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Safety

Chemical Agent Safety Standards

By Order of the Secretary of the Army:

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History. This publication is a major revision.

Applicability. This pamphlet applies to the Regular Army, the Army National Guard/Army National Guard of the United States, and the U.S. Army Reserve, unless otherwise stated. It also applies to all Army Civilian personnel in a duty status, on or off a Department of Defense installation; to Department of the Army contractors (unless otherwise specified within contract clauses and provisioning agreements) with a responsibility for chemical agent operations or a chemical agent mission; and to all persons at any time on an Army installation. Department of Defense military munitions under U.S. title, even though stored in a host country, remain the responsibility of the U.S. commander. Storage will conform with Army standards for explosives safety, unless the use of more stringent criteria has been agreed to or is mandatory. This pamphlet is applicable during full mobilization.

Proponent and exception authority. The proponent of this pamphlet is the Director of 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 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 requirements.

Suggested improvements. Users are invited to send comments and suggested improvements on DA Form 2028 (Recommended Changes to Publications and Blank Forms) directly to Office of the Director, Army Safety (DACS–SF), usarmy.pentagon.hqda-aso.mbx.army-safety-office@army.mil.

Committee management approval. AR 15–39 requires the proponent to justify establishing/continuing committee(s), coordinate draft publications, and coordinate changes in committee status with the Office of the Administrative Assistant to the Secretary of the Army, Special Programs Directorate, 9301 Chapek Road, Building 1458, Fort Belvoir, VA 22060–5527. Further, if it is determined that an established "group" identified within this regulation later takes on the characteristics of a committee as found in AR 15–39, then the proponent will follow AR 15–39 requirements for establishing and continuing the group as a committee.

Distribution. This pamphlet is available in electronic media only and is intended for the Regular Army, the Army National Guard/Army National Guard of the United States, and the U.S. Army Reserve.

*This pamphlet supersedes DA Pam 385–61, dated 1 November 2018.

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Chapter 1
Introduction

1–1. Purpose
This pamphlet provides standards on chemical agent safety. It implements the safety requirements of the Defense Explosives Safety Regulation 6055.09. It also provides the minimum safety criteria, guidance, and procedures for use in training, processing, handling, storage, transportation, disposal, and decontamination of Department of Defense (DoD) chemical agents and nontraditional agents (NTA) per AR 385–10.

1–2. References, forms, and explanation of abbreviations
See appendix A. The abbreviations, brevity codes, and acronyms (ABCAs) used in this electronic publication are defined when you hover over them. All ABCAs are listed in the ABCA database located at https://armypubs.army.mil.

1–3. Associated publications
Policy associated with this pamphlet is found in AR 385–10.

1–4. Records management (recordkeeping) requirements
The records management requirement for all record numbers, associated forms, and reports required by this publication are addressed in the Records Retention Schedule–Army (RRS–A). Detailed information for all related record numbers, forms, and reports are located in Army Records Information Management System (ARIMS/RRS–A at https://www.arims.army.mil. If any record numbers, forms, and reports are not current, addressed, and/or published correctly in ARIMS/RRS–A, see DA Pam 25–403 for guidance.

1–5. Applicability
a. The criteria, guidance, and procedures in this pamphlet apply to Schedule 1 chemicals as defined by the Convention on the Prohibition of the Development, Production, Stockpiling, and Use of Chemical Weapons and on their Destruction, herein referred to as the Chemical Weapons Convention (CWC). Examples include—

(1) Blister agents, including—

(a) Sulfur/distilled mustard (H/HD - 2,2' dich1orodiethyl sulfide).

(b) Sulfur/T-mixture mustard (H/HT - 60 percent HD and 40 percent 2,2' dichloroethylthiodiethyl ether).

(c) Lewisite (L - dichloro (2-chlorovinyl) arsine).

(2) Nerve agents, including—

(a) Tabun (GB - isopropyl methylphosphonofluoridate).

(b) Sarin (GA - dimethylaminoethoxy-cyanophosphine oxide).

(c) VX - 0-ethyl S-[2-(diisopropylamino) ethyl] methylphosphonothioate.

(d) Soman (GD - pinacolyl methylphosphonofluoridate).

(e) Cyclosarin (GF - methylphosphonofluoridic acid, cyclohexyl ester).

(3) Mixtures of these chemical agents not meeting the criteria for dilute solution (and where the chemical agent cannot be removed or recovered from the solution for unauthorized purposes).

(4) NTA and other experimental agents covered by AR 50–6.

b. For the purposes of this pamphlet “chemical munition” is used to mean a DoD munition, with a chemical fill, at a chemical weapons storage facility, or its associated chemical weapons destruction facility as declared per the CWC.

c. This pamphlet does not apply to the following:

(1) Tactical military operations.

(2) Dilute chemical agent solutions except where specifically addressed in this pamphlet. However, the provisions of this pamphlet should be used in conjunction with hazard analyses, standing operating procedures (SOPs), and good laboratory practices to minimize the risks associated with these solutions. See appendix B in AR 50–6 for guidance on the exemption levels for dilute chemical agent solutions.

(3) Recovered chemical warfare material (CWM) except where required by current recovered CWM policy and/or Deputy Assistant Secretary of the Army (Environment, Safety, and Occupational Health)

(DASA(ESOH)) memorandum dated 1 April 2009, “Interim Guidance for Chemical Warfare Material Responses.”

(4) The immediate disposal of chemical munitions or decontamination of chemical agents during an emergency when the delay will cause a greater danger to human life or health.

d. Military unique requirements pertaining to chemical agent safety during the conduct of military tactical training are noted in chapter 11. Where conflicts exist between the military unique requirements of chapter 11 and other parts of this pamphlet, the requirements of chapter 11 have precedence.

e. Contractors working with chemical agent from the U.S. Army inventory will follow health guidance from hazard data sheets and safety data sheets (SDS) for the chemical agents used, or this pamphlet, when identified in chemical agent provisioning agreements.

1–6. Concept

Where there is conflict, this pamphlet takes precedence over the guidance contained in previously issued policy letters; technical manuals (TMs); field manuals; supply bulletins (SBs); technical bulletins (TBs); other Department of the Army (DA) pamphlets; and Army command (ACOM), Army service component command (ASCC), and direct reporting unit (DRU) regulatory documents. Restrictions imposed by local governing agencies will be followed as required. Overseas commands will meet the provisions of this pamphlet or equivalent requirements of the host government.

1–7. Provisions

a. This pamphlet has mandatory procedures and guidance as well as preferred and acceptable methods of accomplishment.

b. The words “will” and “must” are used to state mandatory requirements. Deviation from these provisions requires a DA Form 7632 (Deviation Acceptance and Risk Assessment Document) per provisions of AR 385–10 and DA Pam 385–64.

c. The word “should” indicates an optional or preferred method of accomplishment. Deviation from these provisions requires written authorization from the local commander or activity commander or director or designee of such.

d. The word “may” indicates an acceptable or suggested means of accomplishment.

Chapter 2
Chemical Agent Information and Classification

2–1. Overview

a. An overview and description of hazards, mechanism of action, and physiological effects, persistency, vapor pressure, stability, effectiveness, hydrolysis, dosage, and rates of detoxification and action of chemical agents is provided in appendix B.

b. SDSs for the chemical agents listed in paragraph 1–5 are available from the Combat Capabilities Development Command (DEVCOM) Chemical Biological Center (CBC). Call (410) 436–4411 or (410) 436–4414, Monday through Friday, 0800 to 1600 hours Eastern Time. NTA SDSs will be provided with the initial shipment of NTA and with the first shipment of NTA after a SDS is updated.

2–2. Classification

Chemical agents are classified as Class 6.1 poisons by the DoD (Defense Explosives Safety Regulation (DESR) 6055.09) and the Department of Transportation (DoT) (see Section 132, Part 173, Title 49 of the Code of Federal Regulations (49 CFR 173.132)) and belong to storage compatibility group K. When explosively configured, see the Joint Hazard Classification System for the appropriate classification.

2–3. Chemical agent airborne exposure limits

a. The airborne exposure limits (AELs) for chemical agents are listed in table 2–1. Available NTA information will be listed on agent specific SDSs. The basis for AELs listed in table 2–1 are the following references:

(1) 68 Federal Register (FR) 54460 (dated 17 September 2003), amended in 68 FR 58348 (9 October 2003).

(2) 69 FR 24164 (3 May 2004).

b. Acute exposure guideline levels (AEGLs) are explained here:

(1) AEGLs are intended to describe the risk to humans resulting from once-in-a-lifetime, or rare, exposure to airborne chemicals. The AEGLs are to be used to provide protection to populations not related to chemical agent operations. AEGLs deal with emergency situations involving spills, or other catastrophic exposures. An acute exposure is defined as a single, nonrepetitive exposures for not more than 8 hours. AEGLs are listed at https://www.epa.gov/aegl/.

(2) AEGLs are to be used as public exposure guidelines, not as siting criteria for operations, facilities, or storage of chemical agents. For the agent of concern, if there are no AEGLs available and a one percent lethality cannot be calculated for the chemical in question, it will be evaluated using worst-case situations with maximum considerations for public and worker safety.

(3) Each AEGL includes three tiers, defined as follows:

(a) AEGL–3 is the airborne concentration (expressed as mg/m3 (milligrams per cubic meter)) of a substance above which it is predicted that the general population, including susceptible individuals, could experience life-threatening health effects or death.

Table 2–1
Airborne exposure levels for unprotected workers and general population

Agent	Notes	General population limit (GPL) [mg/m^3]	Worker population limit (WPL) [mg/m^3]	Short-term exposure limit (STEL) [mg/m^3]	Immediately dangerous to life or health (IDLH) [mg/m^3]
GA, GB	1, 2, 3, 6, 7	0.000001 (1 x 10–^{6})	0.00003 (3 x 10–^{5})	0.0001 (1 x 10–^{4})	0.1 (1 x 10–^{1})
GD, GF	1, 2, 3, 6, 7	0.000001 (1 x 10–^{6})	0.00003 (3 x 10–^{5})	0.00005 (5 x 10–^{5})	0.05 (5 x 10–^{2})
VX	1, 2, 4, 6, 7	0.0000006 (6 x 10–^{7})	0.000001 (1 x 10–^{6})	0.00001 (1 x 10–^{5})	0.003 (3 x 10–^{3})
HD, H, HT	1, 2, 5, 6, 8, 10	0.00002 (2 x 10–^{5})	0.0004 (4 x 10–^{4})	0.003 (3 x 10–^{3})	0.7 (7 x 10–^{1})
L, HL	1, 2, 5, 6, 9, 11		0.003 (3 x 10–^{3})	0.003 (3 x 10–^{3})	0.003 (3 x 10–^{3})

Notes:

[1] WPL is an 8-hour time-weighted average (TWA). Exposure below the WPL is safe and not expected to produce any adverse health effect. Acute or subchronic exposure above the WPL is also not expected to produce any adverse health effect, since WPL is a chronic exposure limit.

[2] The STEL is a 15-minute TWA.

[3] For a G-series nerve agent, exposure at the STEL should not be longer than 15 minutes and should not occur more than 4 times per day, and at least 60 minutes should elapse between successive exposures in this range.

[4] For a VX nerve agent, exposure at the STEL should not be longer than 15 minutes and should not occur more than once per day.

[5] For sulfur mustards and L, exposure at the STEL should be as short as practical (but no longer than 15 minutes) and should not occur more than once per day.

[6] IDLH is a 30-minute TWA. The 30-minute period is not meant to imply that anyone should stay in the environment any longer than necessary; in fact, every effort should be made to exit immediately.

[7] For nerve agents, the GPL is a 24-hour TWA.

[8] For sulfur mustards, the GPL is a 12-hour TWA.

[9] IDLH values are used solely for the purpose of establishing the concentrations at which self-contained breathing apparatus (SCBA) or supplied air respirators (SARs) are required.

[10] HT is measured as HD.

[11] All concentrations measured as L.

(b) AEGL–2 is the airborne concentration (expressed as mg/m3) of a substance above which it is predicted that the general population, including susceptible individuals, could experience irreversible or other serious, long-lasting, adverse health effects or an impaired ability to escape.

(c) AEGL–1 is the airborne concentration (expressed as mg/m3) of a substance above which it is predicted that the general population, including susceptible individuals, could experience notable discomfort, irritation, or certain asymptomatic nonsensory effects. However, the effects are not disabling and are transient and reversible upon cessation of exposure.

(d) All three tiers (AEGL–1, AEGL–2, and AEGL–3) are developed for each of five exposure periods: 10 minutes, 30 minutes, 1 hour, 4 hours, and 8 hours. If AEGLs are to be used for siting criteria, in the absence of established one percent lethality standard, AEGL–2 will be used with the worst case exposure (maximum mg/m3) of the five periods.

Chapter 3
Chemical Agent Monitoring Requirements

3–1. Purpose
Employers are required to limit employee workplace chemical exposures to nonhazardous levels and to protect the public around their workplaces. To meet these requirements, air monitoring is needed to determine the exposure level to individual hazardous chemicals. The factors in determining airborne chemical exposure are type of contact, duration of contact, and chemical concentration. The purpose of an air-monitoring program is to confirm whether specific hazardous chemicals are present and to determine if the concentration presents a hazard.

3–2. Chemical agent monitoring requirements
a. Monitoring equipment and results will be used to determine the level of personal protective equipment (PPE) required.

b. First entry monitoring is required when an unknown environment or potential chemical agent sources are present.

c. Monitoring during operations is as follows:

(1) Monitoring with continuous, near-real-time (NRT) devices with alarm capabilities will be conducted according to an approved monitoring plan (see para 3–7).

(2) Air monitoring must be supplemented by visual observations for conditions that may indicate leakage. The frequency and scope of observations should be identified in the SOP or site-specific air monitoring plan.

d. A quality assurance plan for monitoring will be developed that is based on guidance established by the DEVCOM CBC's Chemical Agent Standard Analytical Reference Material (CASARM) Quality Assurance Plan, the U.S. Army Chemical Materials Activity's Laboratory and Monitoring Quality Assurance Plan, or an agency approved site-specific quality assurance program (approved by the requesting agency's higher headquarters). This plan will be reviewed annually.

e. WPL monitoring:

(1) Monitoring will be performed for identified areas of the facility where workers may have an exposure potential to a chemical agent, as identified in the activity SOP.

(2) The monitoring may be either historical and/or real-time or NRT, based on the WPL section of the site-monitoring plan described in paragraph 3–7.

f. STEL monitoring:

(1) Areas involving operations where release of chemical agent into the operating environment, at levels exceeding the STEL can reasonably be expected to occur, will be monitored.

(2) The monitoring will be conducted using equipment capable of measuring the chemical agent level in real-time or NRT, ensuring the time duration of 15 minutes associated with the STEL is not exceeded.

(3) The monitoring equipment must be set to an alarm or notification level to account for the accuracy and precision of the equipment being used, such as the Miniature Continuous Air Monitor System (MINICAMS®) for a 15-minute cycle, set at a fraction of the STEL (such as 0.7 STEL) concentration for a method that measures +/-25 percent of the true concentration, 95 percent of the time to ensure workers are not potentially overexposed.

(4) Records will be maintained of exceedances above STEL. They will include as a minimum: concentration, agent type, location, time, and date.

3–3. Monitoring support requirements
a. Certification. Personnel who operate and maintain air monitoring devices will receive special training on the devices, and will be certified by the qualified local authority, as identified in the quality assurance plan, for the operation and maintenance of chemical agent monitoring systems.

b. Calibration. Air monitoring equipment must be calibrated and calibration methods must be approved before use. Calibration requirements are found in the quality assurance plan (see para 3–2*d*).

3–4. Recordkeeping

a. Detailed records of the results of monitoring conducted in support of operations (such as MINICAMS® records and Depot Area Air Monitoring System (DAAMS) analysis results, and so forth) will be collected each day monitoring is conducted for all chemical agent operations. Monitoring records will include the following:

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

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

(3) The type of PPE used.

(4) A roster of personnel entering the building or area. The roster will have unique identifying information (for example, badge number, employee number, and so forth) for individuals entering chemical agent areas.

b. The installation or garrison commander, or the activity commander or director, must designate the official responsible for maintaining the monitoring records, and have personnel available who are qualified to interpret and correlate the results. A summary of the rosters documenting individual chemical agent area entrance and egress (as defined per National Fire Protection Association (NFPA) 101), level of PPE worn, and the records of air-monitoring measurements will be retained in accordance with 29 CFR 1910.1020(d).

c. Employees will have access to monitoring results, recommendations, and records. Former employees or their designated representatives will also have access to such records.

