREE: CHEMICAL RECONNAISSANCE. Gas noncommissioned officers or trainees acting in this capacity are sent into the area to determine the ground actually contaminated, mark it off, and post gas warning signs. Flags or bleach may be used for marking. The chemical officer verifies correctness of markings.

f. PHASE FOUR: DETECTION. Trainees advance toward the contaminated area from upwind in units the size of an infantry platoon and in squad columns. As each squad approaches close enough to distinguish unmistakably the odor of mustard gas it stops for 1 minute. Trainees then adjust their masks and noncommissioned gas officers check them. The squads then assemble, still masked, and detector devices are demonstrated by the noncommissioned gas officers.

g. PHASE FIVE: PASSAGE THROUGH CONTAMINATED AREA. (1) Squads advance in single file or skirmish line directly across the contaminated area. If desired, shuffle areas may be made at both ends of the passage, and soldiers are instructed to shuffle their feet in the dry mix both before entering and after leaving the area. (It should be pointed out that, because of labor and matériel requirements and also because troops in combat have protective clothing, it is not ordinarily feasible or necessary to decontaminate paths. Removal of high vegetation usually eliminates all danger of bodily contact with blister gas except for the shoes, which may be protected with impregnite. However, one method of decontaminating a path is shown in figure 40.) Trainees are told to button their clothing fully so that a minimum amount of body surface is uncovered. They are instructed to pick their way carefully, avoiding pools of liquid blister gas, empty land mines, shell craters, and other depressions, and to avoid contact with underbrush or high grass. They should make special note of the presence of mustard gas.

(2) After passing through the area, squads continue walking until well out of range of gas vapor. They then test for gas, remove and replace masks. Clothing is loosened to ventilate. Officers and noncommissioned gas officers inspect the men, taking proper first aid measures for any whose clothing has become dangerously contaminated.

h. PHASE SIX: DECONTAMINATION OF TERRAIN. If the exercise area is properly isolated and posted with gas warning signs, it need not be decontaminated, but can be left to weather. However, to illustrate the difficulty of decontaminating terrain, two small portions of the area should be treated. A dry mix of earth and bleach is used on one patch and the other covered with 3 inches of earth to illustrate an expedient method. Men engaged in decontamination work will have their masks adjusted. This phase completes the exercise. Returning to their barracks area, troops remove leggings and shoes, scrubbing them with G.I. soap and water *before entering any building*. They then finish undressing and bathe.

19. Decontamination of Buildings

Organizations equipped with a power-driven decontaminating apparatus M3A1 or M4 may use it on buildings, both exterior and interior. Brooms and brushes are also needed to scrub slurry into the floors and walls. As the slurry should remain on the building 12 to 24 hours, no flushing out should be done during this exercise but the value of the apparatus for flushing should be explained. Earth-bleach mixture may be used on heavily contaminated floor areas, the mixture being removed and buried after it has served its purpose.

20. Decontamination of Metal Equipment

Obsolete or unserviceable pieces of equipment, such as guns, machinery, or vehicles, can be used for this exercise. Mustard gas may be applied with a spray or poured by hand but personnel conducting this operation must be adequately protected. In each group of three squads, squad one prepares noncorrosive decontaminating agent (DANC), squad two applies it, and squad three prepares a soap-and water emulsion and washes it off. When the equipment is dry a coating of light oil is spread over the surface to prevent rust.

21. Supplementary Demonstrations

Since protective clothing and equipment are not available for all personnel in training, demonstrations instead of exercises should be conducted on the following subjects, full information on which is given in TM 3–290:

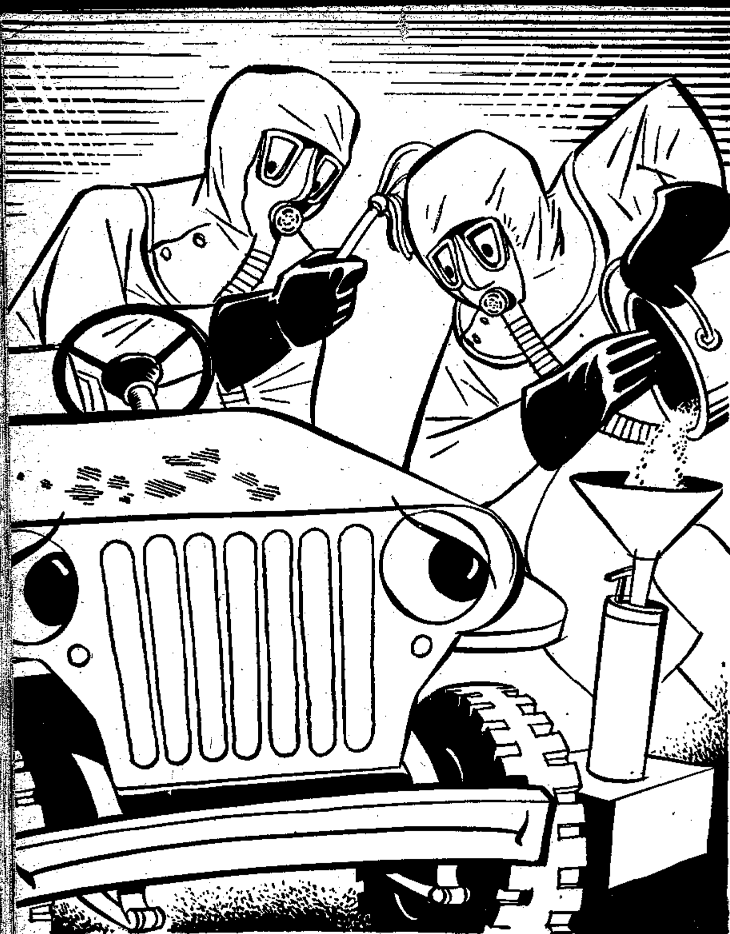
a. Impermeable protective clothing, including construction, method of donning, and removal.

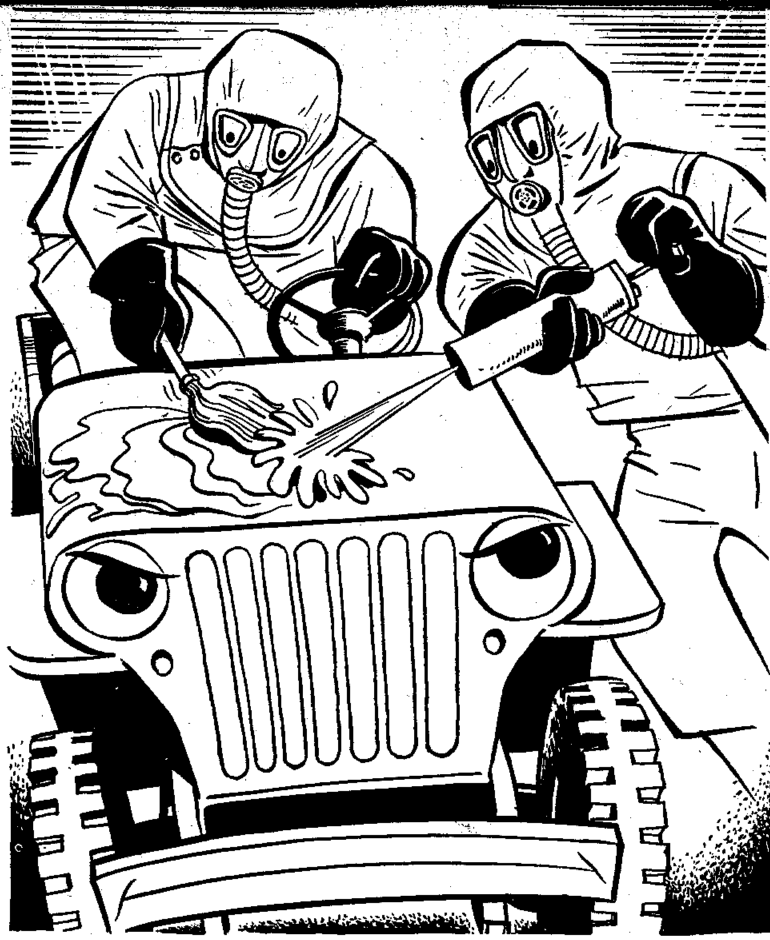
b. Permeable (impregnated) protective clothing, featuring same points as in a above.

c. Individual protective cover, featuring same points as in a above.

d. Shoe impregnite, showing method of applying.

e. Personal decontamination, including use of protective ointment, removal of contaminated clothing, and decontamination of clothing by aeration and steaming.





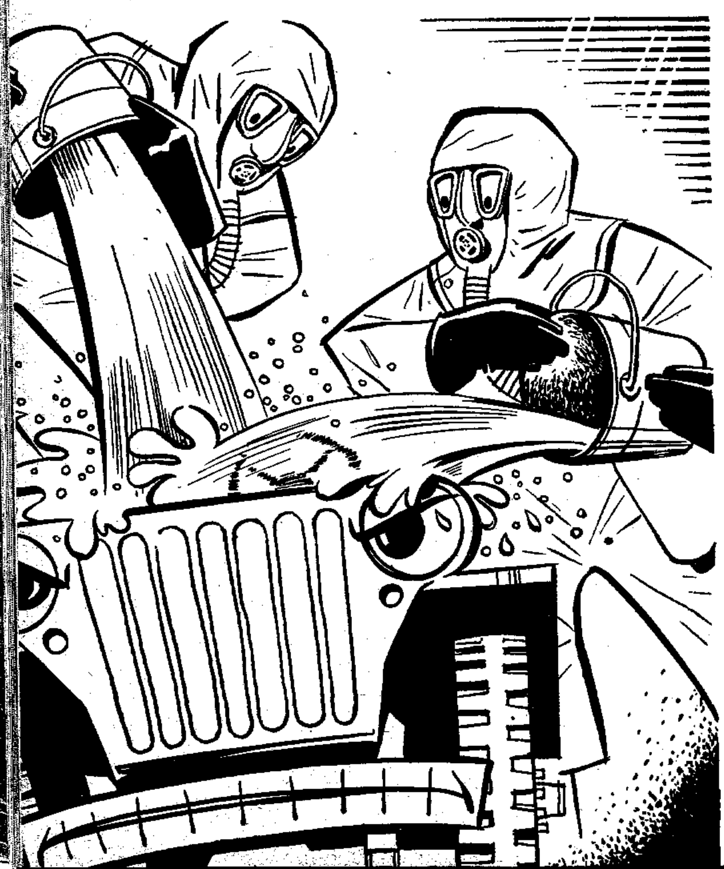
(a) First squad prepares DANC in 1½-quart apparatus.

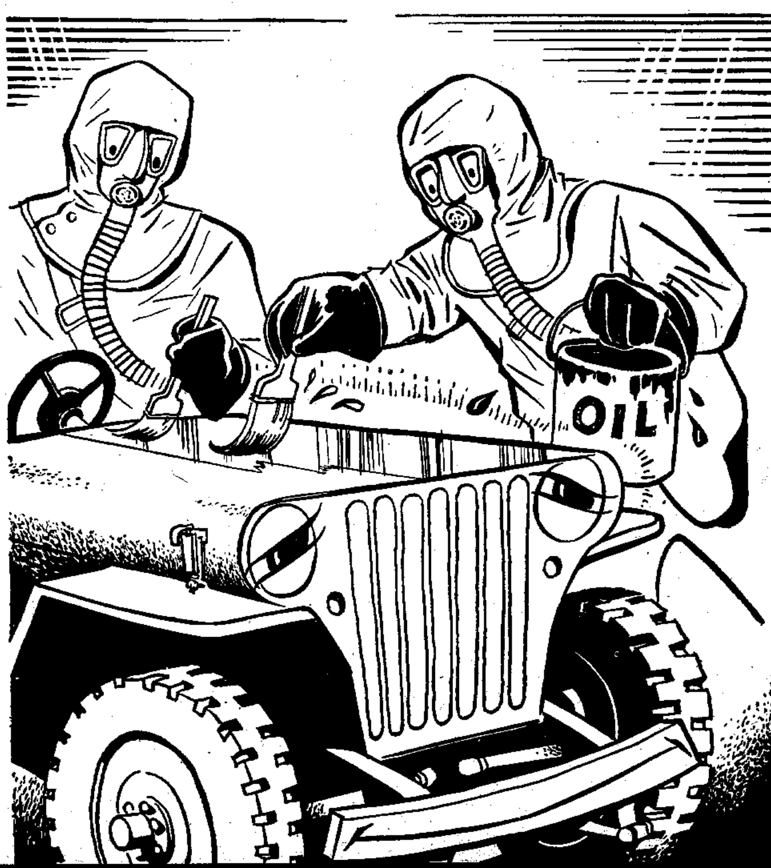
(b) Second squad applies DANC to metal surface.

FIGURE 41. EXERCISE IN DECONTAMINATION OF METAL EQUIPMENT

(c) Third squad prepares soap and water, then washes.

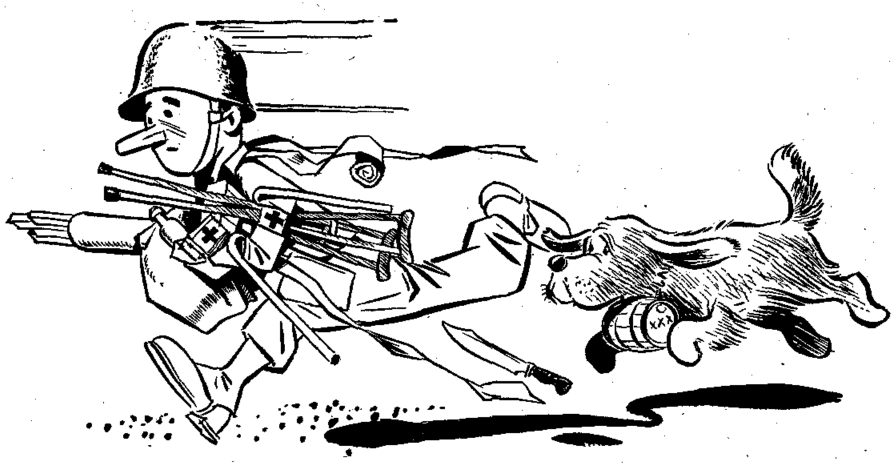
(d) Finally, fourth squad applies light coat of oil.