3–5. Detection methods and equipment

a. Interference issues. M8 (National Stock Number (NSN) 6665–00–050–8529) and M9 (NSN 6665–01–0498–982) detection papers are subject to interference and should not be used as a sole verification of the presence of a chemical agent. Some decontaminates give false-positive results on the M8 detector paper, and contact of the M9 detector paper to hot, dirty, oily, or greasy surfaces may give a false-positive reading.

b. Depot area air monitoring. The DAAMS is a portable air sampling unit that draws a controlled volume of air through a glass tube filled with a sorbent material. Chemical agent vapors are collected on the sorbent material. Sampling times vary from as few as 30 minutes to 12 hours. After sampling is complete, the tubes are removed from the DAAMS station and sent to the laboratory for analysis within 72 hours. The analytical method used for L air monitoring will meet (as a minimum) the quality assurance requirements contained in the latest revision of the CASARM quality assurance plan. More stringent quality assurance requirements are also acceptable. See table 3–1.

Table 3–1
Detector sensitivity and response – detector paper, depot area air monitoring units, and MINICAMS

Detector sensitivity and response/processing time sensitivity (mg/m^3)[1,2]

Equipment	Lewisite	Mustard	GB	VX	Response time
Detector paper (M8/M9)	Positive or negative only	Positive or negative only	Positive or negative only	Positive or negative only	Immediately
DAAMS	≤ 0.003	≤ 0.003	≤ 0.0001	≤ 0.00001	≤ 4 hours
MINICAMS®	0.003	0.003	0.0001	0.00001	≤ 15 min

Notes:

[1] Response times may vary.

[2] Real-time Analytical Platform (RTAP) is a vehicle that transports detectors to the scene. Sensitivity and response time depend on instructions used in the RTAP. MINICAMS® are typically used.

c. Joint chemical agent detector. The joint chemical agent detector (JCAD) M4A1 is a hand-held device intended to automatically detect, identify, quantify, and warn users of the presence of nerve and blister chemical agents. The JCAD detects gross levels of chemical agent vapors and provides an early warning of the presence of chemical agent vapors in sufficient time for individuals to take protection measures to preclude exposure to levels that cause incapacitating health effects, and to levels that cause noticeable effects in laboratory test subjects. The JCAD detector unit simultaneously detects nerve (GA, GB, GD, GF, and VX), and blister (H, HN_3, and L) chemical agents. See table 3–2 and table 3–3.

Table 3–2
Detector sensitivity and response – Joint Chemical Agent Detector M4A1: Maximum alarm response time for point exposures when detector is set to 5 second sampling mode

Parameter type	Agent	Exposure concentration (mg/m^3)	Exposure response time max (seconds)	Atmospheric water vapor content (g/m^3)[1]	Temperature range °Celsius
Objective	VX	1 0.1 0.04	≤10 ≤30 ≤90	0 to 32	+9 to +49 at 1 mg/m^3 -6 to +49 at 0.1 mg/m^3 and 0.04 mg/m^3
Objective	GA	0.22	10	0 to 32	-5 to 49
@	GB	0.22	≤30	0 to 32	-32 to 49
Objective	GD	0.089	≤10	0 to 32	-32 to 49
Objective	GF	0.089	≤10	0 to 32	-30 to 49
Objective	HD	2.5	≤10	0 to 32	-14 to 49
@	L	2.5	≤30	0 to 8	18 to 49
Objective	HN_3	2.5	≤10	0 to 32	-3 to 49

Note: 1 Excluding operation in condensing environments (internal and external)

Table 3–3
Detector sensitivity and response – Joint Chemical Agent Detector M4A1: Maximum alarm response time for point exposures when detector is set to 1 second sampling mode

Parameter type	Agent	Exposure concentration (mg/m^3)	Threshold {objective} exposure response time max (seconds)	Atmospheric water vapor content (g/m^3)[1]	Temperature range (°Celsius)
Threshold	GA	0.14	≤30 {≤10}	0 to 32	-5 to 49
Threshold	GB	0.14	≤30 {≤10}	0 to 32	-32 to 49
Threshold	GD	0.061	≤30 {≤10}	0 to 32	-32 to 49
Threshold	HD	1.2	≤30 {≤10}	0 to 32	-14 to 49
Threshold	HN_3	1.2	≤30 {≤10}	0 to 32	-3 to 49
Threshold	L	0.65	≤30 {≤10}	0 to 32	-18 to 49
Objective	VX	0.04	≤90	0 to 32	9 to 49
Objective	GF	0.057	≤30	0 to 32	-30 to 49

Note: 1 Excluding operation in condensing environments (internal and external)

d. Miniature Continuous Air Monitor System. MINICAMS® is an automatic air monitoring system that collects compounds on a solid sorbent trap, thermally desorbs them into a capillary gas chromatography column for separation, and detects the compounds with a flame-photometric detector. It is a lightweight, portable, real-time, low-level monitor with alarm capability, designed to respond to 0.0001 mg/m3 for GB

in less than 5 minutes, 0.00001 mg/m3 for VX in less than 15 minutes, and 0.003 mg/m3 for mustard and L in less than 5 minutes.

e. Other methods. Detection methods other than those listed above may be used provided sensitivity and reliability have been tested, demonstrated, and documented to the satisfaction of the Department of the Army Chemical Agent Safety Council (DACASC).

f. Prohibited items. Tygon® and rubber tubing will not be used in sampling lines.

3–6. Detection equipment capabilities

a. Capabilities, sensitivities, and response times for detector equipment listed are shown in tables 3–1, 3–2, and 3–3.

b. Information on NTA detection equipment capabilities may be requested by contacting the DEVCOM CBC.

3–7. Monitoring plans

a. A monitoring plan will be written and implemented for each chemical agent facility and operation. The activity commander, or director of the activity or unit, is responsible for reviewing and approving the plans. Safety managers will review and concur on monitoring plans. Development of the plan should be a coordinated effort involving, as a minimum, representatives from the safety office and where available and applicable the chemical agent laboratory, the industrial hygiene (IH) office, and the environmental office.

b. The monitoring plan should contain the following elements:

(1) Diagram of the operational site or storage facility.

(2) Chemical agent and munitions involved.

(3) Chemical agent monitors to be used.

(4) Placement of sample points based on characteristics of chemical agent and munitions, airflow patterns, and monitoring equipment being used.

(5) Type of sampling lines used, to include length, material made from, and whether sampling lines are heat traced.

(6) Provisions for workplace monitoring during operations must be included.

(7) Identification of monitoring work stations where chemical agent leakage is considered possible.

c. It is recognized that chemical agent vapors that may exist in an operational or storage structure will not be uniformly distributed. (This is particularly true for VX and HD agents owing to their relatively low vapor pressure.) To ensure that the air samples taken in a given structure reflect a true representative sample of that environment, the positioning of the sampling points is based on airflows within the storage structure where operations are performed and on characteristics of the chemical agent involved.

d. The storage conditions or configurations in each storage facility differ; therefore, placement of the sampling point in each facility may be different.

e. The WPL monitoring section of the site-specific monitoring plan will address:

(1) Monitoring of areas where workers may be exposed to chemical agent at levels exceeding the WPL.

(2) Monitoring levels at specific locations will be based on potential time of exposure (stay time) and incorporate the maximum use concentration (MUC) and assigned protection factor (APF) for a given respirator. Under these conditions, different monitoring levels may be implemented, depending on the level of PPE used and implementation of administrative controls to reduce potential exposures. The frequency of monitoring will be based on IH best practices considering factors such as:

(a) Historical baselines.

(b) Level of PPE used.

(c) Engineering and work practices.

(d) Containment controls.

(e) Potential chemical agent.

(f) Work, task, or operation being performed.

(g) Number of entries (in/out) performed per shift.

(h) Frequency of occupancy by personnel.

(i) Regulatory and/or permit requirements.

(j) Frequency of work leading to exceedances.

(k) Type of monitors being used.

(l) Duration of possible exposures.
(m) Reliability of engineering and work practices.
(n) Reliability of containment controls.
f. The site-specific monitoring plan will prescribe procedures for the analysis of unexpected discrepancies and/or trends in chemical agent monitoring data. IH principles will be used as guidance in developing these procedures.

3–8. Chemical agent exceedances

a. When chemical agent concentrations exceed the IDLH, the exceedance will be documented and will be preserved for historical purposes (such as logbook).
b. When monitoring indicates exceedances of chemical agent levels above the WPL in areas where exceedances are not expected, the following actions will be completed:
(1) The area will be restricted (for example, increase level of PPE, limit transients) until the cause has been evaluated and corrected. When evaluated and/or corrected, the restrictions may be lifted.
(2) Notice of the exceedance will be posted informing all employees of—
(a) Location of the exceedance.
(b) Period of time during which exceedance occurred.
(c) Name of the chemical agent observed.
(d) WPL for the chemical agent monitored in mg/m3.
(e) Amount of exceedance in mg/m3.
(f) Statement of proposed action to limit future exceedances.
(g) Safety point of contact with phone number.
(h) Medical point of contact with phone number.
(i) Statement concerning the health significance of the exceedance, with concurrence of the competent medical authority (CMA).
c. The notice of exceedance will be provided to employees as soon as possible after the determination of the exceedance in a manner that informs all possibly affected employees of the exceedance. The notice may be delivered electronically, posted on a bulletin board near the location of the exceedance, or other method that ensures affected employees are notified of the required information. If posted, the posting will remain for 3 days or, if the condition leading to the exceedance has been identified, until that condition has been abated, whichever is later.
d. The CMA will be notified of the exceedance and provided the following:
(1) Location of the exceedance.
(2) Period of time during which exceedance occurred.
(3) Name of chemical agent observed.
(4) WPL for the chemical agent monitored in mg/m3.
(5) Amount of exceedance in mg/m3.
(6) Statement of proposed action to limit future exceedances.
(7) Safety point of contact with phone number.
e. A local WPL Exceedance Response Plan that details responsibilities and requirements will be developed and executed to document, notify employees, investigate, identify, and control identified exceedances. This plan may be incorporated with other facility documents such as a contingency plan. The activity commander, or director, of the activity or unit, is responsible for reviewing and approving the plan. Development of the plan should be a coordinated effort involving, as a minimum, representatives from the safety office and where available and applicable the chemical agent laboratory, the IH office, and the environmental office.

Chapter 4
Personal Protective Equipment

4–1. General

Details on the PPE approval process are contained in appendix C. If additional information or guidance is required, contact the Office of the Director of Army Safety (ODASAF). Requesting organizations, at a minimum, will copy-furnish their ACOM, ASCC, or DRU when submitting requests to the ODASAF. The ODASAF tasks the DACASC to evaluate alternate PPE requests and provide a recommendation.

a. PPE selected for use with NTA will be supported by a risk assessment and will be reviewed by the facility's Nontraditional Agent Safety Committee (NTASC) prior to use, to ensure the PPE provides an appropriate level of protection.

b. The selection of PPE for use in chemical agent environments is a complex process. A multidisciplinary group (including representatives from safety, IH, and operations) should be used to evaluate and select commercial PPE.

c. Local policy will determine required PPE for personnel who are not chemical agent workers.

d. PPE inspectors will be certified before appointment to the position of certifying PPE for use in a chemical agent environment or potential chemical agent environment. The Defense Chemical Test Equipment at Pine Bluff Arsenal may be used to obtain such certification.

4–2. Respiratory protection program

a. In operations where respiratory protection is required, there will be a program for the selection, use, inspection, training, fit testing, and maintenance that complies with 29 CFR 1910.134 and AR 11–34. In addition, an MUC will be determined for each combination of chemical agent and respirator type for the WPL and STEL levels for the chemical of concern. This will be documented in the written respiratory protection program.

b. Table 4–1 can be used to identify suitable classes of respirators for protection in various situations. This chart must be used only if all applicable respiratory program requirements have been met, and it must be used in conjunction with a job hazard analysis. Supporting IH personnel can assist in the selection of suitable respirators.

4–3. Protection levels for chemical agent workers

The following describes the protective equipment associated with each level of protection. Based on a local hazard analysis, combinations of PPE may be used to provide flexibility in selecting protection that is more appropriate.

a. Level A. Level A protective equipment consists of a positive-pressure, full-facepiece SCBA, or positive-pressure SAR with escape SCBA, approved by the National Institute for Occupational Safety and Health (NIOSH); totally encapsulating (vapor tight) chemical protective suit; coveralls (optional); gloves, outer, chemical resistant; gloves, inner; boots, chemical resistant, steel toe, and shank.

b. Level B. Level B protective equipment consists of:

(1) A NIOSH-certified, positive-pressure, full-facepiece SCBA or A positive-pressure, SAR with escape SCBA (NIOSH-certified).

(2) Hooded, chemical-resistant clothing (overalls and long-sleeved jacket; coveralls; one- or two-piece chemical-splash suit; disposable chemical resistant overalls); gloves, outer, chemical resistant; gloves, inner; boots, outer, chemical resistant, steel toe and shank; coveralls (optional); boot covers, outer, chemical resistant (optional); hard hat (optional); and face shield (optional).

c. Level C. Level C protective equipment consists of a full-face air-purifying respirator (APR) (NIOSH-certified or DA approved); chemical-resistant clothing (overalls; two-piece chemical-splash suit; sleeved chemical-resistant apron; disposable chemical-resistant overalls); gloves, outer, chemical resistant; gloves, inner; boots, outer, chemical resistant, steel toe and shank; coveralls (optional); boot covers, outer, chemical resistant (optional); hard hat (optional); and face shield (optional).

d. Level D. Level D protective equipment consists of a NIOSH-certified or DA approved respirator or chemical agent protective mask slung or readily available; coveralls, field uniform, or equivalent Government-issued clothing (laboratories may use a lab coat); boots or shoes, chemical resistant, steel toe and shank (optional); boots, outer, chemical resistant (optional); safety glasses or chemical splash goggles (optional); gloves (optional); hard hat (optional); and face shield (optional).

4–4. Special requirements, North Atlantic Treaty Organization/military approved masks

a. For chemical agent environments in industrial operations and applications, the North Atlantic Treaty Organization (NATO)/military approved mask conforms to the Occupational Safety and Health Administration (OSHA) criteria for designating all full-face, air-purifying negative, pressure respirators with an APF of 50. Therefore, the NATO/military approved mask may be used for respiratory protection in chemical agent environments up to a maximum of 50 times the WPL for GB, GA, GD, GF, and VX. For H, HD, and HT, the NATO/military approved mask is authorized for use in either stable and characterized or monitored workplaces above the WPL per table 4–2. The decision to use the NATO/military approved mask in a

chemical agent (mustard) environment must be supported by a risk assessment that supports the respirator decision logic. When workers use the NATO/military approved mask in mustard environments, leaders must ensure that controls are in place to prevent worker exposure above limits established in table 4–2. Available NTA information will be listed on agent specific SDSs. Donning and doffing, use, maintenance, and inspection for the NATO/military approved masks can be found in TM 3–4240–346–10 and TM 3–4240–542–13&P.

b. The NATO/military approved mask provides employee respiratory protection for up to a maximum of 50 times the STEL concentration for periods not to exceed 15 minutes for escape purposes only.

c. Canisters for NATO/military approved masks will not be used for more than 6 continuous hours in a confirmed chemical agent environment (for example, at or above the STEL concentration). Canisters must be replaced no later than 6 hours after the initial agent exposure, with no reuse.

d. The NATO/military approved mask will not be used for respiratory protection in IDLH environments.

e. A facility will be established at each installation or garrison for the issue, testing, and organizational maintenance of serviceable respiratory protective equipment.

f. Canisters and filters will be replaced per the requirements of the latest TMs and SBs.

g. Military protective masks will be stored in the carriers provided and will be hung by the shoulder strap or D-ring on the carrier. NATO/military approved masks attached to butyl hoods may be stored outside of the carrier between shifts by hanging the mask or hood by the hood armpit strap. Protective masks in carriers may also be stored separately in bins in an upright position.

h. Personnel issued a mask are responsible for maintaining it, including monthly detailed visual inspection. Any defects found will be reported to the supervisor and/or mask issuing facility.

i. Quantitative fit testing will be conducted at least annually.

(1) For military applications, test procedures can be found in the latest revision of TM 3–4240–349–13&P (NSN 4240–01–365–8241) (Energy identification code 5MP) and TM 3–4240–350–13&P (NSN 4240–01–665–1803).

(2) For all other applications, fit testing will comply with OSHA requirements.

4–5. Taping of equipment pertaining to Army protective clothing ensembles

a. Chemical resistant tape, or a tape used with reusable suits, should be evaluated to make sure the adhesive does not degrade the suit performance.

b. Chemical resistant tape does not provide a barrier against chemical agent but rather joins or overlaps two barrier materials together.

4–6. Corrective glasses and goggles

a. Corrective glasses or goggles that interfere with the sealing edge of a respirator's facepiece are prohibited.

b. Optical inserts (including mounts) have been developed for use inside a respirator's facepiece and are required in accordance with the latest Office of the Surgeon General (OTSG) guidance. Visiting personnel whose stays are transient in nature (such as chemical agent inspectors, safety inspectors, treaty-verification team members, and environmental inspectors) do not require optical inserts if they can evacuate the area safely with assistance from other authorized personnel.

c. Spectacle kits must be the exact types approved by NIOSH for use with that particular manufacturer's facepiece. More than one set of optical inserts may be necessary if, such as optical inserts are returned with the mask for cleaning and sanitizing.

d. This pamphlet does not prohibit the use of contact lenses with respiratory protection. See the Army Public Health Center (APHC) Fact Sheet 63–006–0916 for information regarding the unique environment the respirator presents to the eye and the potential for irritation or injury.

4–7. Nonstandard gloves

Nonstandard gloves may be used in place of standard toxicological agent protective (TAP) gloves for chemical agent operations requiring special handling consideration. For example, laboratory operations where good hand dexterity is essential or glovebox operations subject to the following requirements:

a. The nonstandard glove selected is limited to use in operations where standard gloves cannot be used because of safety or operational considerations. An example is the use of lightweight, tight fitting, neoprene gloves in laboratory operations involving solvents incompatible with butyl rubber.

b. The nonstandard glove selected will have its agent penetration resistance ascertained by testing each purchased lot under an acceptable quality level (AQL) plan. The plan will, as a minimum, provide for testing in accordance with MIL–STD–282 for the time period exceeding intended use with sufficient sampling to statistically demonstrate 95 percent reliability (no detectable penetration) at a 95 percent confidence level. Sampling to a 4 percent AQL at general level inspection 2, in accordance with MIL–STD–1916 or the American National Standards Institute (ANSI)/American Society for Quality (ASQ) Z1.4, is acceptable.

c. Nonstandard gloves, which are approved for use as a result of AQL testing, will have their approved wear time clearly marked on each glove cuff or documented in locally approved procedures and will be decontaminated and disposed of once approved wear time has been reached or at the end of the operation.

d. Nonstandard gloves will be used only in a manner that prohibits intentional contact and has low potential for unintentional contact with liquid chemical agent. In the event of actual or potential liquid contamination, the gloves will be decontaminated and removed as soon as feasible. They will be disposed of in accordance with chapter 5.

4–8. Personal protective equipment precautions

a. Personal protective equipment. PPE can accumulate static electricity. When dealing with chemical munitions involving explosives, propellants, or other energetic compounds, consideration will be given to static electricity discharge in accordance with DA Pam 385–64.

Table 4–1
Respirator selection decision logic

Step	Criterion	Respirators
1	Is the respirator to be used only for emergency escape purposes?	
	If no, then proceed to step 2.	If yes, then select: Respirator for the atmosphere in which it will be used.
2	Is any of the following true? • The atmosphere is relatively unknown or poorly known. • There is reasonable potential for oxygen content less than 19.5 percent (by volume). • There is reasonable potential to be exposed above the IDLH level. • There is reasonable potential to be exposed above 1,000 to 10,000 times the WPL and/or STEL.	
	If no, then proceed to step 3.	If yes, then select: Tight-fitting full-facepiece SCBA operated in pressure-demand mode with a minimum service life of 30 minutes.
3	Is there reasonable potential to be exposed above 1,000 times (but not above 10,000 times) the WPL and/or STEL?	
	If no, then proceed to step 4.	If yes, then select one of the below: -Tight-fitting full-facepiece SCBA operated in pressure-demand or other positive-pressure mode. -Helmet or hood SCBA operated in pressure-demand or other positive-pressure mode.
4	Is there reasonable potential to be exposed above 50 times (but not above 1,000 times) the WPL and/or STEL?	
	If no, then proceed to step 5.	If yes, then select one of the below: -Tight-fitting full-facepiece SAR or airline respirator operated in pressure-demand or other positive-pressure mode. -Tight-fitting full-facepiece SAR or airline respirator operated in continuous-flow mode. -Tight-fitting full-facepiece powered air-purifying respirator (PAPR). -Any respirator listed in step 2 or 3.
5	Is there reasonable potential to be exposed above 25 times (but not above 50 times) the WPL and/or STEL?	

Table 4–1
Respirator selection decision logic—Continued

	If no, then proceed to step 6.	If yes, then select one of the below: -Tight-fitting full-facepiece SCBA, SAR, or airline respirator operated in demand mode. -Helmet or hood SCBA operated in demand mode. -Tight-fitting full-facepiece APR. -Any respirator listed in steps 2 through 4.
6	Is there reasonable potential to be exposed above (but not above 25 times) the WPL and/or STEL?	
	If no, then proceed to step 7.	If yes, then select one of the below: -Loose-fitting full-facepiece SAR, or airline respirator operated in continuous-flow mode. -Helmet or hood SAR, or airline respirator operated in continuous flow mode. -Loose-fitting full-facepiece PAPR. -Helmet or hood PAPR. -Any respirator listed in steps 2 through 5.
7	There is no reasonable potential to be exposed above the WPL and/or STEL.	
		None required.

Notes:

[1] The IDLH, WPL, and STEL are concentration-time values, not concentration-only values. The exposure potential depends on the specific use scenario, including both the airborne concentration and the task duration.

[2] Any respirator selected must comply with paragraph 4–1.

[3] References: 71 FR 50122 (codified in 29 CFR 1910.134 as of 1 July 2007).

Table 4–2
Daily maximum use limits for approved mask in mustard, distilled mustard, and mustard/T environments above the worker population limit—Continued

Concentration[1] mg/m^3	Duration per workday (hours)
0.006	2
0.003	4
0.0015	8
0.001	12

Note:

[1] Concentration expressed as a TWA.

b. Butyl rubber flammability. Butyl rubber burns and does not possess self-extinguishing properties. Butyl rubber protective clothing must not contact an open flame or any object that would ignite the clothing. Smoking is prohibited in the vicinity of or while wearing butyl rubber protective clothing items.

4–9. Handling of personal protective equipment for laundering

a. Each installation, garrison, or activity will establish a separate area where PPE will be laundered, inspected, tested, and issued.

b. Clean PPE that has been used, but that neither contacted liquid nor was not exposed aerosol chemical agent liquid do not have to be monitored but will be labeled and marked cleared for laundry.

c. PPE that has contacted liquid or been exposed to aerosol chemical agent will not be reused and will be disposed of in accordance with existing laws and regulations. Be cognizant of using the flowchart in chapter 5 when managing disposal of PPE.

d. PPE that has been exposed above the STEL concentration will be decontaminated and/or monitored and marked cleared for laundry. The following two options are permissible for use for exposed PPE that will be sent to a laundry:

(1) If decontaminating and monitoring to the STEL concentration is used for clearing PPE for the laundry, then the laundry work area must be continuously air-monitored real-time or NRT for STEL and periodic monitoring for WPL in accordance with WPL Monitoring Section for the Laundry; or

(2) If decontaminating and monitoring to the WPL concentration is used for clearing PPE for the laundry, then real-time, NRT, or WPL monitoring is not required for the laundry work area.

e. Reusable commercial protective clothing will be laundered and tested in accordance with the manufacturer recommendations.

f. The laundry facility will thoroughly clean, inspect, and repair (if required) PPE in accordance with applicable TMs and/or manufacturer's instructions.

g. Laundry facilities will treat TAP clothing and equipment per TM 10–8415–210–13&P and this paragraph. Impermeable protective clothing (excluding masks) that has been worn in a contaminated environment will be soaked in hot soapy water with an alkalinity of pH 8 to pH 9 at a temperature of 175 degrees to 185 degrees Fahrenheit (F) (79 degrees to 85 degrees Celsius (C)) for at least 1 hour without agitation. The clothing will then be rinsed with fresh water, air dried, and hung in a ventilated area (for aeration) for a 24-hour period. Liquid detergents can be used for laundering if they contain water-soluble, water-based materials.

4–10. Monitoring of decontaminated clothing

Monitoring of decontaminated clothing will be performed as follows:

a. The clothing will be placed in a container or room and held for at least 4 hours at a minimum temperature of 70 degrees F (21 degrees C).

b. The atmosphere inside the container or room will be monitored for contamination, with a low-level detector, to verify that chemical agent concentrations are below the appropriate AELs, before the clothing may be sent to the laundry facility.

c. If chemical agent concentrations are detected above the appropriate AELs, the clothing will be further decontaminated and re-monitored using steps in paragraphs 4–10*a* and 4–10*b*.

d. If, after the number of decontamination attempts determined by local SOPs and proper risk management procedures to bring the clothing below the appropriate AELs the chemical agent concentrations are not brought below the appropriate AEL, the clothing will be bagged and disposed of as contaminated waste using procedures in chapter 5 for disposal of contaminated items.

4–11. Inspection

a. Each user must visually inspect PPE for serviceability before use. Unserviceable PPE must be clearly marked, segregated from serviceable PPE, and properly dispositioned.

(1) Serviceable PPE is not to be worn as a general utility item.

(2) Unserviceable PPE may be used for training provided it is clearly marked "For training use only" and segregated from serviceable PPE.

b. PPE that is not ready-for-issue (for example, inspected and tested but not issued) must be inspected and tested by trained and/or certified personnel prior to issue to the user.

c. Used Army type-classified PPE must be laundered, inspected, and tested quarterly. If issued or ready-for-issue PPE has not been used within the initial 3-month period, a certified PPE inspector may provide it a one-time extension of 3 months.

d. Commercial PPE will be inspected and tested per its manufacturer instructions before it is issued to the user.

e. Used commercial PPE must be laundered (if authorized by the manufacturer) in accordance with the manufacturer's instructions before it is issued to the end user.

4–12. Personal protective equipment marking

a. Masks, coveralls, hoods, aprons, and so forth will be marked by affixing flexible plastic tags or similar devices (such as bar code labels) to the item.

b. The marking should both identify the item and provide means to track the recertification test date, in accordance with the applicable TM.

c. The marking method must be able to withstand decontamination and sanitizing procedures and must not damage the clothing.

4–13. Approved personal protective equipment

The following PPE is approved for Army servicemembers, civilian employees, and contractors for use in Army nonbattlefield chemical agent operations within the limits established elsewhere in this pamphlet. The use of PPE certified to meet NFPA, European Standards (EN), or NIOSH chemical, biological, radiological, and nuclear (CBRN) standards is outlined below. (Note: some PPE may meet multiple standards. When PPE meets multiple standards, the standard with the highest level of protection is authorized. For

example, if an ensemble is certified to the NFPA 1994 standard (which the Army authorizes for Level B protection) and is also certified to DIN EN 943–1 as a Type 1a (which the Army authorizes for Level A protection), then the ensemble is authorized for Level A protection (the higher level of protection authorized)).

a. Limitations. Organizations that use PPE approved under these standards must understand and abide by the limitations of the standard. For example, the NIOSH CBRN standard for APRs mandates a 40mm NATO thread to connect the respirator cartridge to the facepiece. This allows interoperability between one manufacturer's respirator cartridges and another manufacturer's facepiece under emergency conditions. However, this interoperability is intended only for emergency conditions. Under other conditions, such as training or normal operations, interchanging one manufacturer's cartridge with another manufacturers facepiece voids the NIOSH certification and is not authorized.

b. Level A personal protective equipment. PPE Subject to the limitations in Appendix C section I, the following chemical PPE is approved for use in chemical agent operations requiring Level A protection or less:

(1) NIOSH CBRN-approved open-circuit SCBA. See paragraph C–1 for details.

(2) U.S. Army Demilitarization Protective Ensemble (DPE); see paragraph C–2 for details.

(3) Chemical protective ensembles certified to NFPA 1991; see paragraph C–3 for details.

(4) Chemical protective ensembles certified as Class 1 in accordance with NFPA 1994; see paragraph C–4 for details.

(5) Chemical protective ensembles certified as Type 1a in accordance with DIN EN 943–1. See paragraph C–5 for details.

(6) Chemical protective ensembles (only if the facemask is permanently joined to the suit) certified as Type 1b, in accordance with DIN EN 943–1. See paragraph C–5 for details.

(7) Chemical protective ensembles (except if the air inside the suit is used as the breathing air) certified as Type 1c, in accordance with DIN EN 943–1. See paragraph C–5 for details.

(8) Chemical protective ensembles certified as Type 1a-ET in accordance with DIN EN 943–2. See paragraph C–5 for details.

(9) Chemical protective ensembles (only if the facemask is permanently joined to the suit) certified as Type 1b-ET in accordance with DIN EN 943–2. See paragraph C–5 for details.

c. Level B personal protective equipment. Subject to the limitations in appendix C section II, the following chemical protective clothing and equipment is approved for use in chemical agent operations requiring Level B protection or less:

(1) NIOSH CBRN-approved open-circuit SCBA. See paragraph C–6 for details.

(2) U.S. Army butyl rubber TAP Ensemble (with coverall and hood) and commercial alternatives manufactured and tested to TAP specifications.

(3) Chemical protective ensembles certified as Class 2 and Class 2R in accordance with NFPA 1994. See paragraph C–7 for details.

(4) Chemical protective ensembles (with the facemask not permanently joined to the suit) certified as Type 1b in accordance with DIN EN 943–1. See paragraph C–8 for details.

(5) Chemical protective ensembles (with the facemask not permanently joined to the suit) certified as Type 1b-ET in accordance with DIN EN 943–2. See paragraph C–8 for details.

(6) Chemical protective ensembles certified as Type 3, in accordance with DIN EN 14605. See paragraph C–8 for details.

d. Limits for level C. Subject to the limitations in appendix C section III, the following chemical protective clothing and equipment is approved for use in chemical agent operations requiring Level C protection or less:

(1) U.S. Army M40 (NSN 4240–01–370–3821 (small), 4240–01–370–3822 (medium), 4240–01–370–3823 (large)) Field Protective Gas Mask;

(2) DoD M50 (NSN 4240–01–512–4431 (small), 4240–01–512–4434 (medium), 4240–01–512–4437 (large)) Joint Services General Purpose Mask;

(3) U.S. Army TAP Ensemble with apron, hood, boot, and gloves and commercial alternatives manufactured and tested to TAP specifications.

(4) NIOSH CBRN-approved APRs. See paragraph C–9 for details.

(5) NIOSH CBRN-approved PAPR. See paragraph C–9 for details.

(6) Chemical protective ensembles certified as Class 3, in accordance with NFPA 1994. See paragraph C–9 for details.

(7) Chemical protective ensembles certified as Type 4, in accordance with DIN EN 14605. See paragraph C–10 for details.

e. Emergency escape approvals. Subject to the limitations in paragraph C–11, the following chemical protective clothing and equipment is approved for use in chemical agent operations for emergency escape purposes only:

(1) NIOSH CBRN-approved APR; and

(2) NIOSH CBRN-approved self-contained escape respirators.

(3) NIOSH CBRN-approved emergency escape devices (EEDs).

f. Safety analysis required. Prior to using NIOSH CBRN-approved respirators, NFPA-certified chemical protective ensembles, or EN-certified chemical protective ensembles, users must know and understand the limitations of the PPE. The using organization must prepare a safety analysis that documents their PPE selection logic.

g. Model-specific approvals. An organization may elect to use PPE that is not covered in paragraph 4–13*a* through 4–13*f*. However, prior to use, the command must request ODASAF's approval through command channels. For example, if an organization wants to use a closed-circuit SCBA, SAR with auxiliary self-contained air supply, Type 2 chemical protective ensemble, partial body (PB) Type PB[3] clothing, or Type PB[4] clothing, it must submit its request through command channels to ODASAF for approval. See appendix C section V for the process and required documentation.