Section V.

FIRST-AID EXERCISE



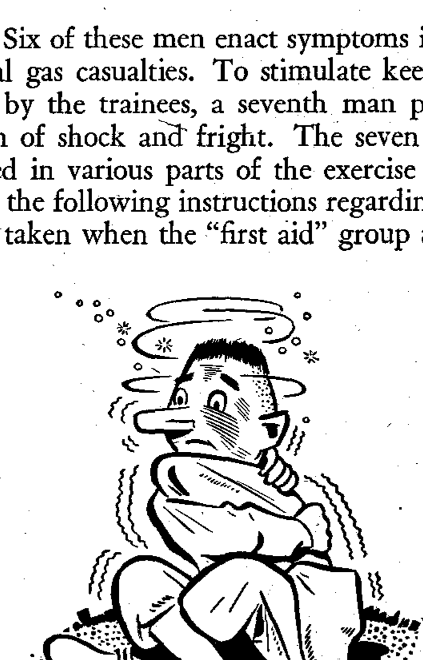
22. Purpose

Text book and lecture instruction in first aid for gas casualties does not always impress itself permanently in the trainee's mind. It should be followed therefore by actual field exercises in which the student learns to administer first aid to various types of gas casualties. Prescribed field aid should be given to simulated victims "suffering" injury from all types of gases. (See FM 21–40 and TM 3–290.) It is advisable to consult medical personnel when preparing such exercises.

23. Exercise

a. Preliminary. The exercise should be preceded by comprehensive classroom training in prescribed first aid generally and for gas casualties in particular. Trainees should be given mimeographed sheets outlining symptoms and first aid measures for the various gases. If such literature cannot be supplied, the men should be required to take complete notes. This information will be needed later in identifying and treating simulated victims.

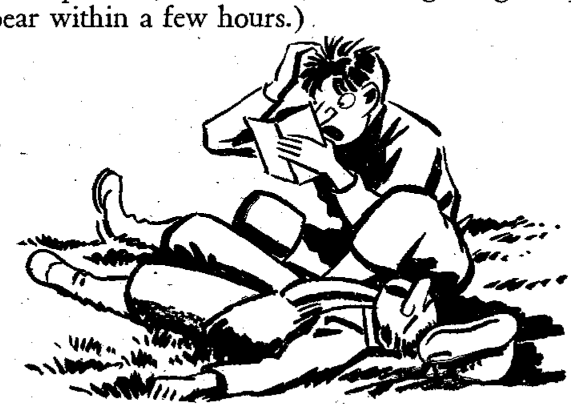
b. Organization. The largest unit which will participate in an exercise is the platoon. When training an entire company each platoon should therefore work independently. Seven men are selected, preferably trainees with a sense of showmanship who can act effectively the role of "victim." Six of these men enact symptoms indicative of real gas casualties. To stimulate keener diagnosis by the trainees, a seventh man portrays a victim of shock and fright. The seven men are located in various parts of the exercise area and given the following instructions regarding actions to be taken when the "first aid" group arrives:



(1) *Shock victim:* Sit on the ground, acting as though badly frightened. Shake, appear nervous, and complain of dizziness and of feeling alternately hot and cold. Such symptoms might be associated with a vomiting gas, blood and nerve poisons, or a choking gas, but thorough examina-

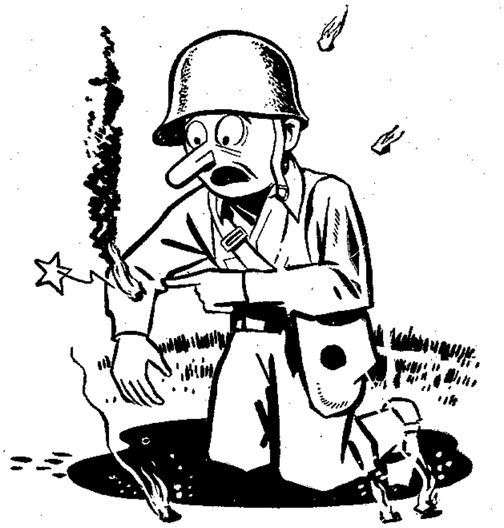
tion by the first-aid party will rule out each of those possibilities: There is no nausea as with vomiting gas poisoning. Blood or nerve poisoning symptoms such as irregular pulse and labored breathing are totally absent. So are irritation of nose, throat, and lungs, as would be the case with a choking gas casualty. It can be determined, therefore, that this man is a shock victim and he should be cared for accordingly.

(2) *Vomiting gas victim:* Sneeze, expectorate profusely, and cough. Complain of an extreme headache and pain in the nose, and tell of vomiting. Report that a cloud of "funny-looking yellow stuff" that smelled a bit like coal smoke passed over the area a short time ago. Actions indicate mental depression and great physical agony. After diagnosing him as a vomiting gas casualty, the first-aid group should take the prescribed measures, making him comfortable "until medical aid arrives." (In combat, vomiting gas casualties carry on if possible, since effects of the gassing disappear within a few hours.)



(3) *Blister gas casualty:* This man is dressed in an old pair of fatigues, ready for salvage. He sits on the ground, his gas mask adjusted. Simulated mustard gas (MR), a mixture of grated garlic and molasses, or plain water have been placed on a portion of one arm. As the aid group arrives he begins trying to tear off the contaminated sleeve. He explains that he has just emerged from a wooded area and has evidently brushed his arm against foliage contaminated by the enemy. The first-aid group should thereupon take over, assisting the victim as outlined in FM 21–40.

(4) *Choking gas casualty:* He sits on the ground, coughing and breathing with difficulty. He complains of irritation of the nose and throat, and says that a few minutes ago he smelled an odor like that of musty hay. His mask is poorly adjusted, so that the facepiece leaks. The first-aid group, following prescribed first aid for phosgene casualties as outlined in FM 21–40, should keep him warm and comfortable and treat for shock.



(5) *Incendiary casualty:* Simulated white phosphorus injury is used most effectively here. A WP grenade may be fired in the vicinity of the victim as the aid group approaches. The victim, sitting on the ground, displays an arm heavily coated with mercurochrome or red watercolor paint, to stimulate a bad WP burn. The first aid group should follow directions prescribed in FM 21–40.

(6) *Tear gas victim:* This man walks about rubbing his eyes and acting partially blind. He should be moved upwind, told to face into the wind, and warned against rubbing his eyes. CN grenades or tear pots may be used in this exercise, or if such munitions are not available, a cut onion may be rubbed against the face. The fumes will produce lacrimation.

(7) *Blood and nerve gas casualty:* He displays an attitude of complete indifference. He mentions having a headache and appears uneasy, but, for the most part, is disinterested in what is going on about him. He should be evacuated to an aid station.

c. Execution. (1) In a regular three-squad rifle platoon, with seven men acting as victims, the remaining men can be divided into eight group of four or five men, each group under the direction of a leader. Each group examines and gives first aid to one of the patients while other squads watch. Then another group takes over and works on the next patient, the remainder of the platoon meanwhile following to watch the demonstration. By rotating the group each man participates in at least one phase of the exercise.

(2) The exercise can be made as elaborate as facilities permit. For example, use of smoke, detonators, firecrackers, etc., adds a touch of battlefield realism, while the gas casualty kit may be used to administer first aid. If time is available the same simulated casualties can enact their roles several times and trainees can be sent out in pairs instead of in larger groups. Cooperation of medical personnel may be obtained in establishing an aid station where the casualties may be brought for further "assistance." Both the victims and the aid groups should use cover and concealment as they would under actual battle conditions.

Section VI.
GASPROOF SHELTER EXERCISE

24. Purpose

The two fundamentals of training involving gasproof shelters are correct construction and proper use. TM 3–350 describes construction, while FM 21–40 lists requirements for effective discipline in their use. The exercise below provides training in both phases.

25. Phase One: Preparation of Shelter

a. MATERIALS. An unused building can be made into a gasproof shelter with boards, gummed paper, adhesive tape, moist clay, dampened newspapers, and other materials. A large can is needed to mix dry clay with water. The clay may be applied to crevices by hand. Adhesive tape or gummed paper will seal window frames. Standard gasproof curtains should be used wherever possible. If a collective protector is available, a ventilated shelter should be constructed.

b. STAGING THE EXERCISE. (1) The number of trainees participating should be limited to 25 as larger groups are unwieldy and, normally, there

Figure 42. Prepare paper for caulking by soaking it in a pail of water.

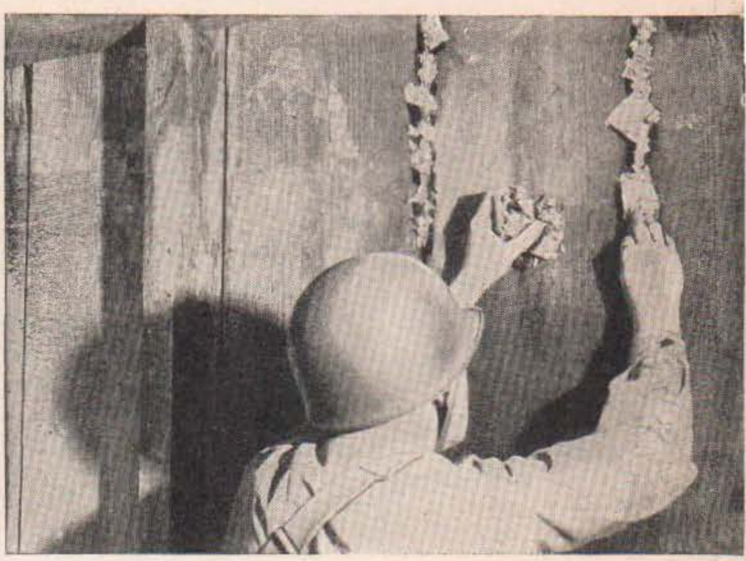


Figure 43. Stuff wet paper caulking into cracks. It seals them effectively.

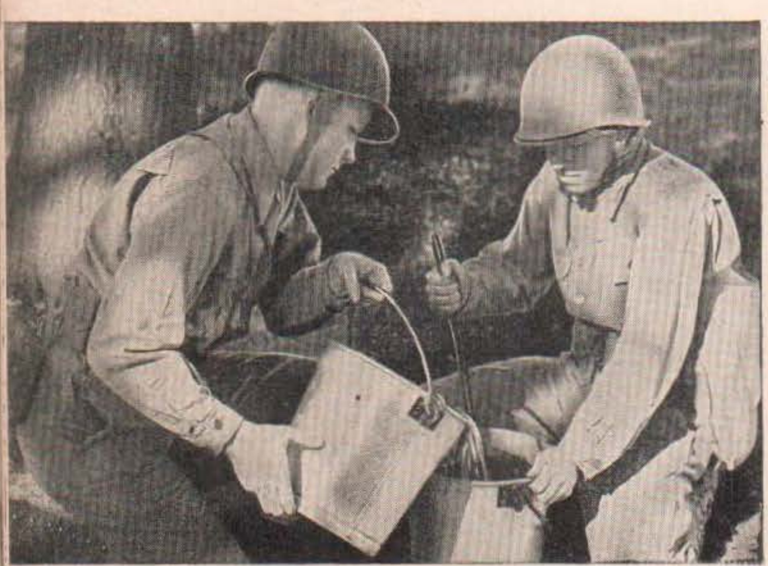


Figure 44. Mix clay and water to prepare thick mud caulking for floors and similar surfaces.

Figure 45. Fill large cracks and holes with mud. Apply generously to insure effective seal.

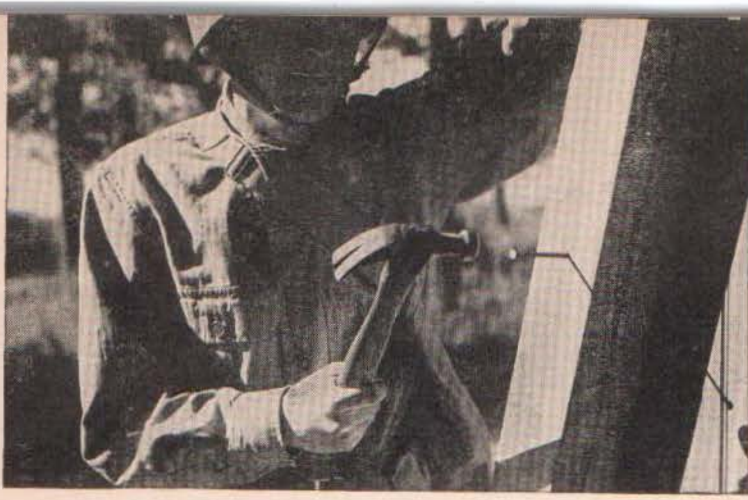


Figure 46. Sturdy slanting door on air lock protects against blast from enemy shells or bombs.

Figure 47. Hang gasproof curtain carefully, making certain it rests flat against frame of air lock.

Figure 48. Build box at top of air lock. Curtain is placed there when rolled up.

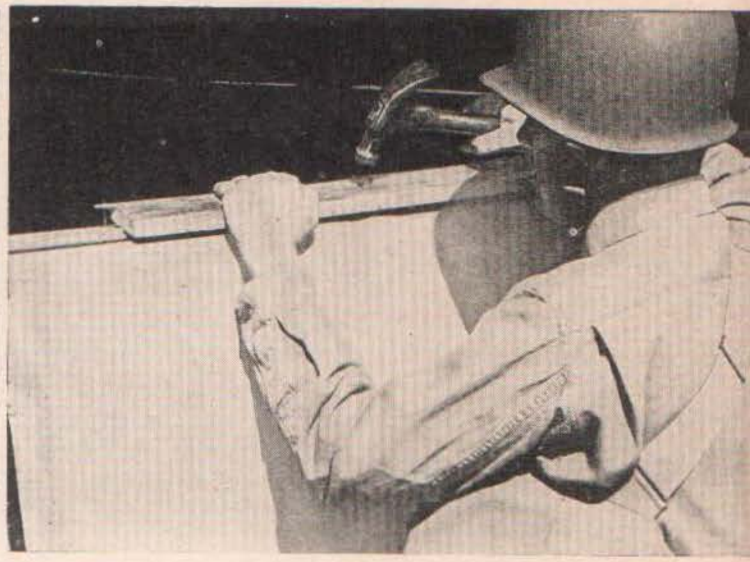


Figure 49. Canvas covering over box will protect curtain against weather.