4–14. Heat-stress prevention plan

Each installation, garrison, or activity that has a mission that requires direct handling of chemical agent is required to develop a heat-stress prevention plan for chemical PPE. The American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Values (TLVs) and Biological Exposure Indices (BEIs) annual guideline handbook, and NIOSH criteria for Occupational Exposure to Hot Environments, will be used as guidance to develop the heat stress plan.

a. The heat-stress prevention plan must be reviewed annually. Heat-stress prevention plans will be:

(1) In writing.

(2) Based on good IH and medical principles.

(3) Coordinated effort involving, at a minimum, representatives from the safety office, IH office, local medical authority, applicable employees, and their supervisors.

b. The heat-stress prevention plan should contain the following elements:

(1) Training requirements, which should include:

(a) Heat-stress hazards (such as passed out from heat (syncope), heat exhaustion, heat stroke).

(b) Proper usages of chemical PPE (such as maximum stay times, and so forth).

(c) Signs and symptoms of heat stress.

(d) Importance of hydration.

(e) First-aid procedures.

(f) Effects of medications and drugs, to include over-the-counter items.

(2) Precautions and/or preventive measures, such as:

(a) Medical clearances.

(b) Personnel monitoring results (such as worker temperature, maximum heart rates and continuous work times, rehydration rates, and duration of cooling periods).

(c) Determination of stay times.

(3) Responsibilities and monitoring logs. The log should contain:

(a) Level of protective clothing.

(b) Personnel monitoring results (such as employee pulse rate and body core temperature, or equivalent, before and after work in a heat-stress environment). Personnel should be monitored periodically during operations, as stated in the hazard analysis.

(c) Activity level (light, moderate, or heavy) and activity duration.

(d) Observed heat-stress symptoms.

(4) Heat-stress symptom relief measures.

(5) Emergency procedures.

c. The following documents provide information for developing a heat stress plan:

(1) ACGIH Heat Stress and Strain Documentation.

(2) NIOSH Publication 86–113.

(3) OSHA Technical Manual #TED–01–00–015.

(4) TB MED 507.

Chapter 5
Decontamination and Disposal

5–1. General

a. Procedures are required to protect personnel from chemical agent contamination and to ensure only trained personnel decontaminate chemical agent-contaminated materials and facilities.

b. Materials and facilities that have come into contact with chemical agent liquid or aerosol must be marked, tagged, or segregated to indicate contamination.

c. The exposure of material or a facility to chemical agent vapors does not, in and of itself, mean it has become contaminated with chemical agent.

d. Material and facilities previously characterized as:

(1) X or "contaminated" must be managed and controlled as material potentially presenting a chemical agent hazard (MPPCAH) or material documented as to its chemical agent hazard (MDCAH), depending on the information available;

(2) 3X, 4X, "clean (restricted)," and "conditionally clean" must be managed and controlled as MDCAH;

(3) 0 (never contaminated), 5X, or "clean (unrestricted)" must be managed and controlled as material documented as safe (MDAS).

e. To allow an orderly transition to the new terminology that is parallel to DoDI 4140.62, currently familiar terms may continue to be used through 31 December 2022 as follows:

(1) MPPCAH may be designated as "potentially contaminated."

(2) MDCAH may be designated as "contaminated," "clean (restricted)," or "conditionally clean" as appropriate, based on information available; and

(3) MDAS may be designated as "clean (unrestricted)" or "never contaminated," as appropriate, based on information available.

f. Materials or facilities used for operations and activities that involve chemical agent should not automatically be considered MDCAH. These materials will be managed and controlled as either MPPCAH, MDCAH, or MDAS based on an assessment of the material. Due to their intrinsic value, every effort will be made to reuse property by limiting chemical agent exposure or decontaminating such through the implementation of accepted IH practices. The materials and facilities must be decontaminated (cleaned) such that their end state is compatible with their intended use.

g. Materials and facilities that were converted to nonchemical agent use and transferred outside of government control and ownership prior to implementation of this guidance are not subject to these requirements.

h. Decontamination and disposal requirements for tools, supplies, equipment, and facilities are presented in flow chart format in figures 5–1 and 5–2.

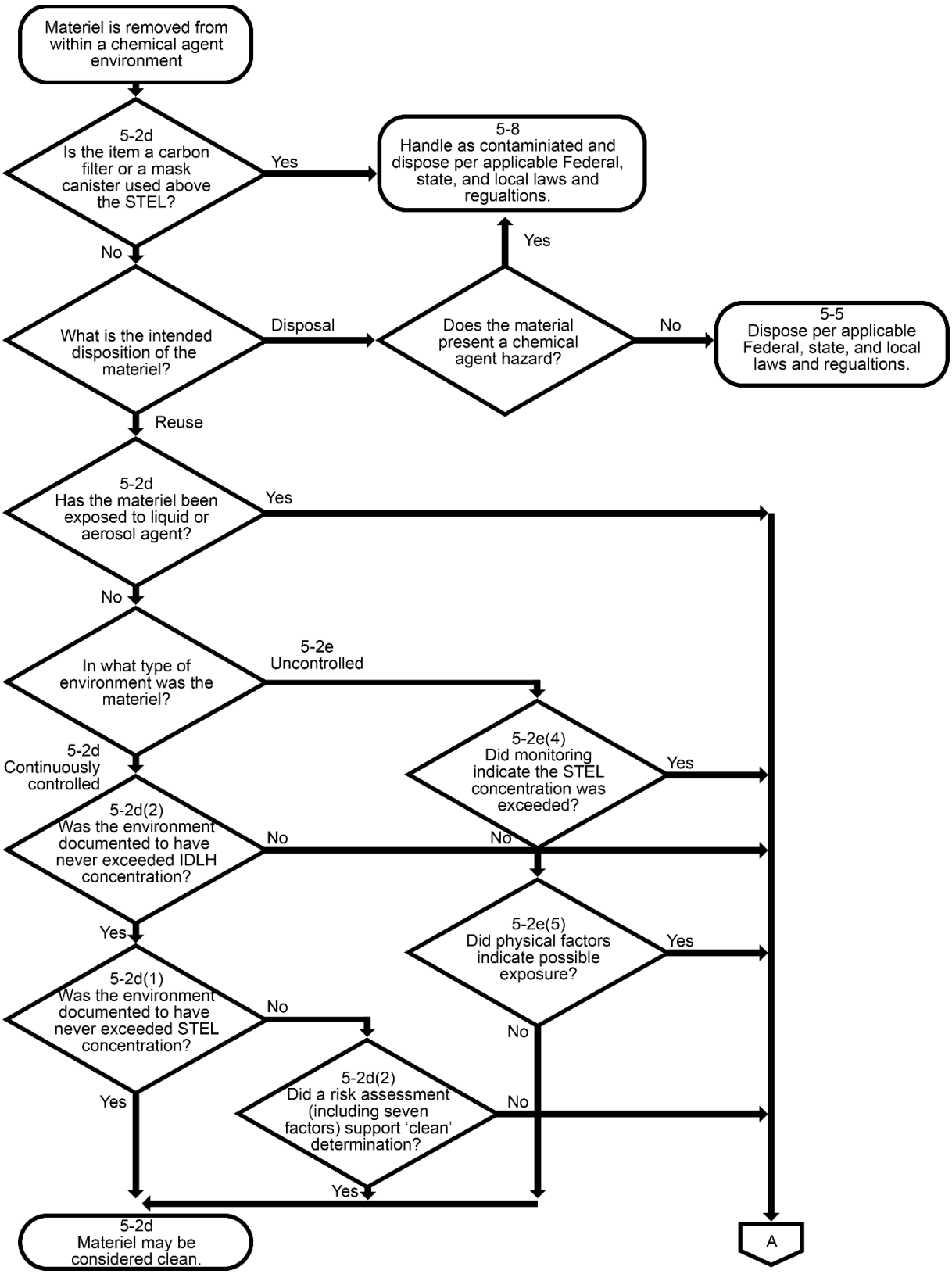

Figure 5–1. Decontamination and disposal of materials

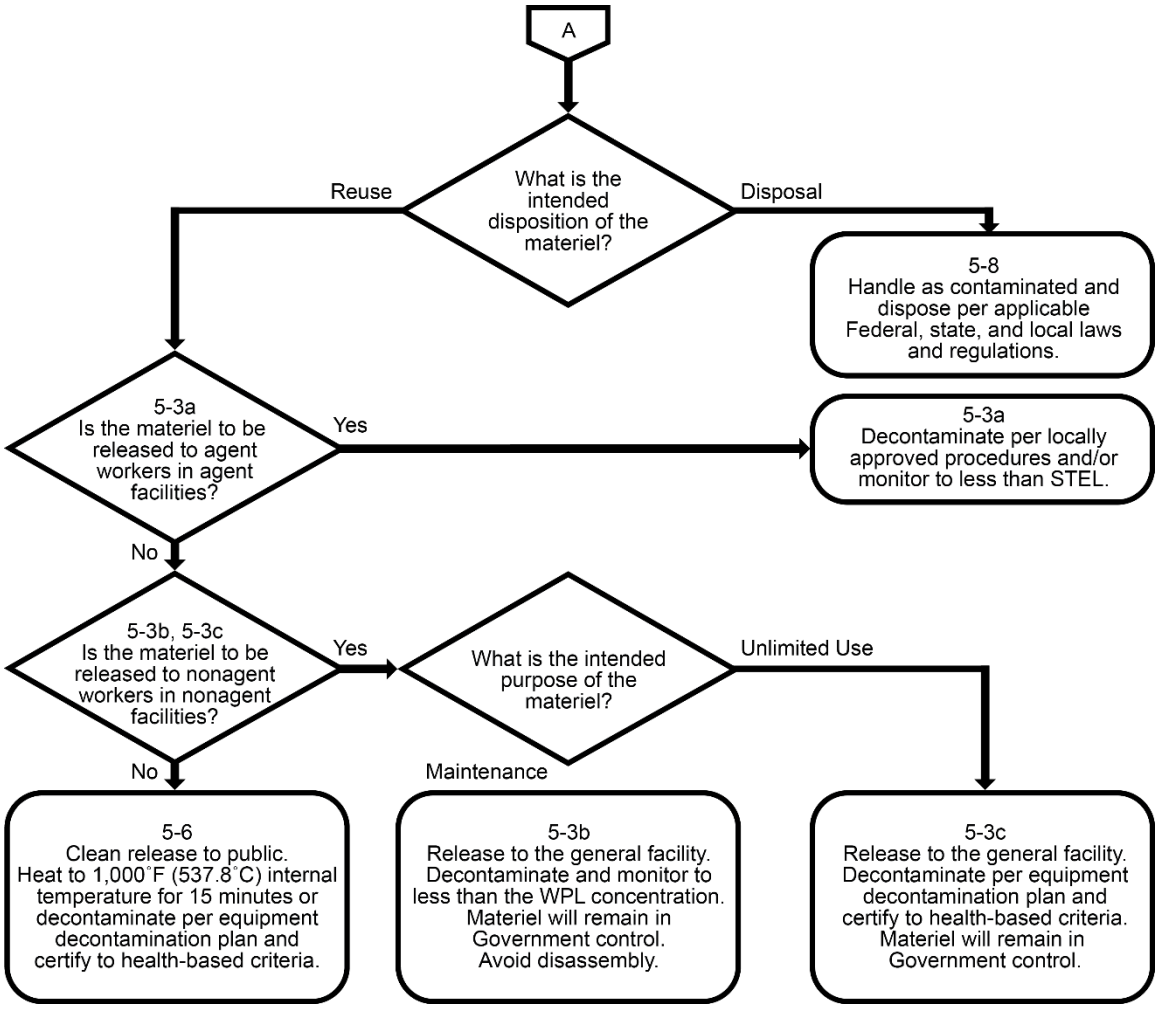

Figure 5–2. Decontamination and disposal of facilities

5–2. Material potentially presenting a chemical agent hazard

a. Materials and facilities that may have become contaminated during operations and activities that involve chemical agent will be managed and controlled as MPPCAH. Such material (such as tools and equipment) and facilities must be handled and controlled as MPPCAH until evaluated by qualified personnel and documented as either MDCAH or MDAS. MPPCAH will be retained in-place, under approved controls that restrict access only to authorized, qualified personnel in the PPE required.

b. MPPCAH may be managed and processed only by those personnel who have the knowledge and skills and, if required, the permits, licenses, and certificates required to manage, process, and evaluate it to determine its chemical safety status.

c. MPPCAH may be documented as MDAS after completing one of the following:

(1) Heating to an internal temperature of 538 degrees C (1000 degrees F) for at least 15 minutes.

(2) Decontamination in accordance with a Material Decontamination Plan (para 5–6) to meet health-based criteria appropriate for public (unrestricted) release (such as GPL) (see app D).

(3) Evaluation through a Chemical Contamination Risk Assessment (para 5–5) to meet health-based criteria appropriate for public (unrestricted) release (such as GPL) (see app D).

(4) MPPCAH may also be documented as MDAS if after inspection per approved procedures qualified personnel determine that all of the following are true:

(a) There is no evidence or reasonable suspicion that it contacted liquid chemical agent.

(b) There is no evidence or reasonable suspicion that it experienced a chemical agent aerosol environment.

(c) There are no physical factors (such as discoloration or stains) indicating chemical agent contamination or decontamination.

(d) It was in an environment subject to routine monitoring and monitoring results have never been greater than the STEL concentration.

d. MPPCAH that qualified personnel have inspected and determined poses a chemical agent hazard may only be retained for use within the using activity by qualified personnel wearing the appropriate PPE; or, if transferred within the organization or release from DoD- or DoD-contractor control may only be transferred to qualified receivers.

5–3. Material documented as to its chemical agent hazard

a. MDCAH may be transferred or released only to qualified receivers. A qualified receiver must—

(1) Have the permits, licenses, and certificates required to receive, manage, and process chemical agent contaminated material.

(2) Have the knowledge and skill necessary to receive, manage, and process the type of material to be processed, and for the type and degree of chemical agent involved.

b. MDCAH may be transferred within DoD control (such as on property book or under contract or bailment agreement) to chemical agent workers for reuse or maintenance if each of the following apply:

(1) The material has been decontaminated (if necessary) and monitored to a vapor screening level (VSL) equivalent to less than the STEL concentration.

(2) Appropriate hazard controls will be used if the material is disassembled or heated.

(3) The workers are informed of the type and level of potential chemical agent contamination.

(4) The workers have the knowledge, experience, skills, and PPE necessary to receive, manage, and process such material.

c. MDCAH may be transferred within DoD control (such as on property book or under contract or bailment agreement) to workers who are familiar with or support chemical agent operations for reuse or maintenance, if each of the following apply:

(1) The material has been decontaminated, if necessary, and headspace screened to less than the WPL concentration.

(2) The material will not be disassembled such that closed spaces are opened or hidden surfaces are uncovered (thus potentially exposing chemical agent contamination).

(3) The material will not be heated with thermal heat or frictional heat (such that there is a potential for increasing chemical agent vapor).

(4) The workers are informed of the type and level of potential chemical agent contamination present.

(5) The workers have the knowledge and skill necessary to safely receive, manage, and process such material safely.

d. MDCAH may be documented as MDAS after—

(1) Heating to an internal temperature of 538 degrees C (1000 degrees F) for at least 15 minutes.

(2) Decontamination in accordance with a Material Decontamination Plan (para 5–6) to meet health-based criteria appropriate for public (unrestricted) release, such as GPL (see app D).

e. MPPCAH and MDCAH (for example, materials and facilities) that are no longer required and cannot be decontaminated and documented as MDAS must be disposed in compliance with applicable environmental laws and regulations as hazardous waste.

5–4. Material documented as safe

a. MDAS does not require special management controls or restrictions as relates to chemical agent or its use.

b. MDAS must be documented on the transfer record as to the fact that it does not pose a chemical agent hazard.

5–5. Chemical contamination risk assessment

a. Chemical contamination risk assessment provides the technical basis for documenting MPPCAH or MDCAH as MDAS. At a minimum, the chemical contamination risk assessment must address the following factors:

(1) Temperature of environment (such as condensation of vapors).