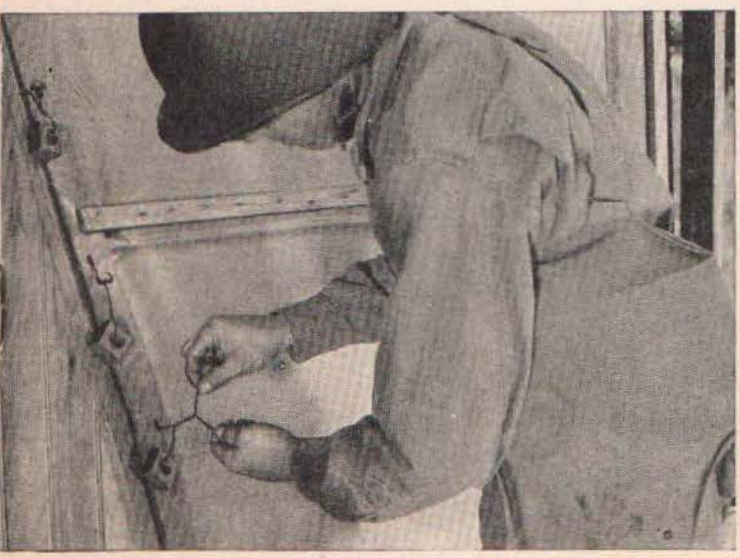


Figure 50. Fasten weights, such as heavy bolts, to holes at each side of gasproof curtain.

Figure 51. Sandbags banked around sides of air lock will protect against blast.

is insufficient work for more. Officers present the problem and outline the work. Each man is then assigned to one of four groups, each group being given a particular job.

(*a*) *Group 1* closes all large holes, cracks, and unnecessary entryways, and builds the air lock.

(*b*) *Group 2* provides and prepares the caulking clay, and tests the shelter with a smudge fire when completed.

(*c*) *Group 3* does the actual caulking.

(*d*) *Group 4* prepares and installs the collective protector. If no protector is available this group assists the first.

(2). When the shelter has been made gasproof, its capacity is determined and the proper sign prepared and put into place. A critique follows.

26. Phase Two: Use of Shelter

a. MATERIALS. Nonpersistent gas attacks may be staged with tear pots, CN grenades, or CN-DM grenades to simulate choking gas. (See TM 3-300.) The toxic gas set (fig. 39) may be used in simulated persistent gas attacks.

b. USE OF SHELTER IN NONPERSISTENT GAS ATTACK. When gas is detected, troops engaged in working, resting, or training near the shelter follow prescribed procedures. The supervising officer notes their efficiency in the following operations:

(1) Warning (gas alarm and gas sentinels).

(2) Adjustment of masks.

(3) Identification of gas.

(4) Proper entry into shelter.

(*a*) Entry of designated number.

(*b*) Use of shuffle box (in blister gas attack).

(*c*) Use of gas curtain.

(5) Efficiency in operating ventilating unit (if any).

(6) Technique of taking litter cases inside shelter.

(7) Discipline inside shelter.

(8) Discipline in clearing shelter after attack.

c. USE OF SHELTER IN PERSISTENT GAS ATTACK. (1) When preparing a persistent gas attack a group of four men wearing protective clothing will be detailed to do the actual contaminating. Three or four bottles of mustard gas from the toxic gas set are emptied on the ground upwind and the group remains there to prevent other personnel from passing through the contaminated area. Afterward, the same squad decontaminates.

(2) Efficiency and discipline of trainees are checked on the same basis outlined above for the nonpersistent gas attack. The supervising officer will find it much easier to carry on the critique if he uses a prepared check list to note his observations and criticisms.

Figure 52. Correct method of entering gasproof shelter.

Figure 53. Strips of tape against the frames will help gas-proof windows from the inside.

Figure 54. If possible, windows should be boarded up from the inside. Boards are then caulked.

Figure 55. Ordinary tarpaper roofing can be nailed over the outside of windows.

Figure 56. Strips of lath nailed against the frames of tar-paper-covered windows give further protection.

Figure 57. To test shelter, close all openings, then build smudge fire in pail, inside air lock.

Figure 58. If smoke from smudge fire seeps out, mark the place and apply additional caulking.

Section VII.

MISCELLANEOUS EXERCISES WITH TEAR GAS

27. Purpose

Although not generally used in combat, tear gas is highly valuable in training to simulate either persistent or nonpersistent gases. One example is given in the previous section, where tear pots and grenades are recommended for a simulated nonpersistent gas attack. Miscellaneous uses for tear gas given below will suggest others to commanders whose troops are being trained in defense against gas attack.

28. Materials

Munitions employed in the exercises include M1 tear pots, CN grenades, CN-DM grenades, and airplane spray tanks filled with CNB. (See TM 3-255.)

29. Exercise in Bivouacs

In combat, gases may be directed against troops in bivouac and against rear area installations as well as against units in forward positions. Therefore all organization warning systems should be kept at high efficiency by periodic tests. Tear pots, irritant grenades, or airplane spray with CNB can be used to simulate either persistent or nonpersistent gases. The gas should be released in outpost areas upwind of the camp, thus providing a test for the alarm system and for the proficiency of personnel in masking and carrying out assigned duties. This exercise is most valuable when conducted at night.

Figure 59. Don't rub eyes affected by CN!

30. Exercise on the March

a. This exercise may be used with foot troops or motor columns. It is most effectively conducted with airplane spray from tanks filled with CNB, since experience is thereby gained in simultaneous defense against air and gas attack. Troops should be issued blank cartridges to fire at the attacking planes.

b. Airplane spray with CNB, used to simulate aerial attack with blister gases, should be planned to release the gas directly on vehicles and personnel. Troops to be sprayed should be provided with protective covers and eyeshields and instructed in their use as outlined in FM 21-40. (See fig. 60.) When eyeshields and protective covers are not available, spray attacks should not be executed below an altitude of 150 feet. Troops should be cautioned not to look up as long as there is danger of spray getting in their eyes. The attack may be followed by an exercise in first echelon decontamination.

c. When tear pots or grenades are used to simulate nonpersistent gases, gas should always be released upwind.

31. Exercise with Service Troops

Under combat conditions service troops in the communications zone, such as depot and maintenance units, may expect aerial gas attack. During and after these attacks troops must continue their work on as nearly normal a basis as possible. By way of preparation, service organizations in training should be subjected to attacks with tear gas discharged from airplane spray tanks, tear pots, or grenades. They should be told in advance what type of attack is to be simulated and what protective measures they should take. If a nonpersistent gas attack is simulated, the men mask and continue their work.

Figure 60. Armored force exercise: Soldiers don protective covers against airplane spray. Later, covers are discarded and first echelon decontamination takes place. Tear gas may be used instead of mustard gas in this exercise, decontamination being simulated.

If the tear gas is used to simulate blister gas, troops mask and seek cover during the attack, transferring vital activities to gasproof shelters. Afterward they decontaminate and restore normal operating conditions as rapidly as possible.

32. Precautions

Troops contaminated in a spray attack should remove their clothing as soon as practicable and bathe with hot, soapy water. If the eyes are contaminated they should be irrigated with a 2- to 3-percent solution of sodium bicarbonate.

Figure 61. Exercise with tear gas: Using grenades against troops in bivouac.

Figure 62. Exercise with tear gas: Using airplane spray against troops on the march.

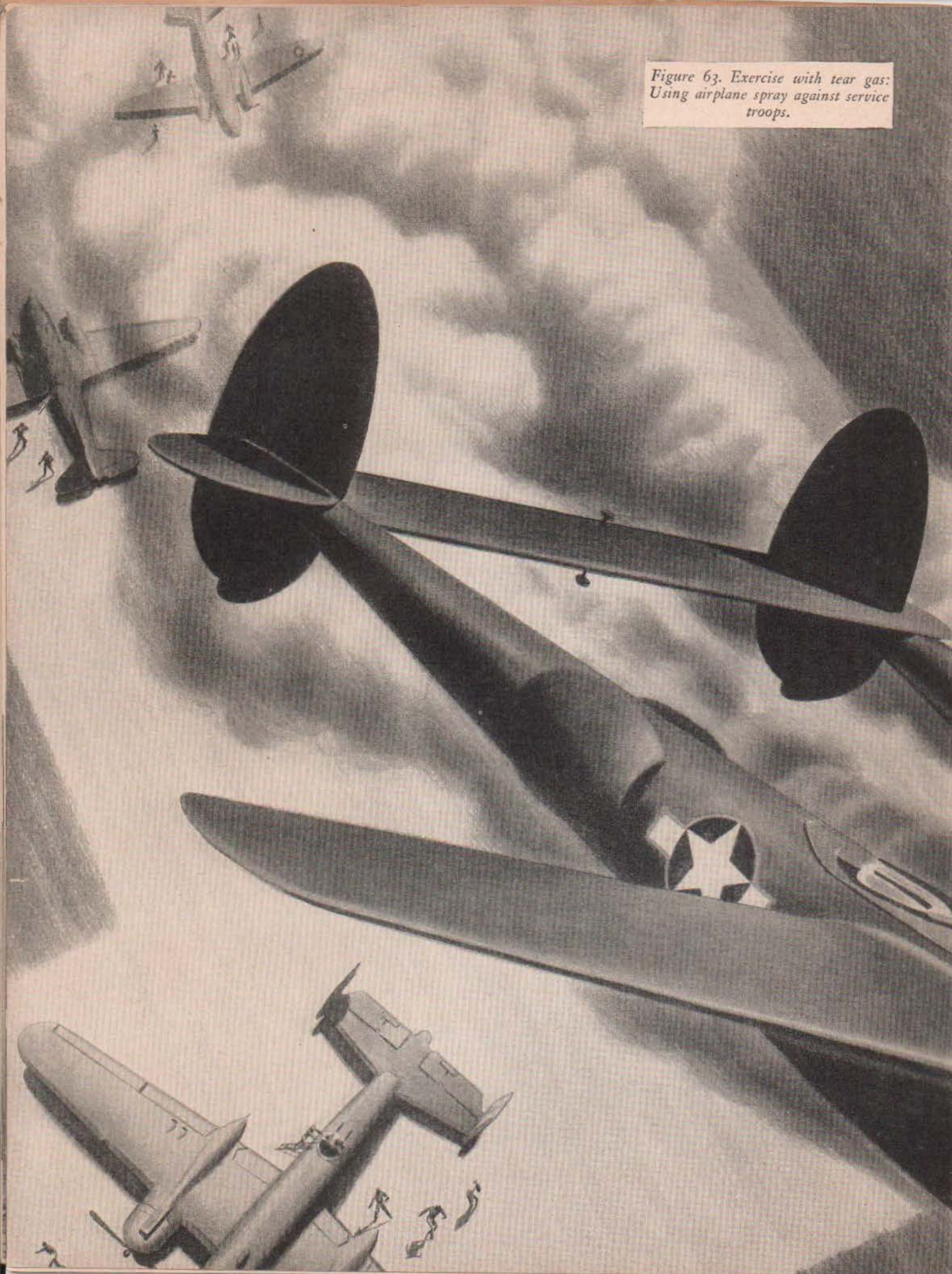


Figure 63. Exercise with tear gas: Using airplane spray against service troops.

CHAPTER 3

EXERCISES WITH SCREENING SMOKES

Section I.

INTRODUCTION

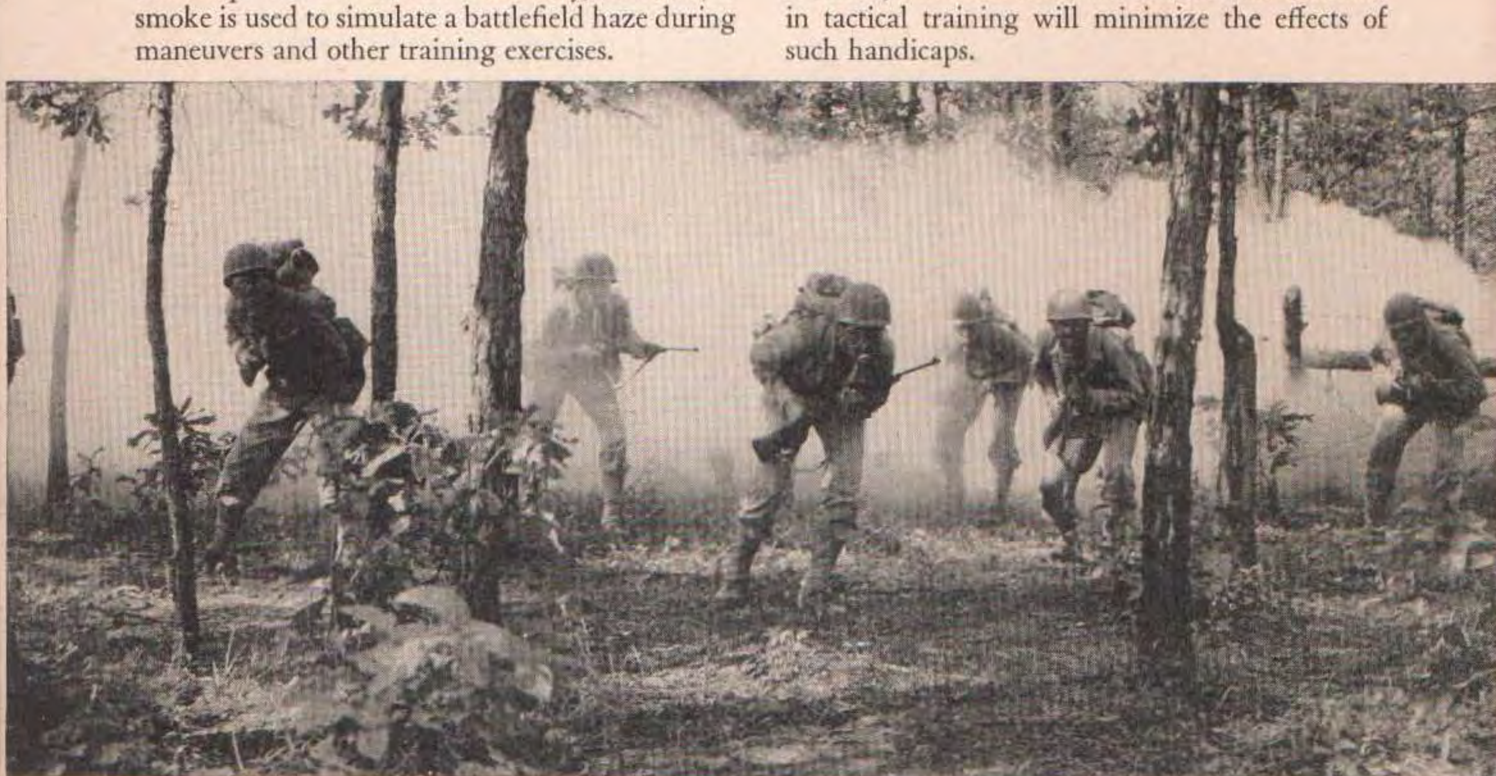
33. General

Smoke is one of the most valuable training aids available to the troop commander. Many varied situations can be simulated with it. All of them help materially to prepare troops for combat. Among the uses covered in this chapter are the following:

a. PROVIDING BATTLEFIELD REALISM. Men in battle are surrounded with smoke and dust, even though neither opposing force is using smoke tactically. Bursting shells, fires, and heavy vehicles pounding over dry roads all contribute to this situation. Consequently troops have poor visibility, their fire is inaccurate, and they may become confused. These handicaps can be reduced materially, however, if smoke is used to simulate a battlefield haze during maneuvers and other training exercises.

b. REPRESENTING OTHER AGENTS. Smoke can be used effectively to represent war gases, especially when gases are not readily available. A few such uses are in gas mask drill, testing gasproof shelters, demonstrating chemical cloud travel, and simulating real war gases on tactical problems.

c. TRAINING IN TACTICAL USE OF SMOKE. Smoke is now used widely for tactical purposes, including screens for assaults, vertical envelopment, retrograde movements, protection of working parties, rear area defense against aerial attack, etc. Although extremely helpful, such screens also involve the handicaps of difficult control, poor orientation, and inaccurate fire. Liberal use of smoke in tactical training will minimize the effects of such handicaps.



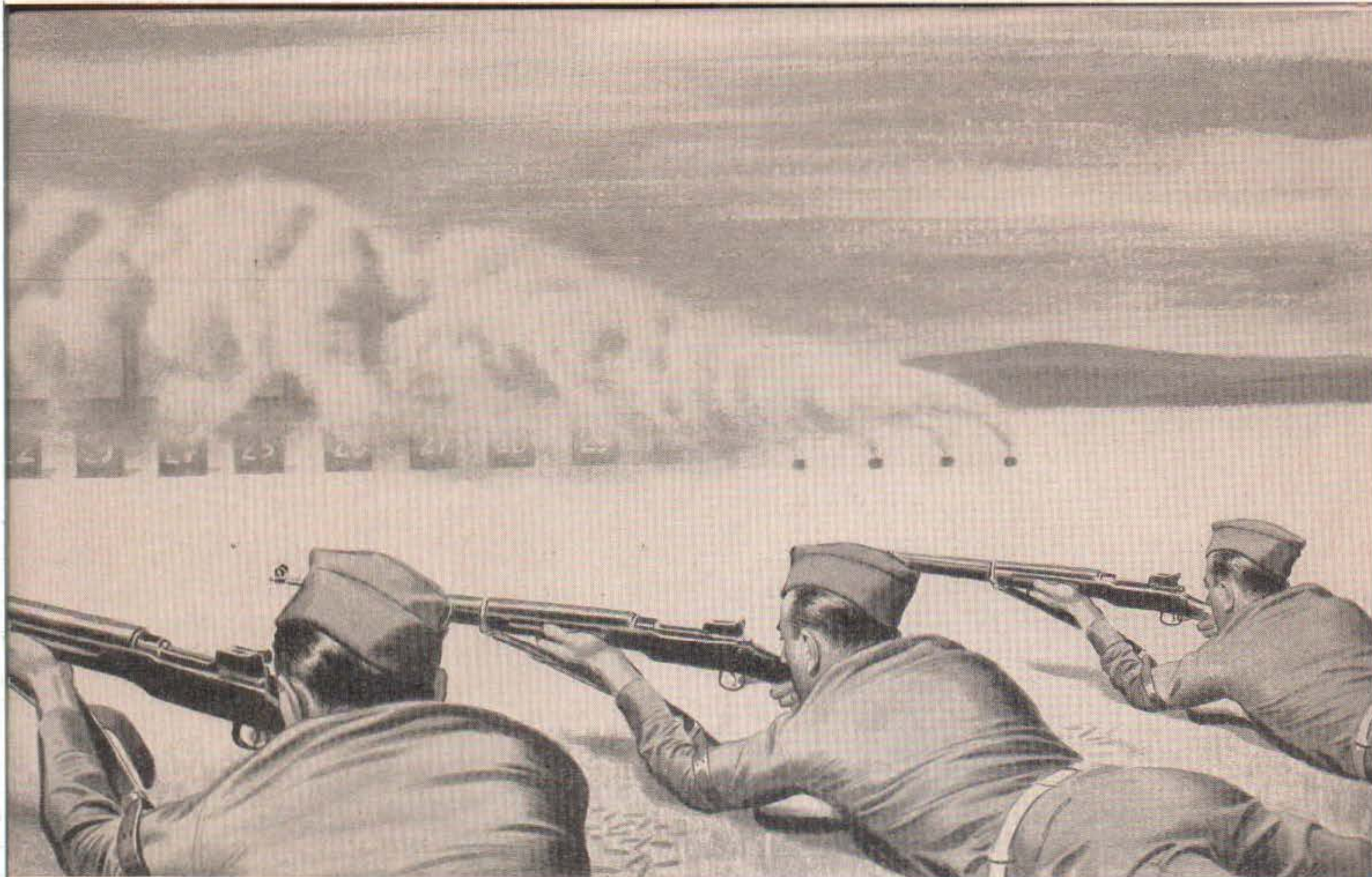
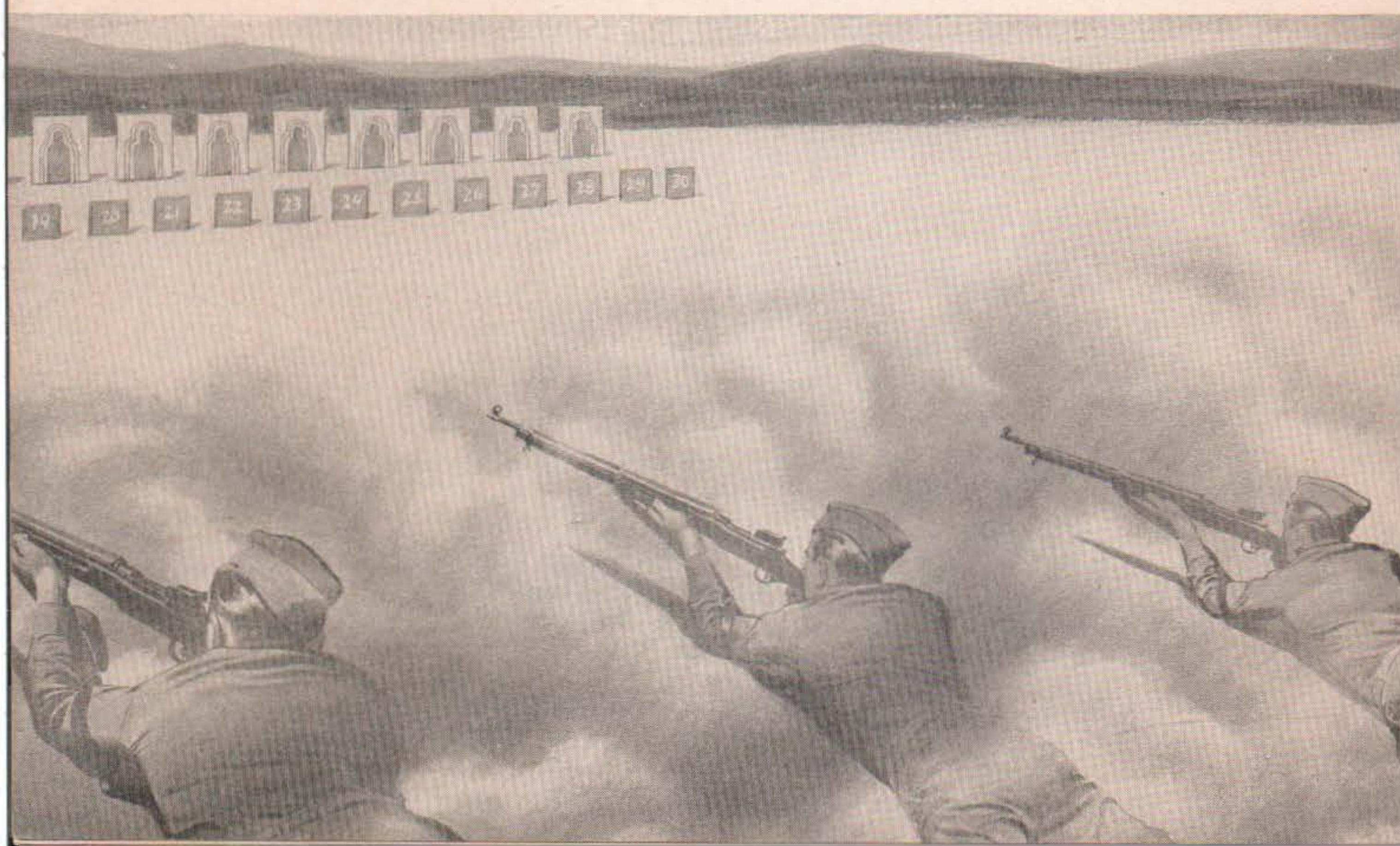


Figure 64. Exercise to show influence of smoke on rifle fire. Above: First phase, with smoke on targets. Below: Second phase, with smoke on riflemen.



Section II.

INFLUENCE OF SMOKE ON RIFLE FIRE

34. Purpose

a. This exercise demonstrates the effect of screening smoke on aimed rifle fire and thus helps prepare troops for combat conditions. In tests on a 300-yard range, troops which averaged 55 percent hits when no smoke was used scored 12 percent hits when smoke was on the target and only 3 percent when smoke was on the firing line. Obviously the percentages will rise in all three situations on a 200-yard range, but the differentials will remain fairly constant.

b. The exercise emphasizes several important considerations in the use of smoke, including the value of this munition for both protective and harassing purposes. It should be pointed out that troops advancing through smoke must operate without observation but that the attacking unit gains a decisive advantage if smoke is placed on the defenders.

c. Every precaution should be taken to avoid injury during the exercise. Attention is directed to AR 750–10, and to the following manuals: FM 23–5, 23–6, and 23–10.

35. Materials

The following materials are needed: HC smoke pots, one for every 20 yards of front to be covered (each pot burns an average of 6 minutes); one electric squib for each smoke pot; enough lead wire to set off all pots being used at one time (double lead wire No. 14 or W40 telephone wire); electrician's tape for insulating splices; a blasting machine of adequate capacity; and silhouette (rapid fire) targets.

36. Exercise with Smoke on Targets

a. Smoke pots are not placed until immediately before the exercise begins, since shifting winds may necessitate rearrangement. The exercise may be conducted in winds ranging anywhere between 2 o'clock and 10 o'clock, in a clockwise direction. Smoke pots are placed according to wind. The screen should be wide enough to provide 20 percent excess coverage of the targets. Pots will normally be about 20 yards apart. For wiring instructions see TM 3–300.

b. Smoke pots should not be started until after the trainees have taken their positions and have fired preliminary "sighting in" shots at the rate of five shots per minute. Results should be tallied and the targets pasted. Smoke pots are then ignited, producing a good cloud in a couple of minutes. Trainees are then given 1 minute, beginning at a signal, to fire five shots. Scores are tallied and targets pasted. A short critique follows in which average scores are compared with and without smoke on the target.

37. Exercise with Smoke on Riflemen

This exercise differs only in location of the smoke pots. They must be at a safe distance from the firing line but in such a position that a good screening cloud covers the line. Strict range discipline is required, since there may be some wild firing. When the trainees are completely obscured they are given the signal to fire five rounds in 1 minute. Scoring, pasting of the targets, and a critique follow. Trainees should be asked to express their reaction to firing in smoke.