(2) Type of process, operation, or task.
(3) Concentration of chemical agent and duration of exposure.
(4) Material composition (such as porosity, density, organic, inorganic, metallic, crystalline).
(5) Historical documentation for similar operations and items.
(6) Type of equipment (such as wrench, rubber mat, process equipment, auxiliary equipment).
(7) Location of object considering the source of chemical agent vapor and airflow direction.

b. Chemical contamination risk assessments require concurrence of the safety office or other independent reviewer and approval as a risk decision at the level of authority prescribed in DA Pam 385–10 and DA Pam 385–64 (or AR 70–1 for acquisition programs with an established system safety program).

5–6. Material decontamination plan

a. A material decontamination plan describes how MPPCAH or MDCAH will be decontaminated to MDAS. At a minimum, the Material Decontamination Plan must address each of the following factors:
(1) Description of the material to be released.
(2) The decontaminating process to be used, to include—
(a) Decontaminating materials.
(b) Duration of the decontaminating process.
(c) Decontaminating environment.
(3) Rationale for selecting the health-based criteria being used.
(4) The analytical methods to be used to determine the material has been decontaminated to below the selected health-based criteria.
(5) The quality control process, used in conjunction with the analytical method to ensure decontamination, to include either of the following:
(a) Use of two inspections or analyses that are as independent as practical (such as two MINICAMS® operated by the same technician or two DAAMS tubes run on the same gas chromatograph).
(b) Decontamination using DoD Explosives Safety Board (DDESB) approved procedures.
(6) A statement of the reasonably anticipated environment in which the public could be expected to use the material. This statement should consider temperature, modifications, and so forth, and how the selected decontamination process and monitoring meets the conditions considered.

b. The Material Decontamination Plan must be approved by the activity commander or director.

5–7. Facilities

a. Facilities (such as storage magazines) used for operations and activities (such as demilitarization of chemical munitions) in which chemical agent may be released (such as leak or vent) will be managed and controlled as MPPCAH or, after determination of the chemical hazard posed as MDCAH, until processed and documented as MDAS.

b. Facilities (such as rooms, floors, walls) that have come into contact with liquid chemical agent will be marked to indicate contamination. Signage will be posted to contaminated facilities to indicate all of the following:
(1) The facility or areas (such as specific rooms, bays) contaminated with chemical agent.
(2) The type of chemical agent contamination, if known.
(3) A point of contact to obtain authorized entry.
(4) The PPE required for entry.

c. Prior to being put to a use for nonchemical agent purposes (such as an administrative office, storage of material) that are incompatible with the known or suspected presence of chemical agent contamination, the facility:
(1) Will be decontaminated per DDESB approved procedures (such as thermal treatment), or locally-developed or accepted practices that have been reviewed and approved by the DDESB.
(2) And must meet the conditions below or otherwise be restricted to similar chemical agent operations, activities, and tasks. (Note: Chemical agent facilities and real property that were converted to nonchemical agent use prior to implementation of this guidance are not subject to these requirements.)
(a) The facility will be decontaminated and monitored – unventilated – to a vapor screening procedure equivalent to less than the appropriate health-based criteria required for the facility's designated or reasonably anticipated end use.
(b) The activity will develop and implement a monitoring plan for the facility's future use. The monitoring plan will describe how the facility will be monitored prior to its release for use and describe both the

intended use and the monitoring strategy for the facility's release including criteria for cessation of monitoring. If the facility is being exchanged between different organizations, the facility's monitoring plan will be approved by the senior ACOM or DRU commander, or director directing the facility's transfer, and by the ACOM or DRU commander, or director receiving the facility.

(3) Records of the facility's historical use, chemical agent contamination, and decontamination will be maintained with Installation Master Planning for permanent facility recordkeeping.

d. The U.S. Army Technical Center for Explosives Safety (USATCES) and DDESB must approve the decontamination plan prior to decontamination of the facility for nonchemical agent use. The decontamination plan will consist of similar information as that provided in a chemical agent site plan (CSP). However, the decontamination plan will detail how the facility or storage location will be decontaminated to ensure it does not present a chemical hazard and is below the appropriate monitoring level for the determined or reasonably anticipate end use. Contents of the decontamination plan are addressed in paragraph 5–6.

e. Former chemical agent facilities (such as storage magazines and industrial buildings) that nongovernment organizations will use must be decontaminated per the procedures listed and monitored against the GPL and ownership must remain with the government unless released from Government control and ownership in accordance with paragraph 5–7*f* and paragraph 5–7*g*. Risk of chemical agent contamination must be documented and accepted by the nongovernment organization, signed by the senior ACOM or DRU commander—or the commander's delegate—and approved by the DASA (ESOH). A copy of the approval must be furnished to the USATCES to become part of the Army installation site plan records.

f. Release from government control of former chemical agent facilities must have a decommissioning and decontamination plan approved by USATCES, in coordination with ODASAF, DASA (ESOH), as necessary, the DDESB. The decontamination plan must address how the facility will be inspected (for example, a closure inspection) to verify the facility's decontamination and safety for use.

g. If released from Government ownership or control, the new owner must be provided a statement that the facility was used for chemical agent operations and may have residual risk associated with acceptance of the facility.

5–8. Patient decontamination and quadrant monitoring

a. Per established policy in the Interim Guidance on Occupational Health Practices for the Evaluation and Control of Occupational Exposures to Nerve Agents GA, GB, GD, GF, and VX and Mustard Agents H, HD, and HT, dated 23 January 2013, following skin decontamination the CMA is required to monitor the casualty to verify adequate decontamination (for example, less than or equal to the VSL, which is the numeric value of the STEL), before allowing the patient entry into the treatment area inside a military or contractor-operated medical treatment facility. This monitoring is also required before transporting the patient by ambulance to an off-post definitive care facility.

b. The primary type of monitoring equipment that is used to determine if a worker is potentially exposed to chemical warfare agent is a NRT monitor, capable of detecting agent concentrations at the level of the VSL, and providing a digital read out to the operator. The MINICAMS®, or other low-level NRT monitoring systems (such as the RTAP) are acceptable for this purpose. Regardless of the type of instrument the CMA relies on, trained personnel must properly maintain, calibrate, and operate the low-level NRT monitor. Laboratory personnel must regularly train the workforce on the proper utilization of the existing low-level NRT monitor hand-held probe, and the communications required between those performing the monitoring of the patient, and those who operate the NRT monitor.

c. To be effective, those conducting the monitoring must pass the low level NRT monitor probe slowly and deliberately over the surface of the decontaminated skin for one full low level monitoring sampling cycle. The probe must remain within one to two inches from the surface of the skin. Trained personnel will monitor each potentially exposed worker's body by quadrants, starting at the head and moving downwards.

(1) To achieve a slow and deliberate screening of the worker, the NRT low level monitoring operator will provide continuous direction on time intervals (for example, when to begin monitoring, when to move to the next quadrant, and when to cease monitoring).

(2) Ideally, 25 percent of the total NRT monitoring sample cycle will be spent on each quadrant of the potentially exposed worker's body, giving special attention to those areas of the body which may have come into direct contact with chemical agent (if known). For example, if the sampling portion of the MINICAMS® cycle is 6 minutes, then this time would be spent monitoring the four quadrants of the body

sequentially. The first 90 seconds would be spent sampling the top of the head, face, and neck, arms, hands, chest, and abdomen; then 90 seconds sampling the front and sides of the pelvic region, legs, and feet paying special attention to the inside of the legs and groin; then 90 seconds sampling the back of the head and neck, and the back; and finally, 90 seconds sampling the buttocks and back of the legs, for a total of 6 minutes.

(3) The low-level NRT monitor operator will provide constant verbal direction to those sweeping the probe as to how far along they have progressed in each quadrant, and when to advance to the next quadrant. It is crucial for low-level NRT monitor operators and probe operators to practice this screening procedure on a regular basis.

(4) The goal of this process is to be able to verify the patient as free from any residual chemical agent contamination that is sufficient to produce vapor off-gassing greater than the VSL—the numeric value of the STEL, during one cycle of the NRT low level monitor. Special attention should be given to the hair, open wounds, foreign bodies and intertriginous areas of the skin, such as the armpits, behind the knees, and in the skin folds of the neck, buttocks, groin, and elbows. If concentrations of chemical agent are detected that are greater than the VSL, the patient should be re-decontaminated. Following this re-decontamination, the patient should be re-monitored and verified as clean, before transport to an off-post definitive care facility, or admission to the treatment area of an on-post medical treatment facility. Patients should be prominently tagged as decontaminated before being transported to off-post definitive care facilities, as specified in local procedures or memoranda of agreement.

d. In cases where immediate, life-saving care is required, and delays in obtaining NRT monitoring would compromise patient survival, the Medical Response Team Leader may deem the patient to be free from chemical agent contamination, based upon the verified observation of patient decontamination procedures, without quadrant monitoring results. In such cases, the ambulance run sheet or report to the receiving hospital should reflect the monitoring status of the patient, and the basis used for verifying that the patient is free of chemical agent contamination.

e. For chemical sites and operations that do not have low-level NRT monitors, the site safety plan must address the patient decontamination process, the screening of potentially exposed workers, and release criteria for decontaminated workers to medical control for the purposes of treatment and transport. Provisions should be made for direct observation of the decontamination process to ensure workers are adequately decontaminated and protected. The site will base the level of decontamination on the extent of the worker's injuries and degree of exposure. The decontamination procedures within the site safety plan should be practiced on a regular basis.

5–9. Chemical contaminated waste material

When chemical agent contaminated material (such as carbon and respirator filters, canisters exposed above the STEL concentration) is determined to be waste (solid, hazardous), it must be managed, stored, shipped, and disposed of per applicable DoD and Army policies, and Federal, State, and/or environmental laws and regulations.

5–10. Decontaminants

a. Chlorine-based decontaminants must be checked at least annually, in a manner consistent with quality assurance procedures, to ensure deterioration has not occurred. The minimum acceptable chlorine content for super tropical bleach (STB) is 10 percent, 30 percent for high-test hypochlorite (HTH), and 3 percent for sodium hypochlorite solution. Analysis should follow procedures referenced in specifications for the decontaminant involved. These testing requirements apply to decontaminants stored in original, closed containers. If decontaminants are kept in open containers or receptacles, they need to be checked or rotated at least once a month.

b. Other decontaminants may be used when approved in accordance with approved decontamination plans. Prior to initial use at a site, such decontaminants must be evaluated. At a minimum, the evaluation must address the following factors:

(1) Effectiveness in reducing the chemical agent hazard (either by destruction or by removal).

(2) Potential to do any of the following:

(a) Introduce new hazards (such as rapid release of large amounts of gas in a tank, piping, or other confined volume).

(b) Interfere with chemical agent monitoring or analytical methods used to verify decontamination or to select PPE (such as decontaminant vapor destroys chemical agent that has been collected on a sorbent tube).

(3) Limits on use and storage (such as minimum contact time and maximum shelf life).

5–11. Resource Conservation and Recovery Act hazardous waste permitting

Waste managed and facility closure conducted under a Resource Conservation and Recovery Act (RCRA) permit (Federal or state) are subject to this chapter's and the RCRA permit's requirements. In cases where these requirements may differ, compliance with the most stringent requirements is appropriate. However, the permittee must ensure coordination with the RCRA permit's issuing authority.

Chapter 6
Chemical Agent Operations

6–1. Guidance

a. Activities that involve the handling (such as storage, transport, demilitarization) of chemical agent (such as samples, bulk) will be executed in a safe and efficient manner that is protective of human health and the environment and complies with applicable laws and regulations.

b. Explosively configured chemical munitions may present additional explosives hazards (such as blast, fragments, and thermal). Standards relating to these explosives hazards are addressed in DA Pam 385–64.

c. Installations and activities conducting chemical agent operations will apply the cardinal rule of explosives and chemical agent safety to every operation that involves chemical agents or chemical munitions. As such, installations and commands will limit the potential exposure to a minimum number of personnel, for a minimum period of time, to a minimum amount of the chemical agent consistent with safe and efficient operations. This includes prohibiting concurrent, unrelated work within the same work area.

d. Guidance for operations will emphasize, as a minimum, the proper use, maintenance, care, decontamination, testing, and disposition of PPE.

6–2. Risk management

a. The goal of risk management is to enhance operational effectiveness by conserving the Army's combat resources without degrading the Army's performance. The risk management process contributes to a high level of operational readiness and increased combat effectiveness by eliminating unnecessary hazards or mitigating the effects of such. Identifying and eliminating or mitigating the hazards associated with chemical agent operations greatly contribute to force protection and the Army's combat readiness and effectiveness.

b. Risk management for the chemical agent safety program will be executed in accordance with DA Pam 385–10 and DA Pam 385–64.

6–3. Standing operating procedures

a. An SOP is required for every chemical agent operation. SOPs will be prepared in accordance with requirements of DA Pam 385–10. At a minimum, SOPs for chemical agent operations will describe the:

(1) Personnel (such as workers, supervisors) required for the safe conduct of the activity, including personnel limits for each phase of operations.

(2) Actions to be taken during an event or emergency (such as actions to evacuate the immediate area).

(3) PPE required for safely performing the operation.

(4) Monitoring procedures, methods, and equipment to be used during the operation.

(5) Decontaminants, decontamination equipment, and decontamination procedures to be used during and after the operation.

(6) Explosive limits, if required, for operations involving explosively configured chemical munitions or requiring use of explosives.

b. Concurrent, unrelated work in an area of operation (worksite) that involves chemical agent and/or agent munitions is prohibited.

c. NTA SOPs must be reviewed initially by the NTASC, and annually thereafter by the NTA safety officer, in accordance with AR 385–10.

6–4. Preoperational safety surveys

a. A preoperational safety survey will be conducted when a CSP or munitions response chemical safety submission (MRCSS) of new chemical agent operations are required; or when chemical agent operations of an existing operation have been suspended or stopped for longer than 90 days; or when chemical agent operations resume after being stopped for a mishap where a disabling injury, injury requiring hospitalization, or personnel exposure to chemical agent was confirmed; or if the operation is contractor operated and the primary contractor changes. The preoperational safety survey will be conducted by ACOMs, ASCCs, or DRUs with responsibility for the chemical agent mission (such as U.S. Army Chemical Materials Activity for stockpile operations). The ACOM, ASCC, or DRU can delegate the conducting of the survey to a major subordinate command as long as that command is at least one level above the activity performing the operation.

b. The preoperational survey will—

(1) Minimally, assure compliance with all provisions of the CSP and MRCSS, as appropriate, and Army regulations.

(2) Include a simulated run conducted by operational personnel using dummy and/or inert material and associated PPE.

(3) Assure operator proficiency is demonstrated through SOP compliance.

(4) Include evaluation of emergency procedures, as necessary.

(5) Verify that training prepares workers to safely perform their duties related to chemical agent and that workers undergoing on-the-job training do not work independently; that periodically the training is revalidated based on what is needed to safely perform job duties; and that workers are evaluated initially and periodically to ensure they are prepared to work independently.

(6) Verify the operational mission can be performed within chemical agent safety standards prescribed in this pamphlet and special requirements prescribed by the ACOM, ASCC, and/or DRU.

(7) Verify that personnel and organizational changes that affect positions with job duties related to chemical agent are evaluated for potential impacts on chemical agent safety through management of change process (which may be part of an existing business such as personnel management or contractor qualifications).

c. Supervisory personnel will certify that facilities, equipment, training, and procedures are in accordance with the provisions in this pamphlet.

d. Operational personnel will perform a simulated run in the presence of their first-line supervisor or the most senior subject matter expert prior to restart of any chemical operation that has not been conducted in the last 90 days. Installation or activity safety personnel and operational subject matter experts and first-line supervisor will evaluate the procedures to ensure the operation will be conducted in a safe manner. After the simulated run and final SOP approval, live operations may be initiated under close supervision at controlled production rates and build to desired production rates.

e. A representative of the ODASAF will be invited to all chemical agent preoperational safety surveys when CSPs and MRCSSs of new chemical agent operations are required. It may be determined by the ODASAF that their presence is not required, however that determination is made by the ODASAF, not the installation or organization conducting the operation. ODASAF participation on a chemical agent preoperational safety survey is as representative of the U.S. Army, not as part of the organization conducting the chemical agent operation. The ODASAF will participate in conducting the survey and evaluate the operation and the survey team to ensure the chemical agent operation can be conducted meeting the minimum safety standards of this pamphlet. The ODASAF can delegate their representative from the USATCES or any ACOM.

f. Use of the Chemical/Biological Inspection and Survey Worksheet (https://www.milsuite.mil/book/groups/us-army-safety-publications) is recommended for capturing inspection and survey findings and observations and tracking closure of corrective actions.