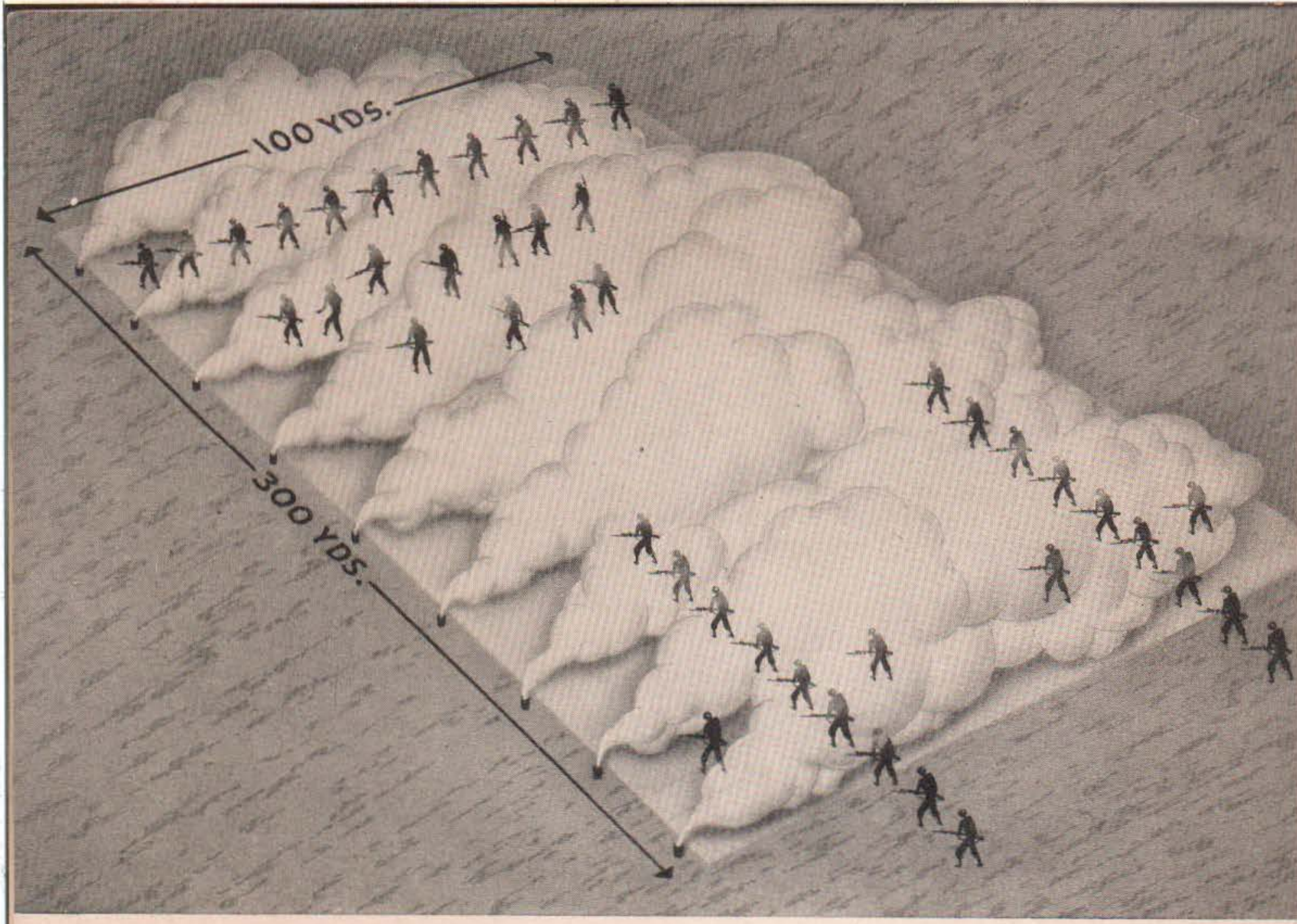


Figure 65. Diagrammatic layout of exercise area to teach troop control in smoke.

Section III.

TROOP CONTROL IN SMOKE OPERATIONS

38. Purpose

a. Experience of unit commanders in maneuvers and combat testifies to the extreme difficulty of maintaining control of troops in smoke. There are two principal reasons: First, with vision obscured neither the objective nor one's own forces are visible and guiding terrain features are blotted out. Second, visual signaling is extremely limited. Equally important is the reaction of the individual soldier, who is likely to become confused and lose his normal sense of direction. Mental confusion of the soldier may be lessened by training him to operate in smoke; experience helps him to retain balance and direction. Visual signals may be replaced by sound signals when silence is not essential, thereby partially overcoming one effect of smoke.

b. The following exercise provides a controlled situation in which officers and men may gain experience in smoke operations. Although infantry units are used here, other arms and services can adapt the exercise to their own requirements.

39. Materials

a. Each squad leader carries a compass to establish and check the direction in which his squad moves.

b. Requirements for producing the screen depend on size of the area, number of troops participating, terrain, wind speed and direction, and other related factors. HC smoke pots should be used, the number required being determined on the basis of appendix VII, FM 3–5. For wiring instructions, see TM 3–300.

c. The smoked-out portion of the exercise area should be at least 300 yards long and wide enough to accommodate two squads in skirmish line formation. Terrain should be fairly open but with some obstacles such as broken ground or prepared obstructions. The diagrammatic drawing (fig. 65) shows a satisfactory lay-out.

40. Exercise

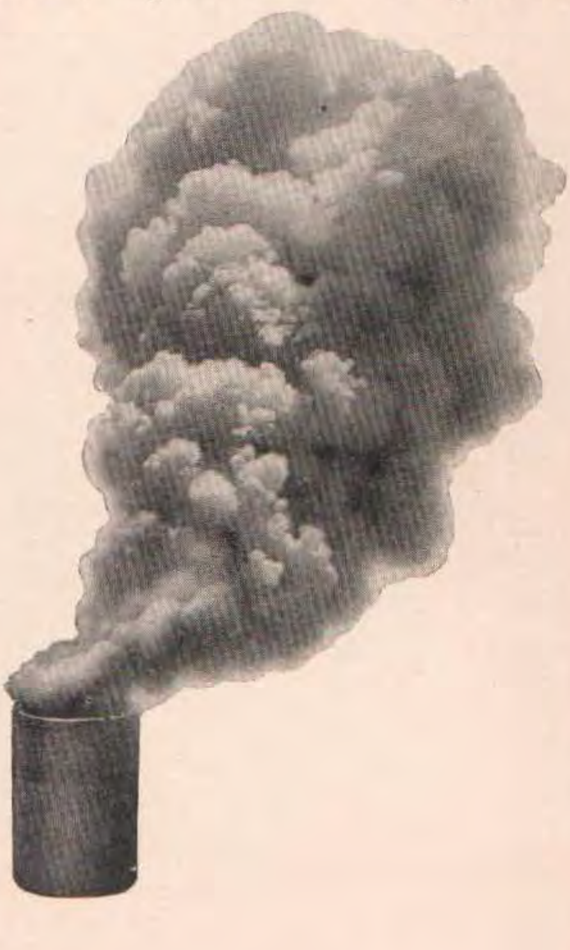
a. The officer in charge checks to make certain all his men know the prearranged signals for movement. Designation of signals is left to him, but it is suggested that they be limited to five or six. Forward, halt, by the right flank, by the left flank, and a signal for forming a skirmish line are the basic requirements.

b. When signals have been established two squads move into the smoked area, using the normal approach march formation. Shortly after entering the smoke the commander gives the order to mask. Various maneuvers may be called for at the discretion of the officer in charge. Just before emerging from the smoke the squads form a skirmish line and begin their assault on the objective. Determination of the correct point in advance at which to form the skirmish line provides a test for the group's accuracy in estimating distance traveled when there is no observation to provide orientation.

c. When several groups are participating they move into the exercise area in waves at 2-minute intervals. Upon completing its assault, each group leaves the area to make way for succeeding waves. Competition may be injected by recording the time each group requires to complete the exercise. A committee of officers may act as judges.

41. Precautions

If the exercise area is near roads or establishments, guards should be provided so that the smoke does not cause accidents or interfere with activities. Precautions should also be taken against grass fires starting from smoke pots.



Section IV.

SMOKE IN MANEUVERS

42. General

a. The effectiveness of smoke in combat was well demonstrated in the British capture of Bardia. Artillery smoke shell laid down ahead of attacking tank columns provided excellent screens until a wind increase on the left caused a more rapid dissipation of the cloud on that flank. The left flank column thus exposed was then subjected to heavy antitank fire from enemy positions to the northwest. Meanwhile, the right flank column, completely screened. was able to advance as planned and with a minimum of loss.

b. Smoke used in maneuvers where large bodies of troops are on the move in simulated combat activities makes these operations realistic. A fairly complete picture of situations in which smoke may be used is presented in figures 66 to 79. Officers directing maneuvers or troop training may work out a combination of these situations.

43. Materials

These include HC smoke pots M4A1 floating smoke pots (TM 3-300), smoke grenades, and airplane spray equipment. Quantities and types of munitions depend upon the operations planned. This subject is covered in FM 3-5. Since it is usually inadvisable to fire artillery or mortar smoke shell in maneuvers, smoke screens called for in orders of the participating units should specify use of smoke pots or airplane spray.

44. Exercises

a. TACTICAL USE OF SMOKE. As the tactics of chemical warfare are fully discussed in FM 3-5, this section is concerned only with smoke in training. Situations shown in the sketches are those which lend themselves most readily to this purpose. Variations and combinations may be developed to conform with the requirements and facilities of individual units.

b. SMOKE IN SIGNALING. Development of the colored smoke grenade (TM 3-300) has made possible a greatly enlarged use of smoke for signaling. Various colors and combinations of colors should be worked into a system of smoke code for maneuvers. Since much of the signaling will be from ground forces to supporting aircraft, the cooperation of supporting Army Air Forces units will be necessary. No separate training exercises are needed, but troops should be made aware of the value of smoke in signaling.

Figure 66. Colored smoke grenades are used to send signals from ground troops to air support.

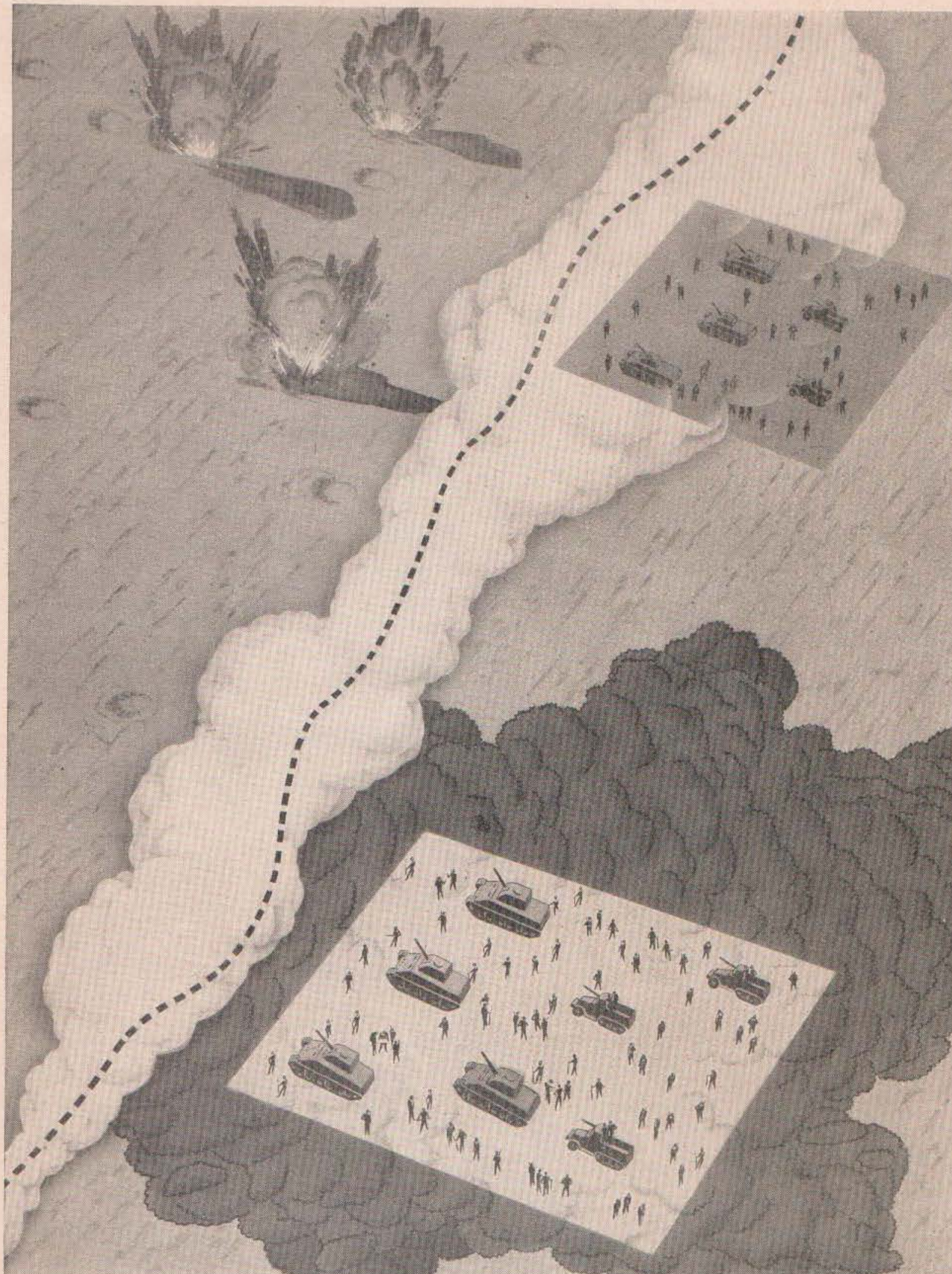
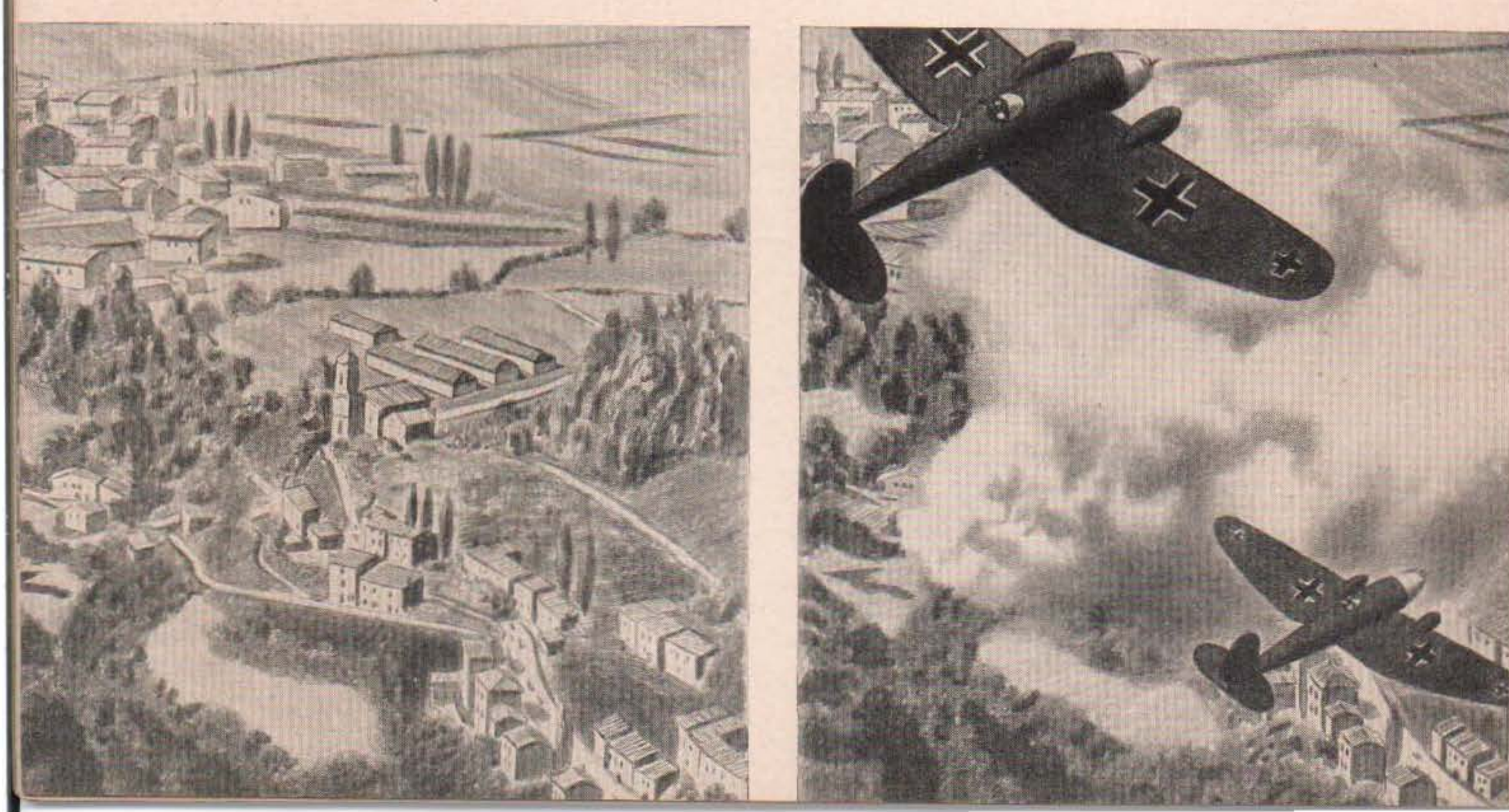


Figure 67. Long smoked-out front used to deceive enemy regarding point of attack. Preparation fire and token force are located at top. Real attacking force hides in wooded area at bottom, but behind the same smoke screen.

Figure 68. Screening an advance over open terrain.

Figure 69. Screening movement to a friendly position.

Figure 70. Screening rear area installations: "Before" and "after" views.



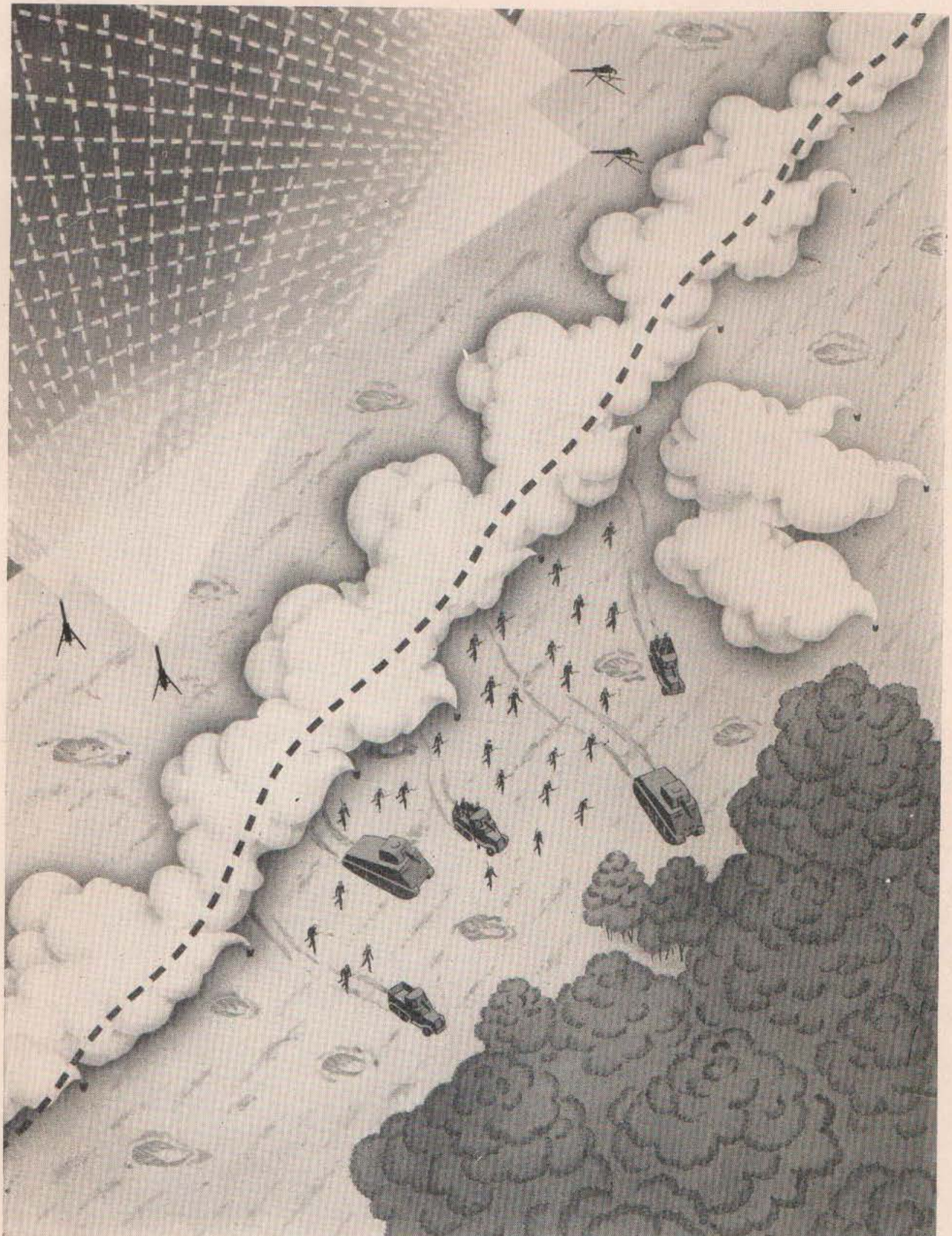


Figure 71. Screening a general retrograde movement. While machine guns provide rear guard protection, main body withdraws towards woods. Note start of second screen to replace first as retrograde continues.

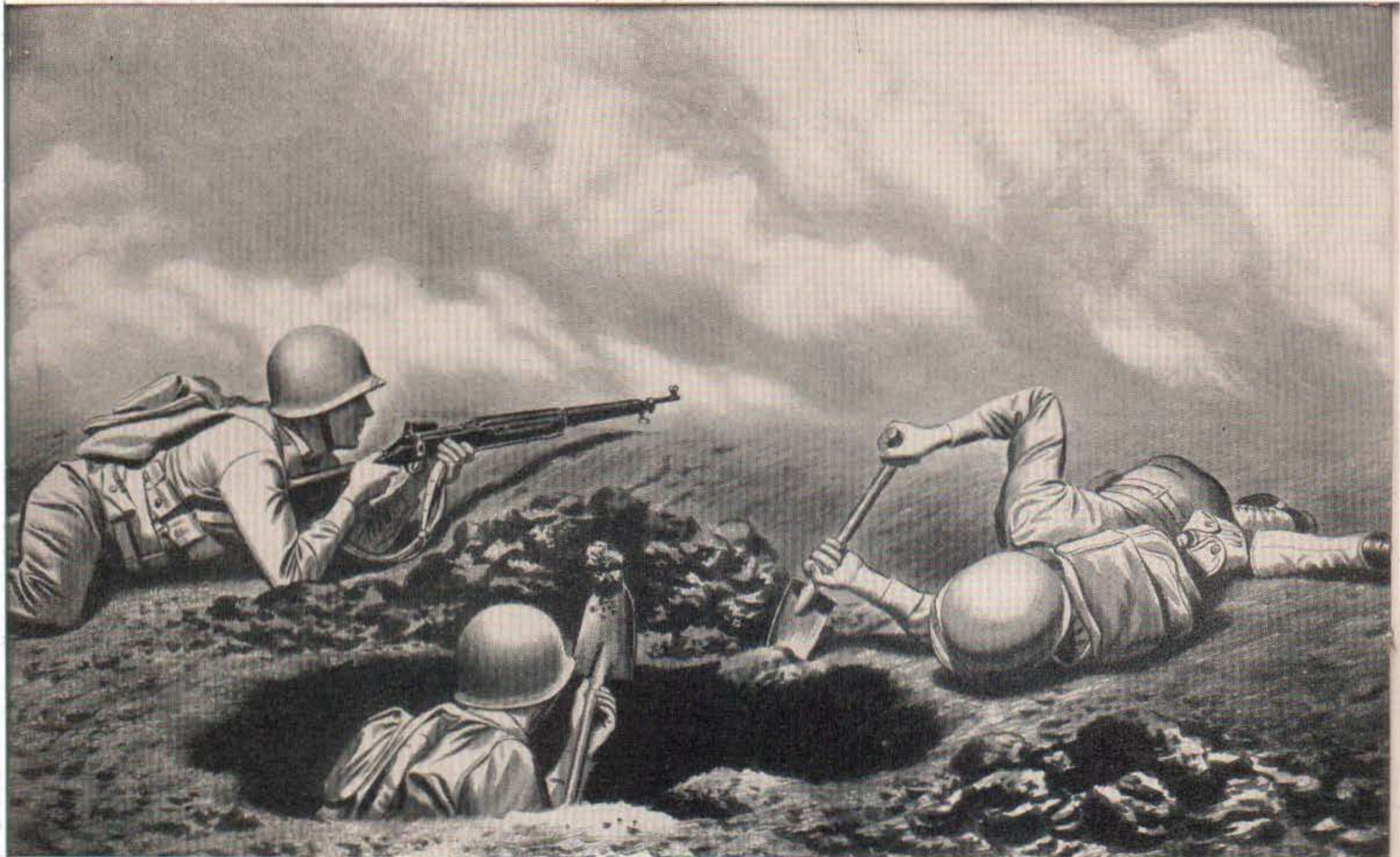
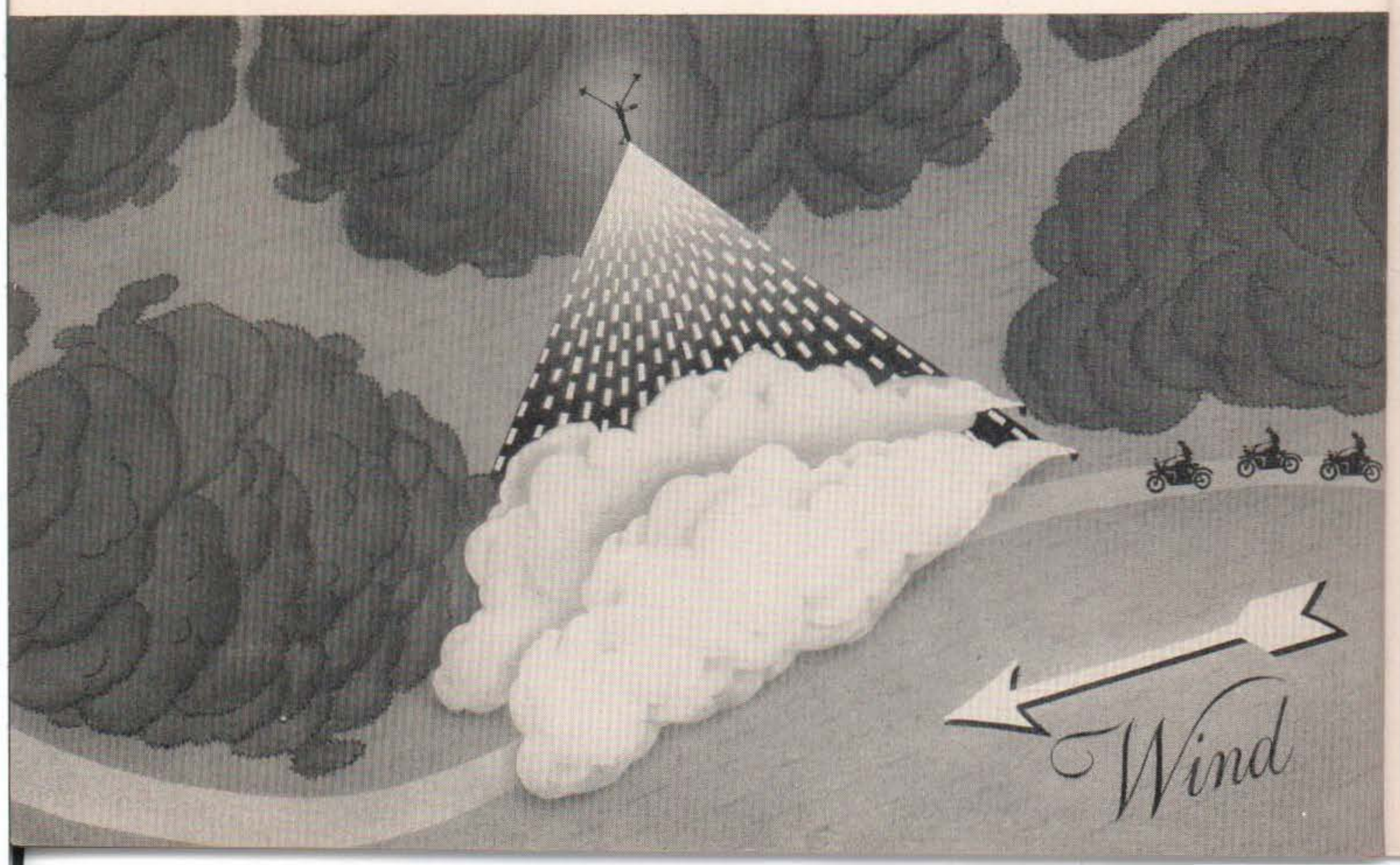


Figure 72. Pending further maneuver, advancing troops dig in under cover of smoke.

Figure 73. Below: Scout party lays down screen when crossing area covered by machine gun.