6–5. Care of equipment and personal protective equipment

a. PPE, chemical agent monitoring, detection, and other equipment associated with chemical agent operations will be calibrated, if required, and used, inspected, tested, maintained, and repaired according to the applicable technical or field manuals and the manufacturer’s instructions.

b. Users of this equipment will be instructed in the proper use, inspection, testing, maintenance, repair, and calibration requirements.

6–6. Training and information

a. Personnel (such as maintenance workers and security) who have the potential for exposure to chemical agent when performing their assigned duties will be trained as outlined in this pamphlet prior to performance of their assigned duties. Refresher training is required at least annually. Hazardous waste operations and emergency response (HAZWOPER) training will be provided in accordance with 29 CFR 1910.120.

b. Training will include signs and symptoms of chemical agent exposure, information on sources of exposure, possible adverse health effects, and practices and controls used to limit exposures. Environmental and medical monitoring procedures and purposes, and worker responsibilities in health protection programs, including instruction in cardiopulmonary resuscitation, automated external defibrillation, first-, self-, and buddy-aid techniques will also be included in the training program. Training will provide employee awareness to help employees assess personal risks to safety and health.

c. Training must enable workers to take appropriate actions in the event of a chemical agent mishap.

d. Workers must demonstrate proficiency prior to performing hazardous operations.

e. Worker attendance at initial and refresher training will be documented and kept on file for the duration of employment plus 3 years.

f. NTA workers will be trained on signs and symptoms of NTA exposure, information on sources of exposure, possible adverse health effects, practices and controls to limit exposure, and medical countermeasures for first-, self-, and buddy-aid.

6–7. Medical surveillance

Medical surveillance programs will be established according to the latest OTSG guidance. Employees with the potential for exposure to chemical agent and NTA will be enrolled in the medical surveillance program. Recommended pre-placement, periodic, and termination medical surveillance results will be managed in accordance with the latest OTSG guidance. See also the chapter on occupational health in DA Pam 40–11.

6–8. Emergency preparedness

a. In the event of an accidental release of chemical agent that may result in personnel exposure, nonessential and unprotected personnel will be immediately evacuated or use shelter-in-place. Emergency procedures will be implemented. The source of the release will be contained and affected areas monitored and decontaminated, as appropriate, to applicable AEL before normal operations are resumed.

b. Medical evaluations for personnel who may have been exposed should follow the procedures outlined in the latest OTSG guidance or published guidance.

c. The installation or activity must maintain current chemical incident or mishap response and assistance (CIMRA) plans in accordance with AR 50–6.

d. The responsible entity will advise local emergency response agencies (such as police departments, Fire and Emergency Services, health departments, and local governments)—

(1) When the command or activity will be conducting chemical agent operations within their jurisdictions; and

(2) Of equipment, personnel, and other forms of support that may be required in the event of an emergency involving a chemical agent.

6–9. Special operational provisions for emergency preparedness

a. Each command or activity will establish a central control point for coordination of emergencies involving chemical agent. This control point may also be used as the control center for chemical mishaps and incidents.

b. The chemical agent work areas will be clearly defined, with access limited to only authorized personnel trained in chemical agent safety or accompanied by trained personnel.

c. Unnecessary work will not be performed in chemical agent work areas.

d. Laboratories will have an area set aside (separate) from the chemical agent work area for nonagent operations.

e. Adequate operable monitoring equipment and materials must be maintained at active chemical agent work areas. This equipment will include wind direction indicators located to be readily visible to personnel in the work area.

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

g. Decontamination equipment and materials, which are maintained operational, will be positioned at each location where chemical agent operations are conducted. Designated personnel will be trained to operate this equipment and decontaminate both personnel and equipment in the event of an emergency. An ambulance or government vehicle suitable for patient transport will be readily available at the chemical agent work areas whenever operations are in progress.

h. For off-site field operations, each crew will have one individual designated as the safety person to ensure that the equipment required in paragraphs 6–9*f* are available and properly positioned, monitor communications equipment, assist personnel in donning (putting on) PPE and check for its proper fit, maintain records of entry and exit time, monitor stay times, ensure protective clothing is properly decontaminated and doffed (removed), and so forth.

i. A team of a minimum of two people who are knowledgeable in agent exposure symptomatology, self- or buddy-aid, and treatment must be present during chemical agent and NTA operations. This team will remain in visual contact with each other at all times or within the immediate access area when communication is provided and observation by operational control personnel is possible.

j. Workers will immediately report nausea or other symptoms of illness that occur during chemical agent operations to their supervisor. Workers should advise their supervisor of illness prior to start of operations or before leaving the job.

k. Chemical agent or NTA exposure, potential exposure, agent spill or release, or other abnormal situation that may result in personnel injury will be reported to supervisory personnel immediately after emergency action has been taken. Personnel with possible chemical agent or NTA exposures will report for medical evaluation as soon as possible. Personnel who have been exposed or potentially exposed to a nerve agent will have a cholinesterase level drawn that day prior to release from duty.

l. Personnel who have worked with chemical agent will be given an after-duty hour telephone number to use to report illness that occur after work.

6–10. Labeling and posting of hazards

a. When chemical agent contamination is verified, equipment, tools, or other items will be marked or tagged to indicate degree of contamination (see chap 5). Inactive equipment and decontaminated facilities will be marked to indicate the level of decontamination. Records will be maintained for historical documentation.

b. Items containing chemical agent will be marked or labeled according to local requirements.

6–11. Maintenance controls

A continuing program for equipment and facility maintenance will be implemented and documented for all chemical agent operations. If feasible, the chemical agent process or operation or a portion of the process or operation will be shut down, and equipment or facilities decontaminated, before maintenance, testing, or repair operations are conducted.

6–12. Chemical agent sampling

Sampling (drill, sample, tap, and plug) of chemical agent munitions in storage facilities or other locations is prohibited without the approval of DA. Approval to conduct sampling operations must be obtained by submitting written justification to Chief of Staff, Army (DACS–SF), 200 Army Pentagon, Washington DC 20310–0200. Justification must include a CSP or MRCSS, as appropriate, risk assessment, and identified control measures.

6–13. Leaking munitions and containers

a. Before starting operations in areas where chemical agents are stored without continuous air monitoring, first entry monitoring will be performed to ensure that chemical agent leakage has not occurred. In the event a leaker or contamination is discovered during the first entry monitoring or in subsequent operations, the immediate area will be evacuated.

b. Except for leaker removal and decontamination activities, re-entry into the area will not be permitted until the following corrective actions have been accomplished. The area will be monitored to—

(1) Ensure decontamination was successfully completed.

(2) Verify the area is below the STEL or the protective capabilities of the PPE specified in this pamphlet for use.

c. Upon discovery and confirmation of a leaker or chemical agent contamination, the crew will exit the location and notify the central control point. Prior to reentry, the area will be monitored to determine the level of PPE required. If a real-time low-level continuous monitoring with alarm capability is not available, entry will be conducted in SCBA with appropriate level of dermal protection. The entry team will take steps to reduce the levels of chemical agent contamination until containerization or demilitarization processing can be resumed. Leaking munitions in—

(1) A chemical agent disposal facility will be processed in accordance with established chemical demilitarization SOPs.

(2) A storage or transport situation will be containerized in accordance with DA Pam 742–1.

6–14. Chemical agent and ammunition hazard symbols

Chemical agent and ammunition hazard symbols will be in accordance with requirements of DA Pam 385–64.

6–15. Material handling equipment

Material handling equipment (MHE) operation and maintenance will be in accordance with requirements of DA Pam 385–64 and 29 CFR 1910.

6–16. Storage

a. Chemical munitions and chemical agent storage containers will be stored in compliance with DESR 6055.09.

b. If a leaker is detected—

(1) In storage the leakers will be overpacked in an approved overpack listed in DA Pam 742–1 and DDESB Technical Paper 15 or that the U.S. Army Materiel Command has approved for use until its final disposition.

(2) In a chemical demilitarization facility unpack area, it will be entered into the demilitarization process expeditiously.

c. Storage—

(1) When storage space within the chemical area is available, the over-packed leaker will be stored in a separate magazine.

(2) When storage space is not available, the over-packed leaker will be identified and retained in the magazine but separated to the greatest extent possible. Encapsulated munitions will not be opened within a magazine in which other serviceable munitions are stored.

d. Fire division and chemical hazard symbols will be placed in compliance with the DESR 6055.09.

e. Wooded areas within, or immediately adjacent to, the border of chemical exclusion areas can significantly reduce the one percent lethality distances to both on-post, nonrelated inhabited buildings, and off-post inhabited buildings. Except for maintaining the required firebreak around each magazine and the security clear zone around the perimeter of chemical exclusion areas, cutting or harvesting of trees is prohibited within the one percent lethality distance, unless specifically approved by the ACOM, ASCC, or DRU. Normal selective thinning, not to exceed 70 square feet basal area, is acceptable.

Chapter 7
Personal Protective Practices

7–1. Training

a. Supervisors will ensure that the training outlined in this pamphlet is accomplished and used by their personnel.

b. Safety, IH, and medical personnel (if medical information and issues are involved) will provide technical assistance.

c. All personnel (such as maintenance workers, firefighters, security guards, chemical handlers, surveillance personnel) who work with or have a potential for exposure to chemical agent or chemical munitions will receive training to enable them to work safely and understand the significance of chemical agent and NTA exposures. Prior to being assigned to operations or duties in support of chemical agent operations, such personnel will, at a minimum, demonstrate proficiency in—

(1) Knowledge of operating procedures, to include safety requirements.
(2) Recognition of hazards involved in each operation.
(3) Recognition of signs and symptoms of chemical agent exposure.
(4) Administration of self- or buddy-aid.
(5) Knowledge of personnel decontaminating procedures.
(6) Execution of emergency procedures.
(7) Donning (putting on) and doffing (removing) of PPE.
(8) Recognition and prevention of heat stress.

d. Instruction in the subjects listed above will be conducted for personnel prior to allowing them to conduct chemical agent operations, and at least annually thereafter. This instruction will be conducted in accordance with this pamphlet and the latest OTSG guidance.

7–2. Safeguarding of personnel

a. Personnel who work in contaminated or potentially contaminated areas, or who handle or contact chemical agents, chemical munitions or other chemical agent filled materials (such as laboratory vials)—

(1) Change clothing, including shoes, prior to starting and after completing their work shift.
(2) Have open sores or wounds evaluated by medical personnel.
(3) Shower thoroughly (using plenty of soap) with special attention given to hair, face, neck, and hands at the end of the workday before leaving their workplace.
(4) Not eat, drink, chew, smoke, or apply cosmetics within their work area, doing so only in designated areas.

b. Supplies for decontaminating personnel will be available when operations are in progress.

c. The supervisor will be responsible for ensuring that safety equipment is checked and ready for use.

d. Users will inspect the equipment before each use in accordance with their training, SOPs, and appropriate regulations.

e. See chapter 8 for laboratory operations.

7–3. Emergency response equipment

A list of hazard-specific, first aid, toxic aid, or emergency medical response supplies and equipment will be developed and approved by the local medical authority, based on appropriate risk assessments. These supplies and equipment will be readily available for use at storage, disposal, laboratory, remediation, or training sites conducting chemical agent operations. Appropriately trained personnel will be available to use these items. Commonly used supplies and equipment may include, but are not limited to—

a. An ambulance or Government vehicle to serve as a patient transport vehicle.

b. A communication system to summon immediate aid.

c. Skin decontamination solutions, including soap and water, sodium hypochlorite and Reactive Skin Decontamination Lotion (RSDL), as appropriate to the hazard, in sufficient quantities to provide immediate spot and hasty decontamination of a victim.

d. A sufficient number of nerve agent autoinjectors (either Antidote Treatment Nerve Agent Autoinjector (ATNAA) or DuoDote®) in the immediate vicinity, on a per-person basis, to provide for the self-aid or buddy aid of the nerve agent-exposed victims (this is driven by either risk assessment or most probable event analysis, with input from the local medical authority).

(1) Auto-injectors will be handled and stored in accordance with manufacturer's instructions.
(2) DuoDote or ATNAA injectors must not be stored in the proximity of organic solvents, even when sealed in polyethylene bags because the vapors can cause the auto-injector to malfunction.
(3) The injectors must be protected from freezing because the injector may not function properly while frozen.

e. Medical antidotes, reversal agents or treatments for other chemical agent exposures, including NTAs or pharmacological agents, which might reasonably be anticipated in the workplace, based upon prior hazard analysis.

7–4. Self-aid and buddy-aid procedures

a. Although a prime consideration in rendering assistance to an individual who has been exposed to vesicant (mustard) agent is immediate removal to an uncontaminated area, the risk of leaving liquid vesicant in the eye is so much greater than the risk of exposure to vesicant vapors during the short period of decontamination, that eye decontamination must be done despite the presence of vapor.

b. Exposure to G-series agents poses primarily an immediate vapor hazard and unprotected individuals will be removed immediately to an uncontaminated area. V-series agents are typically more of a percutaneous hazard; however, move away from the area of contamination and don a protective mask. Immediately remove all contaminated clothing and spot decontaminate the affected area of the skin with soap-and-water wash, RSDL, or shower. Decontamination of personnel exposed to liquid mustard, nerve agents or NTAs will be done as quickly as possible by following the procedures in SOPs, SDSs, and the latest OTSG guidance.

c. Employees and supervisors must be trained in emergency and self or buddy-aid procedures, as specified in SDSs or as prescribed by the CMA, for chemical agents, NTAs, and industrial chemicals to which they may potentially be exposed.

d. In the event of potential exposure to a chemical agent, NTA, or an industrial chemical, the emergency and self-aid or buddy-aid procedures specified in the applicable SDS or prescribed by the site medical authority must be followed. Older format material safety data sheets (MSDS) may still be in use for material received prior to 1 December 2015.

7–5. Mishap notification, investigation, and reporting

a. Mishaps involving chemical agent will be reported and investigated in accordance with the requirements of this pamphlet, AR 385–10, DA Pam 385–40, DESR 6055.09, current guidance messages and Federal, State, and local requirements, as applicable.

b. ODASAF will be notified, through command channels, of the below mishaps within 24 hours of occurrence. Notification will include the information required in paragraph 7–5*c*. When the activity is a tenant on a DoD installation, the host installation or garrison commander will also be notified. Notification of ODASAF is not required when the chemical agent mishap is reported to the Headquarters, DA Operations Center as a serious-incident report per AR 190–45 or AR 190–59. That Operations Center will forward the serious-incident report to ODASAF.

(1) Explosion or fire involving chemical agent operations.

(2) Any confirmed detection of a chemical agent outside of engineering controls or the magazine and into the environment, exceeding the STEL for the chemical agent.

(3) Any confirmed detection of chemical agent resulting in an exposed worker or potentially exposed worker (see definitions in glossary) where unprotected or protected personnel were likely to have been present at the time of release, and requiring a potential exposure evaluation, self-aid, buddy-aid, or medical treatment.

(4) Personnel having an exposure potential to chemical agents or NTAs, who are exhibiting the signs or symptoms of an exposed worker.

(5) A release of a chemical agent into the atmosphere that an approved downwind hazard projection method indicates will create a hazard greater than the appropriate AEGLs.

(6) A mishap that has received or is expected to receive negative public attention from news media or the attention of State or local officials or in the judgment of the reporting commander or director or responsible official could reflect negatively on the Army.

(7) Any known release of NTA resulting in a potential exposure to an NTA requiring a potential exposure evaluation, self-aid, buddy-aid or medical treatment.

c. Reports submitted to ODASAF will include, at a minimum, the following elements:

(1) Date and time of the mishap.

(2) Organizations (installation, tenants, and activities) involved in the mishap.

(3) Location (building, room, magazine) of the mishap.

(4) Type of operation being conducted (such as demilitarization, laboratory analysis, training).

(5) Types of chemical agents, munitions, and/or containers involved.

(6) Quantities involved (number of containers, volume of spill, concentration in mg/m3).

(7) A brief description of what happened.

(8) A description of any personnel exposures, injuries, or deaths and any property damage.

(9) Actions taken to respond to the mishap.