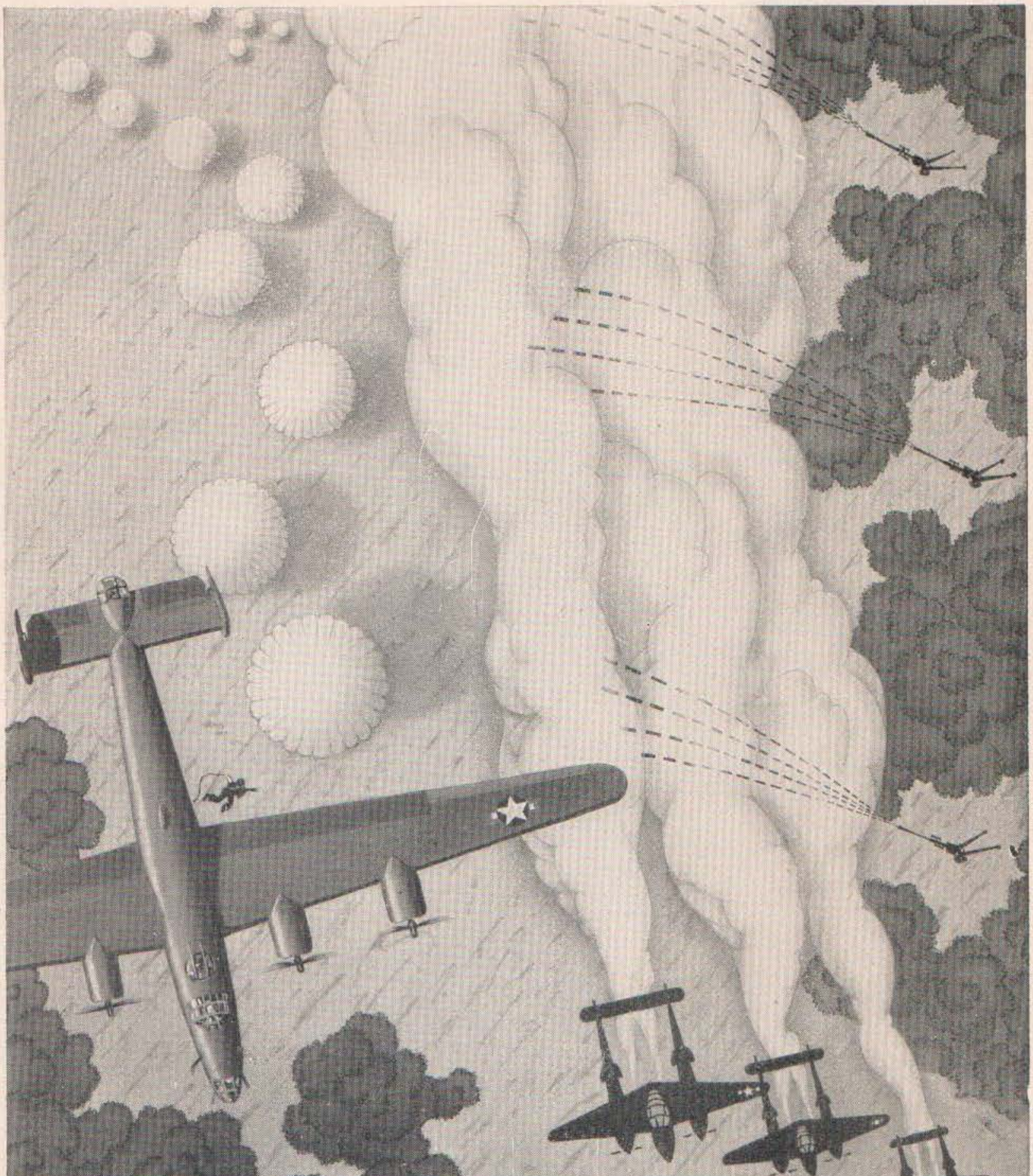


Figure 74. Aerial smoke screen used to conceal paratroopers. Screen is laid down in great depth, providing a curtain to blind observation of enemy gunners at right. Planes laying smoke screen precede troop transports by several minutes.

Figure 75. Above: Blinding observation post.

Figure 76. Below: Concealing a landing party.

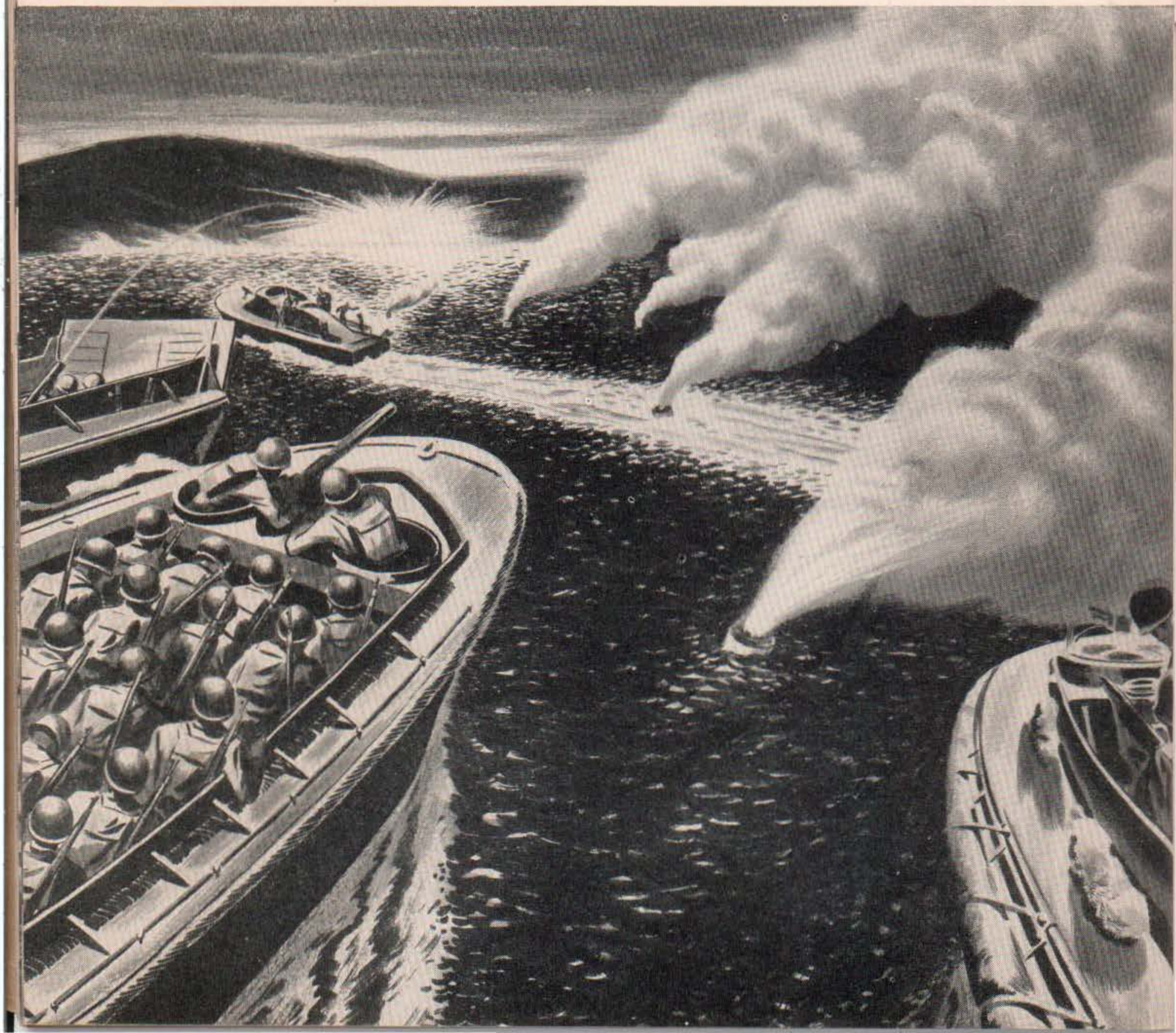


Figure 77. Screening a river crossing operation with smoke shell fired by mortars. Several screens are established to deceive enemy regarding point of attack, which is through woods at bottom.

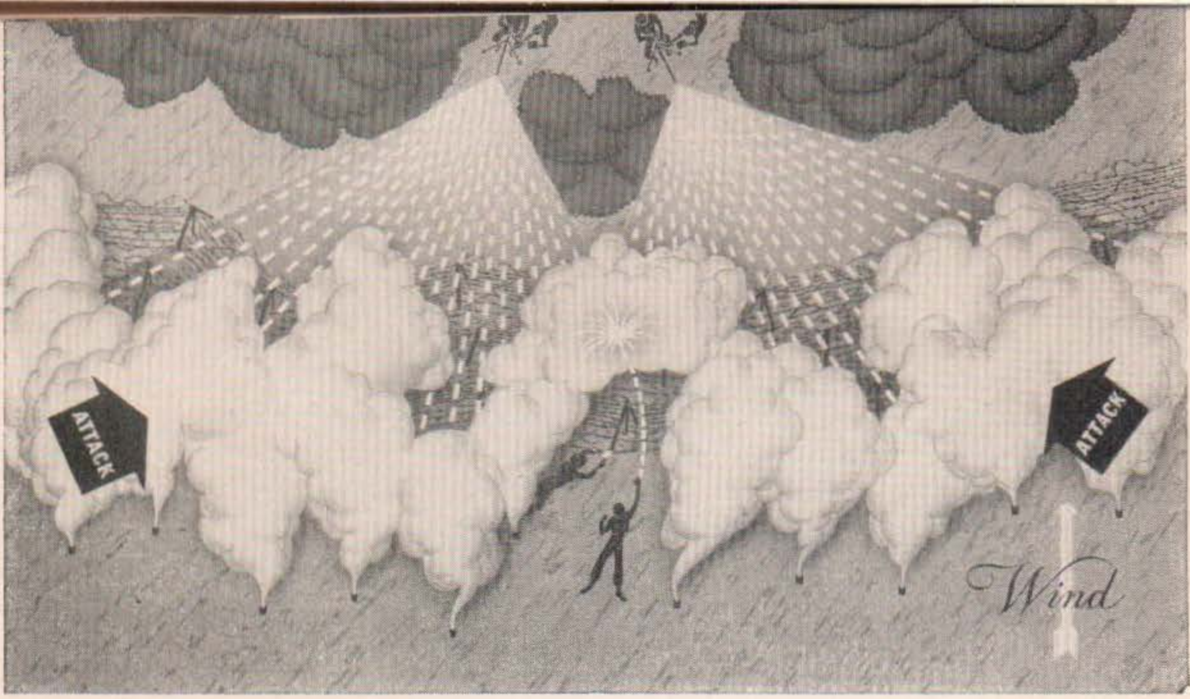
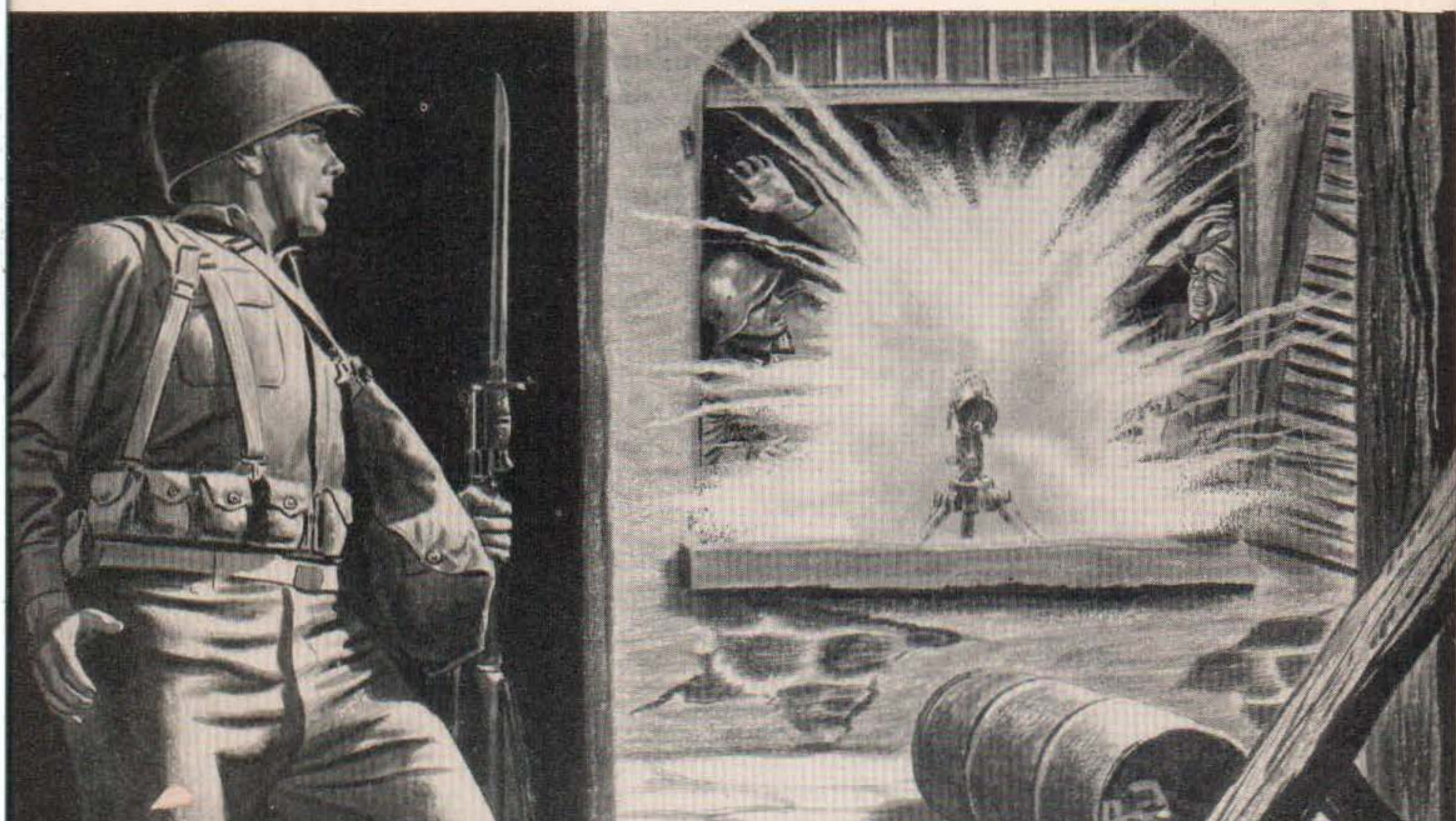


Figure 78. Above: Concealing wire-cutting detail. Troops attack on flanks simultaneously.

Figure 79. Below: Using WP grenade for combined smoke and casualty effect.



CHAPTER 4

EXERCISES WITH INCENDIARIES

45. Purpose

Since incendiary munitions have been used effectively in the present war, instruction should be given troops in the technique of handling them. Incendiaries are contained in bombs, shell, and grenades. In training, grenades and instructional bombs are used. The main objectives are to teach when, where, and how to use incendiaries, and how to fight them. Matériel requirements may prohibit total unit participation. Therefore the exercises have been developed in the form of demonstrations, the aim being to give as many men as possible experience in handling incendiary munitions. Reference is made to FM 23–30 and to TM 3–300 regarding correct technique in throwing grenades.

46. Materials

Incendiary instructional bombs (magnesium) M1, incendiary instructional bombs (thermate) M2, incendiary grenades (thermate) AN–M14, WP grenades M15, and IM and NP frangible grenades M1, are used in the demonstrations. Information on these munitions is found in TM 3–300. Old buildings, packing cases, boards, metal plates, and similar materials are needed to make platforms or targets upon which the incendiaries can be ignited. Tools and equipment for fire-fighting should include some or all of the following items:

Hose (fire or garden).
Buckets, barrels, and cups.
Four-hundred-gallon decontaminating apparatus.
Sand mats.
Burlap sacks.
Shovels (long-handled).
Axes.
Brooms.
Supply of sand or loose earth.

47. Destruction of Enemy Cover

a. When vegetation is dry, artillery and mortar shell filled with white phosphorus may be used to

Figure 80. Remain a safe distance from incendiaries to avoid flying particles.

Figure 81. Method of lighting instructional incendiary bomb, using pull-wire fuze.

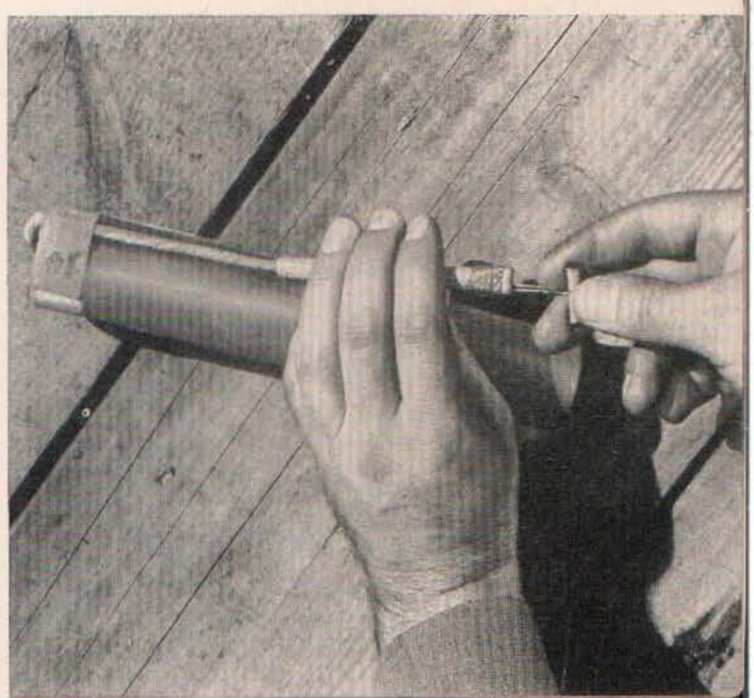


Figure 82. Destruction of enemy cover. At top, detail advances on position which is protected by heavy logs. Center: Member of detail hurls WP grenade. Below: Grenade lands in enemy position, burning personnel and producing thick smoke that blinds observation.

disperse incendiary material over a wide area and to set vegetation afire, thus destroying enemy cover and concealment. Such shell also have an effective antipersonnel action. White phosphorus grenades may be used for the same purpose in training and, at times, may be effective for destroying enemy cover in actual combat.

b. A squad is selected to advance under concealment to the upwind edge of the target, members of the group being dispersed sufficiently in skirmish formation to cover the entire width of the target area. The incendiary squad is backed up by a second squad providing small arms support. Each member of the incendiary group carries several grenades. At a predesignated time or signal the grenades are tossed, firing the area.

48. Attack on Armored Vehicle

Frangible grenades filled with IM and NP may be hurled at enemy armored vehicles such as tanks and half-tracks, enveloping them in hot flame and forcing their abandonment. For most effective results the grenade should be thrown into the vehicle. Although actual vehicles will not usually be available for a realistic exercise, the frangible grenade may be thrown at a heavy steel plate to demonstrate its effectiveness. Trainees should be shown that the grenade is most useful when tossed on a comparatively horizontal surface from which it will not fall readily to the ground.

49. Destruction of Matériel

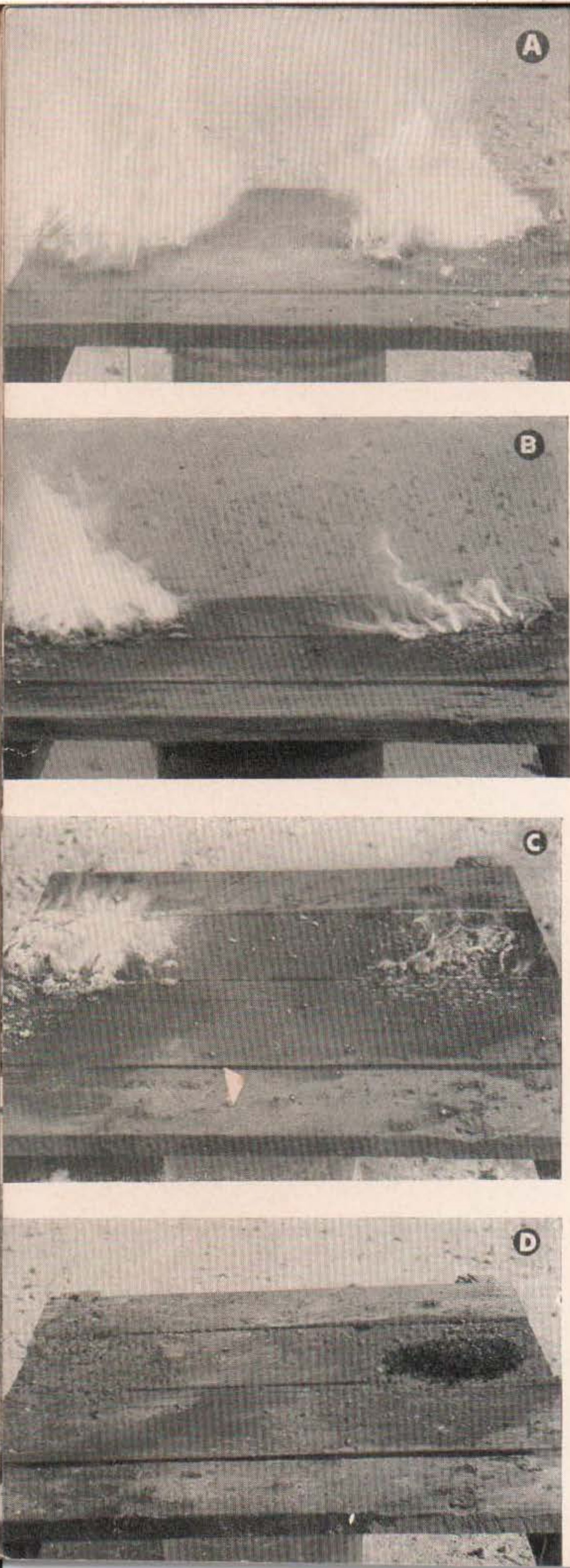
a. This is frequently a vital operation in retrograde movements, especially when abandoned matériel must be destroyed to prevent its use by the enemy. Readily inflammable matériel, of course, may be piled together and ignited. However, heavy metal vehicles, weapons, and other items of machinery require special treatment. Thermate grenades are generally most useful. They are placed on the machinery where their tremendous heat will destroy vital parts. (See fig. 83.) If no piece of military matériel is available for demonstration, grenades may be ignited on a heavy steel plate. Trainees should observe the manner of burning, should be told about the great heat generated, and afterward should inspect the steel plate to see how it has been damaged.

b. The exercise should be followed by special instruction in the destruction of organizational equipment of the unit being trained. Detailed information on such destruction methods will be found in technical manuals pertaining to such matériel. Artillery weapons and some mortars are destroyed by dropping thermate grenades down the barrel.

50. Comparison of Incendiaries

To emphasize the difference in burning time, heat, dispersion action, etc., a magnesium instructional bomb and a thermate instructional bomb may be ignited simultaneously or in succession on steel or wooden platforms. (See fig. 84.) Although the primary purpose of this demonstration is to compare burning action of the two types of bombs, it may be elaborated by adding another phase—that of igniting the two types of bombs and comparing the results when squads attempt to extinguish them.

Figure 83. Destroying matériel with thermate grenades. First grenade (upper left) is placed in mortar barrel unarmed. Second grenade is armed before it is inserted. Lower photos show effect.



51. Defense Against Incendiaries

a. Since defensive measures are usually concentrated against incendiaries dropped from airplanes, the magnesium instructional bomb or thermate instructional bomb is used for demonstration purposes. During preliminary instruction, thermate and magnesium incendiaries are compared from the standpoints of burning action, heat generation, and methods of control. It should be pointed out to trainees that many incendiaries contain delayed explosive charges and that all bombs should be treated accordingly.

b. A squad is chosen to combat the incendiary, which is set off on a platform or in a small building. The squad is told to simulate a situation wherein the installation to be fired is of extreme importance and must be saved "even at the risk of life." Any or all of the following methods may be demonstrated:

(1) If a fire extinguisher is used (any commercial extinguisher *except* one containing carbon tetrachloride which generates phosgene) three men are needed—one to operate the extinguisher, one to bring up a reserve extinguisher, and a third to handle the sand mat.

(2) If a bomb is fought with water using the pail-and-cup method, one man lies in a prone position and throws cupfuls of water on the incendiary, a second keeps him supplied with full pails of water, and a third carries water from the nearest source. The squad leader handles the sand mat.

(3) Lacking other equipment, sand or dirt may be thrown on the area around the bomb, helping to smother secondary fires. This should be done by a squad member in prone position while the leader runs in with the sand mat. The remaining members of the squad bring up a supply of sand or dirt. If necessary, the bomb or fragments of it may be covered with sand, scooped up with a shovel, and placed in a bucket which has a layer of sand in the bottom. The bucket may then be carried away.

Figure 84. Comparing action of thermate (left) and magnesium (right) instructional incendiaries. In photo A, thermate bomb burns with less smoke but greater heat over a more confined area. Magnesium bomb burns longer (photo B). Magnesium leaves much more residue than thermate (photo C). Thermate bomb burns deeper hole in plank (photo D).

Figure 85. Water may be thrown on incendiary from a cup. Pail provides protection from bomb.

Figure 86. Fire extinguisher is effective, but don't use carbon tetrachloride type.

Figure 87. Sand may be thrown from a bucket by the handful.

Figure 88. Sand may also be shoveled on bomb, but keep your distance.

APPENDIX I

LIST OF COMMON NAMES AND NOMENCLATURE

Common Name	*Nomenclature*
Accessories set M1, for the detonation gas identification set	Set, Accessories (Gas Identification, Detonation) M1
Chemical land mine	Mine, Land, Chemical, One-gallon
CN capsule	Capsule, CN
CN–DM grenade M6	Grenade, Hand, Irritant (CN-DM), M6
CN grenade M7	Grenade, Hand, Tear (CN), M7
CN tear pot M1	Pot, Tear Gas (CN), M1
Colored smoke grenade	Grenade, Smoke, Colored, M18
Decontaminating agent, noncorrosive (DANC)	Agent, Decontaminating, M3 and M4
Detonation gas identification set, M1	Set, Gas Identification, Detonation, M1
Field filling apparatus M2	Apparatus, Filling, Field, M2
Floating smoke pot M4A1	Pot, Smoke, Floating, HC, M4A1
Gas casualty kit	Kit, First-aid, Gas Casualty
Gas mask eyeglass M1	Eyeglass, Gas Mask, M1
Gasproof curtain	Curtain, Gasproof, M1
HC smoke pot M1	Pot, Smoke, HC, M1
IM and NP frangible grenade M1	Grenade, Frangible (IM and NP), M1
Incendiary grenade (thermate) AN–M14	Grenade, Incendiary, AN–M14
Incendiary instructional bomb M1 (magnesium)	Bomb, Incendiary, Instructional, M1
Incendiary instructional bomb M2 (thermate)	Bomb, Incendiary, Instructional, M2
Individual protective cover	Cover, Protective, Individual
Instructional gas identification set M1	Set, Gas Identification, Instructional MI
Liquid vesicant detector paper M6	Paper, Liquid Vesicant Detector, M6
Mechanical smoke generator M1	Generator, Smoke, Mechanical, M1 (100 Gal.)
Portable chemical cylinder M1A2	Cylinder, Portable, Chemical, M1A2
Power-driven decontaminating apparatus M3A1 and M4	Apparatus, Decontaminating, Power-driven, M3A1 and M4
Shoe impregnite	Impregnite, Shoe, M1
Toxic gas set M1	Set, Gas, Toxic, M1
WP grenade M15	Grenade, Hand, Smoke (WP), M15

APPENDIX II

LIST OF REFERENCES

FM 3–5	Tactics of Chemical Warfare
FM 5–25	Explosives and Demolitions
FM 21–40	Defense Against Chemical Attack
FM 23–5	U. S. Rifle, Caliber .30, M1
FM 23–6	U. S. Rifle, Caliber .30, M1917 (Enfield)
FM 23–10	U. S. Rifle, Caliber .30, M1903
FM 23–30	Hand and Rifle Grenades, Rocket, AT, HE, 2.36-inch
TM 3–220	Decontamination
TM 3–221	Decontaminating Apparatus M3A1 (Power-driven, 400-gallon)
TM 3–222	Decontaminating Apparatus M4 (Power-driven, 400-gallon)
TM 3–250	Storage and Shipment of Dangerous Chemicals
TM 3–255	Chemical Handling and Loading Equipment
TM 3–290	Miscellaneous Gas Protective Equipment
TM 3–300	Miscellaneous Chemical Munitions
TM 3–315	Portable Chemical Cylinder M1A2
TM 3–350	Gasproof Shelters
AR 750–10	Range Regulations for Firing Ammunition for Training and Target Practice
AR 775–10	Qualification in Arms and Ammunition Training Allowances

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