(10) Status and description of any media statement planned or released.

d. A close-out report will be submitted to ODASAF through command channels after the mishap investigation is complete. Close-out reports will provide a final status of the information required in paragraph 7–5*c* as well as causal analysis of the mishap cause and corrective actions taken to prevent similar mishaps. Commanders or directors will submit the investigation report within 90 days of the chemical agent mishap to ODASAF, email at usarmy.pentagon.hqda-aso.mbx.army-safety-office@mail.mil.

e. Contractor activities will report chemical agent mishaps per contract requirements.

(1) Within 24-hours of notification of a contractor mishap meeting the criteria listed in paragraphs 7–5*b*(1) through 7–5*b*(7), the contracting officer will provide mishap notification in accordance with the requirements of 7–5*b*.

(2) The contracting officer will submit a close-out report in accordance with requirements of paragraph 7–5*d*.

f. Medical records will be maintained per AR 40–400 for occupational illnesses or injuries resulting from chemical agent mishaps.

g. Lessons learned from chemical agent and NTA mishap investigation reports will be shared with the DACASC as a means of dissemination to other Army organizations.

Chapter 8
Laboratory Safety

8–1. Common laboratory safety guidelines

a. Chemical agent operations and storage accomplished in a laboratory, as defined in the glossary, are subject to the requirements in this chapter. Chemical agent laboratories, as a minimum, will meet the requirements contained in 29 CFR 1910.1450. The risk assessment approach in accordance with DA Pam 385–10 and DA Pam 385–64 is a valid method of eliminating or reducing the unique hazards associated with research and development laboratory operations.

b. Where conflicts exist between the requirements of this chapter and other parts of this pamphlet, the requirements of this chapter have precedence.

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

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

(a) A double-containment system. A double-containment system must provide total primary containment and in the event of leakage or breakage of the primary containment, must totally contain chemical agent liquid and substantially contain chemical agent vapors. Examples of secondary containment include metal cans with friction-fit lids containing absorbent material and sealed syringe carriers.

(b) A single-containment system with a protective mask worn. A single-containment system must totally contain chemical agent liquid and vapor. Examples include glass bottles sealed with gaskets or parafilm tape, syringes with needle caps, septum bottles, and sealed ampoules.

(2) For quantities in excess of 1 ml of neat chemical agent, a double-containment system is required.

(3) Prior to removal from engineering controls, chemical agent containers will be sampled for surface liquid contamination with M8 paper or air monitoring.

d. Unattended overnight storage of neat agents will be in ventilation hoods or gloveboxes and requires double containment of chemical agent. For operations in which the disassembly of equipment would result in increased hazards (such as agent generators, agent synthesis, and Q-testers), the double containment requirement is advisory and requires a hazard analysis.

e. Operations in RTAPs and fixed-site, real-time monitoring operations are exempt from the facility requirements in this pamphlet. Only dilute solutions, as well as calibration and precision and accuracy operations, are permitted in RTAPs and fixed-site, real-time monitoring operations. Hazard analyses and SOPs must be developed to ensure that the risks associated with these operations are minimized.

f. Unrelated operations involving different chemical agents should not be performed concurrently in the same room unless chemical agents are separated by engineering controls (such as separate laboratory hoods).

g. Good housekeeping will be maintained.

h. SOPs for hazardous operations will require a daily checklist to be used at the beginning of each day's operation to ensure presence of required equipment as stated in the SOP. The listed equipment

must be specific as to type, such as specifying the type of glove or eye protection required (such as butyl gloves, nitrile gloves, and so forth).

i. Each chemical laboratory will develop and implement a chemical hygiene plan in accordance with 29 CFR 1910.1450, if applicable. This plan will be reviewed and concurred with by the activity, installation, or organizational safety manager and industrial hygienist annually.

j. All laboratories will keep an inventory of hazardous chemicals and SDSs on hazardous chemicals readily available to the workforce and emergency response personnel; older format MSDSs may still be in use for material received prior to 1 December 2015. The supervisor will ensure laboratory personnel are trained in accordance with 29 CFR 1910.1450. The standard requires that labels on incoming containers of hazardous chemicals are not removed or defaced. Chemicals likely to have dangerous reactions on contact with each other will be stored separately in placarded areas in accordance with an approved compatibility system, such as that found in the Hazardous Materials Identification System, or other acceptable laboratory guidelines. Tracking of laboratory chemicals should ensure that unused, outdated, or excess materials will be disposed of in accordance with appropriate Federal, State, and local hazardous waste regulations. The installation environmental coordinator should be consulted prior to disposal of hazardous chemicals.

k. A pre-operational survey will be conducted in accordance with local policies for all new laboratory chemical agent operations.

8–2. Dilute chemical agents

For storage or operations involving dilute chemical agents, as defined in the glossary, the following may be applied:

a. The dilute chemical agents may be stored in single containment within a refrigerator or freezer. The refrigerator or freezer will have a high temperature alarm to warn of malfunction; field operations may check and log interior temperature of refrigerators and freezers instead of installing an alarm. Refrigerator or freezer used with flammable materials will meet appropriate electrical requirements for flammable materials.

b. Engineering controls used for storage and operations with dilute chemical agents are not required to have backup emergency power.

8–3. Ventilation

a. Laboratories.

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

(2) Ventilation systems will be designed so that airflow is away from the operator and toward the potential source of chemical agent. Air pressure within the laboratory will be maintained below that of surrounding areas and entry corridor. Each laboratory room will have a means of assessing laboratory pressurization prior to entering.

(3) A record noting filter replacement dates for each air filtering system will be maintained. Ventilation requirements in paragraphs 9–6 and 9–7 apply to ventilation systems in laboratories.

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

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

(6) Ventilation hoods or gloveboxes used for overnight storage of chemical agents will not be used for any chemical agent operation, except transfers from storage and related dilutions, unless only 100 ml or less of a single category of chemical agent (such as nerve agents versus vesicant agents) is stored inside the ventilation hood or glovebox; or unless the chemical agent is stored in a vault or refrigerator within the hood or glovebox. Charged agent generators may be stored overnight and used in the same hood if other chemical agent present is stored in a vault or refrigerator within the hood or glovebox.

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

b. Laboratory hoods used for chemical agent operations.

(1) Laboratory hood construction:

(a) New hoods must have a one-piece welded stainless steel liner.

(b) New hoods must have a provision to indicate airflow rate.

(c) Hoods installed as part of new construction must be designed such that the exhaust systems maintain negative pressure during a backup power switch over in case of a primary power source loss. Hoods installed as part of a renovation that cannot meet this criterion must be accepted through locally developed deliberate risk assessment.

(2) Laboratory hood ventilation requirements:

(a) Laboratory hoods in which chemical agent operations are conducted will provide an average face velocity of 100 plus-or-minus 20 linear feet per minute (lfpm) through the working opening. A traverse of one measurement per square foot (approximately) in the plane of the sash with the anemometer held for a minimum of 5 seconds in the center of the grid space (at least four readings per point for instantaneous point velocities) for the designed hood opening should be used to compute the average face velocity. No single point velocity may deviate from the average face velocity by more than 20 percent. If any point deviates from the average face velocity by more than 20 percent, then a smoke test must be performed to ensure that smoke does not escape from the plane of the sash and will require an update of the hazard analysis. The hazard analysis will be approved in accordance with DA Pam 385–10.

(b) Laboratory hoods in which chemical agent operations are conducted will be challenged with test aerosols (visible smoke) with the sash in the maximum open position. No visible smoke will escape from the hood while the sash is slowly closed to as much as the operational setup will allow and then slowly raised to the fully opened position.

(c) New laboratory hoods with added customization (such as ganged with pass-throughs) will be factory tested in the as-manufactured configuration and re-tested when installed, in accordance with ANSI 110.

(3) Laboratory hoods will be evaluated in accordance with ANSI/ASSP Z9.5-2022 once installed, initially tested, and operating properly. Laboratory hoods will be evaluated within a 12-month period of initial operation and annually thereafter. This will include assessment of face velocity, cross draft measurement, and containment (such as smoke candles, or smoke generating instrument). Variable air volume laboratory hood testing should include verification that controls are functioning as designed including face velocity and response testing at varying sash positions (such as 25 percent and 50 percent of the design hood opening).

(a) No smoke should escape from the plane of the sash during containment.

(b) Cross drafts ideally should be less than 30 percent of the average face velocity but will not exceed 50 percent.

(c) An average face velocity between 80–120 lfpm is the optimal range.

(4) Laboratory hoods will also be evaluated when substantive changes have occurred to the hood or hood operating environment. A risk assessment may indicate a full acceptance test, such as ANSI 110, or less rigorous testing to ensure adequate performance of the hood(s). Substantive changes include:

(a) When the ventilation system has undergone repairs or changes that may affect the airflow rate or patterns.

(b) When the laboratory hood's operating environment (such as supply air distribution patterns and volume, laboratory and furniture geometry) has changed such that it may decrease the hood’s performance.

(c) When there have been changes in laboratory hood’s setup (that could decrease its performance), hood face velocity control type, set point, range, and response time.

(d) When there have been changes in the laboratory hood’s exhaust system, static pressure, control range, and response time.

(5) Sash stops may be used to define the maximum sash position opening.

(6) Laboratory hoods used only for the storage of double-contained chemical agents are not subject to upper limits on airflow provided the hood’s sash is lowered and locked for security.

(7) When existing laboratory hoods are replaced in a room or a facility, the ability of the ventilation system to maintain the room or facility at a negative pressure must be verified. (Note: Because adjustments or renovation to the system may be required, the supporting industrial hygienist should be consulted for design guidelines.)

(8) When a laboratory hood’s ventilation exhaust systems contains filters that have been used for chemical agent operations, the ventilation system must maintain an inward airflow through the laboratory

hood even when the hood's working area no longer contains chemical agent or agent-contaminated material. In this case, no minimum face velocities are required; however, inward flow will be verified by smoke tests or other visual means. If the filter system is isolated from the hood (such as back-flow dampers and blind hinges), this subparagraph does not apply, though visible indicators that show the positioning of dampers (open, closed, or partly closed) should be provided at the work station.

(9) Future capacity for expansion should be considered in the laboratory design. Diversity in laboratory systems should be considered based on individual laboratory usage and requirements.

(10) A new installation of a laboratory hood should make maximum use of proven technologies (such as bypass construction, multiple baffles, and other enhancements) to provide optimal containment of chemical agent vapors and mists. APHC is available for consultation regarding laboratory hood construction criteria and concept development and design.

(11) Effluent air from laboratory hoods (for example the entire system) must not contain concentrations of chemical agent in excess of the STEL concentration contained in this pamphlet. If the quantity of chemical agent being used or the type of operation is such that this amount may be discharged into the atmosphere, the ventilation system's discharge must be equipped with chemical-type filters or other air treatment systems to ensure the chemical agent in the effluent does not exceed acceptable levels.

(12) Laboratory chemical hoods will be equipped with a flow indicator or face velocity alarm that is visible or audible to the laboratory hood's user to alert them of improper airflow. A 20 percent drop or rise in the certified airflow will activate the alarm. The alarm set point will be reset at least annually by determining the certified average face velocity as indicated in paragraph 8–3*b*(2)(*a*), and resetting the alarm to 80 percent of this value. For new construction, hoods will be provided with both visible and audible alarm devices. Visible alarms will be located so that they can be readily seen by personnel while working at the exhaust hood. For storage hoods, the visual alarm should be visible from outside the room containing the hood. Alarms should be periodically function tested every 6 months, as a minimum.

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

(14) No chemical agent, equipment, or other chemicals or supplies will be allowed within 20 centimeters (8 inches) of the hood face unless a hazard analysis demonstrates that worker safety will not be compromised. Any reconfiguration of the chemical agent or equipment within the 20 centimeters will require an update of the hazard analysis and retesting and verification of the hood per paragraph 8–3*b*(3). The hazard analysis will be approved in accordance with DA Pam 385–10. The 20-centimeter (8-inch) zone should be designated by paint or tape.

c. Glovebox. Glovebox requirements for the laboratory will be consistent with those in paragraph 9–6*m*.

d. Traps. Catch basins and traps of suitable size will be provided within hoods and gloveboxes.

8–4. Neat chemical agent monitoring

a. Neat chemical agent operations—

(1) During the first 5 days of new neat chemical agent operations, monitoring at the WPL (AEL for L) will be conducted to verify the adequacy of engineering controls.

(2) Re-monitoring at the WPL (AEL for L) will be conducted for 1 operating day on a quarterly basis.

(3) Re-monitoring at the WPL (AEL for L) will be conducted for 1 operating day following changes in the operation with the potential to impact, or following damage or repairs to, the ventilation system or containment controls. If the only change in the operation is to an agent of lower volatility, re-monitoring is not required.

b. The methods, techniques, and rationale for chemical agent monitoring in labs will be documented in the local agent air-monitoring plan.

8–5. Loss of engineering controls

Local policies will be developed to address conditions constituting loss of engineering controls, actions taken to evaluate the hazard and protect personnel, decontamination, and conditions for restored use of the area.

8–6. Personal protective equipment

a. Approved protective masks will be issued to all personnel who are routinely assigned to chemical agent operations. Training in the use of the masks will be provided. A properly fitted mask with instruction

in its use, and how to react in the event of an emergency, will be provided to all transients entering areas in which a chemical agent is being used or stored. The mask must be readily available to each individual in the room in which agent is being used or stored.

b. Personal protective clothing necessary to protect personnel during operations and for use in case of emergency will be kept readily available. Clothing sizes will be appropriate for the personnel who might need to wear them. PPE used in laboratory operations will be marked and maintained in an accountability program (see also para 8–6*e*(1)(*d*)).

c. Protective gloves worn in laboratory operations will meet the testing requirements in accordance with the provisions of paragraph 4–7.

d. Surgical gloves may be used without testing only if the total quantity of chemical agent accessible is less than 1 ml; a time limit of 5 minutes from the beginning of access to uncontained chemical agent is established; an individual wearing approved gloves (nonsurgical) is dedicated to watch and to provide immediate emergency response for spills, mishaps, or chemical agent contact with gloves; and a hazard analysis is performed and used in accordance with an approved SOP. Users of surgical gloves must wear two pairs simultaneously, wash hands with soap and water immediately after any use, and avoid sources of ignition.

e. The wearing of protective gloves is intended to preclude any contact of skin with the chemical agent. No glove may be used that allows such contact in the event of an actual spill. In addition, the glove must provide reasonable protection against unrecognized contamination. For types of gloves authorized for use, the following procedures are considered reasonable:

(1) Standard gloves (M3, M4, and glove set gloves).

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

(b) If liquid chemical agent contamination occurs, decontaminate immediately and continue operation. Upon completion, decontaminate again, remove gloves, and dispose of in accordance with local permits and procedures.

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

(d) Butyl rubber gloves used in laboratory operations that require laundering and testing will be included in the installation PPE accountability program for control and processing as prescribed in TM 10–8415–210–13&P.

(2) Nonstandard gloves.

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

(b) Restrict the use and duration, as required by the type of acceptance testing performed. Gloves will be marked to indicate restrictions that apply.

(c) If liquid chemical agent contamination occurs, decontaminate immediately and continue operation. Upon completion, decontaminate again, remove gloves, and dispose of in accordance with local permits and procedures.

f. Personnel handling chemical agent containers will wear, as a minimum, level D PPE with gloves. Supervisors and visitors may wear street clothes or lab coats. Protective gloves will be worn by all personnel accessing chemical agent operating areas (such as hoods) whenever agent is present in the hood.

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

(a) Chemical agent has not been placed within hood confines.

(b) Decontamination status for hood is known.

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

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

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

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

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

8–7. Facility requirements

a. Regarding warning signs, the following requirements apply:

(1) *Chemical agent other than a nontraditional agent.* Entrances to laboratory rooms in which chemical agent is present will be posted with signs warning personnel of the presence and type of chemical agent (or specific chemical agent) within the room and any special entrance requirements.

(2) *Nontraditional agent.* A “CAUTION” sign is to be completed and posted at the entrance of each laboratory room or suite, prior to using the room or suite for NTA storage. A “DANGER” sign is to be posted at the entrance of each laboratory room or suite prior to initiating NTA handling or activities. These signs must include the information listed below, will be limited to the generic term "NTA," and for security purposes will not list NTA names, numbers, or other identifying information:

(a) Indication that NTA is present (CAUTION sign) or in use (DANGER sign).

(b) PPE requirements.

(c) Buddy rule requirements.

(d) Emergency notification requirements, including name and on- and off-duty telephone numbers for the person in charge of laboratory.

b. Floors, work surfaces, and walls will have nonporous surfaces or coatings that resist chemical agent absorption and decontamination materials and solutions and that can be readily decontaminated.

c. Emergency deluge-showers and eyewash fountains will be readily accessible to all work situations within the laboratory in accordance with 29 CFR 1910.151(c).

d. Entry to the laboratory will be restricted to authorized personnel. This restriction can be indicated by signs or enforced by locks. The laboratory or individual rooms or storage or work hoods containing chemical agent must be capable of being locked during nonwork periods and will be locked when unoccupied. All methods employed for locking systems should be consistent with the Life Safety Code (NFPA 101) requirements for hazardous areas and appropriate security measures.

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

f. Means of egress (as defined in NFPA 101) must be continuously maintained free of all obstructions or impediments to allow full, instant use in case of a fire, chemical agent release, or other emergency. Means of egress (as defined per NFPA 101) must not exit into an area of greater hazard. For new construction, one means of egress (as defined per NFPA 101) must be directly to the outside. The provision of interior corridors, which is typical for protecting means of egress (as defined per NFPA 101) from laboratory space to an exit providing egress (as defined per NFPA 101) to the outside, complies with the intent of this text.

g. Compressed gas cylinders not necessary for current laboratory requirements will be stored safely in a location outside the laboratory, in accordance with AR 700–68/ DLAR (JS) 4145.25/NAVSUPINST 4440.128D/AFJMAN 230227(I)/MCO 10330.2D.

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

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

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

8–8. Personnel practices

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

b. Prior to assignment to such work, personnel who work with chemical agents will be trained in the use and handling of chemical agents; on the donning (putting on), wearing, and doffing (removing) of PPE; in the use of decontaminating materials; and in procedures to be followed in the event of a spill or exposure.

c. When conducting chemical agent operations, only personnel necessary to the operation will be permitted in the laboratory work area. However, a minimum of two qualified personnel will be present.

d. Procedures will be established to ensure that the installation firefighting personnel and the security force are aware, and will be notified, of the presence and type of chemical agent and room in which it is located in order to adequately respond to emergency situations.

e. Storage compatibility group standards (DA Pam 385–64) do not apply to laboratory stocks of chemical agent of 1 liter or less. A reasonable effort should be made to group chemical agents of like physiological effects together, but generation of additional storage locations is not required to accomplish this.

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

g. The storage or consumption of food or beverages; the storage or application of cosmetics; the smoking or storage of smoking materials, tobacco products or other products for chewing or vaping; or the chewing of such product in all laboratory chemical agent areas, is prohibited. Laboratory glassware will not be used to prepare or consume food or beverages.

h. Chemical agent first-aid kits will be maintained in each laboratory operating or storage room in accordance with paragraph 7–4.

i. Each inner container and the outer container of chemical agents and agent candidates must be labeled with the chemical agent and/or code name to properly identify the contents. These labeling requirements are in place of OSHA Hazard Communication Standard's Global Harmonization System labeling requirements for primary and secondary containers. The label will have a red border and will have dimensions of at least 4 1/2 by 5 1/2 inches, when container size permits. As necessary, the dimensions of labels for small inner containers may be as small as approximately one-fourth of those stated. Those inner containers too small for labeling all required information must have name or code name of chemical agent clearly marked and may refer to remainder of information by locally determined system. The color of inner and outer container labels, as well as information thereon, will be identical. In addition, the outer container must also include, at a minimum, the OSHA Skull and Crossbones pictogram and may refer to the SDS for the remainder of the pictograms, hazard statements, and precautionary statements. The outer container may also include name, locations, and telephone number of the manufacturer, importer, or other responsible party. Labels will contain the following information:

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

(2) "DANGER."

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

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

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

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

(7) Special instructions or supplementary information.

8–9. Decontamination

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

b. Personnel. Available personnel decontamination procedures will be used, as specified in the SDS or medical treatment protocol for the chemical agent of interest; older format MSDS may still be in use for material received prior to 1 December 2015. If a 0.5 percent bleach solution will be used for personal decontamination, sufficient quantities of the solution must be present to achieve the necessary immediate removal of the chemical agent from the skin. Spray bottle quantities are not sufficient. At least 1-gallon containers are required depending on the quantities of chemical agent present.

c. Equipment.

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

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

(3) Porous material and equipment that has remained in the hood for 1 week or longer, or has been exposed to significant vapor contamination, will be considered potentially contaminated and will be treated as contaminated per paragraph 8–9*c*(2).

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

(5) Monitoring is not required for completely decontaminated laboratory equipment that is shaped simply (no crevices or the like) and is made of essentially impervious materials (such as laboratory glassware.) However, a solvent wash is not considered complete decontamination.

(6) Contaminated laboratory equipment will remain within laboratory hoods or other protective container until it meets the definition of clean.

d. Animals. Laboratory animals injected with or ingesting chemical agent are not considered contaminated unless massive doses relative to the animals' mass are given. Animals exposed by other routes of entry require decontamination and disposal in accordance with local permits.

e. Chemical agent detoxification.

(1) Detoxification of chemical agent in a laboratory hood or glovebox is limited to a maximum of 50 grams of chemical agent at any one time unless approval for a greater amount is given in the CSP or MRCSS, as appropriate.

(2) Checking by analytical methods for residual contamination, after detoxification of chemical agent, is not necessary if the chemical agent is known to be in solution using proven methods. These methods will require that appropriate decontaminants are used in calculated excessive amounts, the time allowed for reaction exceeds many half-lives, and no interference (slowed reactions, low temperatures) or other complications are reasonably expected. Solutions that meet these criteria may be considered decontaminated and need not be stored in an approved lab hood.

Chapter 9
Design Criteria

9–1. Minimum engineering design guidance

Minimum engineering design guidance is set forth in this publication for facilities that are used for handling, storage, maintenance, surveillance, transportation, training, testing, research, disposal, and demilitarization of chemical agents or ammunition. This design guidance is intended for new construction or major renovation projects. Support areas for these operations and for operations personnel are included. Other design features that afford the same degree of safety can be used.

9–2. Ventilation systems

Ventilation systems will be designed to ensure that control of chemical agent-contaminated exhaust will not exceed source emission limits (SELs) (see table 9–1) and will be designed to maintain negative pressure throughout the system. In operations requiring air ventilation systems, the following techniques may be used:

a. Filters or scrubbers for exhausted air will be designed and approved for the maximum credible event (MCE) of the operations involved. Additionally, exhausted air from a facility that is potentially contaminated with chemical agent vapor can be thermally treated. Adequate treatment of the air is based on high temperature and sufficient residence time. Changes in the chemical agent operations within a facility require that the design of the existing filter be evaluated for adequacy in terms of the new MCE. When a single filter or scrubber is employed, a gas life indicator or other suitable method to predict filter life will be used to allow filter change-out before SELs are exceeded.

(1) When high concentrations of a chemical agent are involved and breakthrough of an agent can be expected, preprocessing through a series of scrubbers or use of redundant filters will be employed. At a minimum, high efficiency particulate air filters also will be used in the air ventilation systems upstream from the carbon filter beds. Each filter bank will be provided with a means to measure differential pressures across each bank of filters.

(2) In larger facilities, ducting and manually operated dampers will be provided for backup exhaust ventilation capability. Filter disposal will be in accordance with Federal, State, and local requirements. A bag-in, bag-out type filter system should be considered for new facilities.

b. The ventilation system (for example, ductwork and blower housing) will be sealed to preclude leakage.

c. All exhaust equipment will have backup blowers that engage automatically if the main blower fails. The backup blowers will ensure that a negative pressure is maintained at all times in any facility area where there is a potential for a chemical agent to be released. If backup blowers are not used then adequate positive safe shutdown devices should be employed. Due to the design, a given system may be shut down safely based on the induced draft fan wind down times and airflow bypasses to other operating

systems. Where a backup blower is not used a supporting risk analysis should be performed to support this design decision.

d. The airflow for laboratory exhaust hoods and gloveboxes will be designed to prevent a chemical agent vapor exposure to unprotected workers above permissible limits. The design parameters will consider equipment and process layout as well as makeup airflow and operational positions with regard to maintaining flow balance and cross currents. The system will maintain negative pressure in chemical agent operating areas in relation to hallways, offices, and other nonagent areas. Gloveboxes will be used when the hazard analysis indicates that the toxicity, dusting, or dispersion of material caused by airflow and type of operation require such protection.

e. Performance of the chemical hood is affected by airflow within the facility as well as hood geometry, design, and operating parameters. The adequacy of the hood performance must be based upon test data ensuring that the WPL for the materials used have not been exceeded. The adequacy of hood performance can be determined periodically using ventilation measurements, smoke testing, and monitoring of worker exposure to ensure proper functioning of the hoods.

f. Special design features will be incorporated for situations that involve explosives fines (dust, particles) that may become airborne to segregate these materials from the air stream to minimize or preclude contamination of the air handling system.

9–3. Mechanical and utilities design for facilities

A concept of chemical agent contamination avoidance and control will be incorporated and included with the facility layout and design.

a. Working surfaces, such as walls, floors, and ceilings within a facility likely to be agent-contaminated during regular or accidental situations will be constructed of materials that are resistant to an chemical agent retention. The surface treatment will have properties to allow for ease of decontamination of surfaces. Flooring will be coved 6 inches onto all wall surfaces unless other means (such as steam or decontamination systems) are shown to thoroughly decontaminate residue chemical agent in cracks and corners. Floor surfaces will be treated, silled, or sloped and seams sealed to contain and control chemical agent contamination and ease agent clean up.

b. Utilities, mechanical rooms, and other nonagent areas will be located so that air flows toward the chemical agent operating areas. Access to these nonagent areas will be accomplished without entry into the chemical agent operating areas.

c. The electrical system will be equipped with a backup power source designed to start automatically and supply enough power to support critical functions in the event of power outage. Wiring, controls, lightning protection, and other electrical devices will meet the requirements of NFPA 70 for the applicable hazardous operational facility.

d. All water outlets in chemical agent rooms or areas, to include agent operating hoods or gloveboxes will be designed to prevent backflow of water into the service lines.

e. Dedicated liquid waste systems will be designed to collect and maintain the effluent produced by the activity until processed and certified to meet the release limits in accordance with Federal, State, and local laws. The system will be equipped with a means to sample and test the chemical agent content of the effluent, to add required agent decontaminant, and to release the waste when authorized. Vents or other openings in the waste system will be fitted with approved agent filters or discharged into agent air exhaust systems. A containment dike designed to hold the total content of the waste system plus 10 percent of the volume will be placed around above ground liquid waste systems. For multiple tank waste containment systems, the containment dike will hold 110 percent of the largest tank.

f. Decontamination facilities of sufficient capacity to catch and contain the effluent will be provided for the chemical agents involved. Ammunition, drained of agent and chemically decontaminated, will be processed through approved agent destruction processes before release.

g. When operations require work assignments to be conducted at exposure levels above or potentially above the WPL, decontamination change facilities with showers will be provided.

9–4. General design considerations

a. Facility alarms. Facility alarms and monitors for engineering systems—

(1) Each chemical facility will have a master alarm and control panel that will permit functional verification of the exhaust blowers, backup blowers, air-conditioning units, fire control systems, waste treatment systems (such as agent and nonagent), and exhaust filters. Keyed to this master alarm panel will be

visual and audible alert alarms to indicate instantly the failure of exhaust blowers, chemical agent breakthrough of primary filter, backup blowers, fire alarm (infrared, ultraviolet, ionization, or particulate activated sensors) field waste pump failure and temperature increases in low temperature storage areas.

(2) Alarms will be incorporated for use in the work areas when injury or mishaps occur in the facility. Except for static storage operations, all facility alarm systems for dynamic operations will be monitored, consistent with operational requirements. In the absence of real-time monitors, first entry monitoring procedures are required after loss of engineering controls that may have caused contamination in excess of the appropriate AEL.

b. Fire detection and protection. Fire detection and protection systems for production and maintenance facilities will comply with the requirements and guidelines published in the latest version of the Unified Facilities Criteria (UFC) 3–600–1.

c. Bulk storage tanks. Impermeable dikes that have enough capacity to hold at least 110 percent of the tank capacity and the required volume of decontaminant solution will be placed around all bulk chemical agent tanks, reactors, and mixers.

d. Isolation of facility functions. The chemical agent facilities will be designed to isolate one activity from another activity in an independent and completely autonomous manner. Special design criteria will segregate explosives from drain lines and sumps to prevent deposition of explosives materials in these process units.

e. Monitoring. Stations will be established around chemical agent operating areas and facilities to monitor the air and liquid waste effluents, as required by local permits.

f. Chemical agent operating areas.

(1) The chemical handling and maintenance areas associated with industrial operations will be isolated from the main facility by protective walls and doors and will be operated at a negative pressure with respect to the main facility area. All hazardous materials will be handled in these rooms unless a glovebox is used.

(2) The handling rooms will be equipped with local exhaust ventilation and approved work surfaces that inhibit chemical agent penetration and retention, and other means to minimize the spread of contamination. All air leaving the facility will be filtered or decontaminated before release to the atmosphere.

(3) Air flow in facility cascade ventilation systems will be from the areas of least contamination (hazard) to areas of increasing contamination (for example, clean to dirty), whereby the flow is controlled by differential in negative pressure.

(4) Appropriate containment facilities will be used as necessary during ammunition maintenance procedures.

g. Utility areas.

(1) Electrical control panels, hot water heaters, and vacuum pumps will be located in a utility area.

(2) Compressed air, argon, and nitrogen may be supplied to the facility from gas bottle manifolds in a utility area.

(a) Facilities that use large quantities of compressed air (such as breathing air, instrument air, and plant air that require different levels of quality) require different types of air compressor systems.

(b) For these facilities, manifold systems are too small and are very labor intensive for the amount of compressed air used.

(3) When air-supplied PPE is used, breathing-quality air will be provided with suitable connections throughout the facility.

(4) The waste liquid treatment area and the emergency auxiliary power will be located in the facility complex. Appropriate access to all plumbing, electrical conduits and relays, refrigeration equipment, and air-handling equipment will be incorporated.

h. Viewing of operations. A valuable asset in the industrial facility design is to provide for visual observation of virtually all workspaces by a viewing hall. A clear view of the laboratory exhaust hood, workrooms, main laboratory rooms, storage areas, and safety shower area is possible by selection of the appropriate design.

9–5. Design of change-house facilities and areas

a. Facilities must be provided for showering and changing clothes. It may be a designated area or a change-house.

b. The following criteria apply to the location, design, and operation of change-house facilities:

(1) Change-houses servicing a chemical agent operating area will be located at the maximum practicable distance from the storage or operating area; however, as a minimum, the separation distance for related explosives operations will be unbarricaded intraline distance (ILD) based on the maximum quantity of explosives at any nearby location.

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

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

(1) Building airflow will be from the clean area toward the potentially contaminated areas.

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

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

d. Change-houses or areas may be provided as an integral part of the operating building. In such cases, the following provisions apply in addition to those specified in paragraph 9–5*c*:

(1) The building design (such as floor slope, drainage, airflow, and so forth) will preclude chemical agent migration into the change-house or area.

(2) A means of direct egress (as defined per NFPA 101) (for example, one that does not pass through chemical agent operating areas) to the exterior of the building or outside the no-effects zone for the given operation will be provided for personnel.

(3) Change-houses or areas must be separated from explosives hazards by a wall or barrier that provides protection equivalent to that provided by unbarricaded ILD if either of the following applies:

(a) Personnel other than those directly associated with the operational use of the facility.

(b) The facility operates on a multiple-shift basis.

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

f. Utilization of chemical change-houses or areas will be controlled by locally approved regulations.

g. For operations in the field and in operating buildings without an integral change-house or area, provisions must be made for decontamination and removal of contaminated or potentially contaminated protective clothing at or adjacent to the worksite. Provisions for collecting such clothing for processing at the laundry facility will be provided as specified in paragraph 9–5*c*(3). Chemical agent-contaminated PPE will not normally be worn or transported to change-houses or areas.

h. Field and laboratory operations only have to comply with paragraph 9–5*g*.

9–6. Design of operational chemical agent operating facilities

a. The following safety features will be included in the design and construction of chemical agent operating facilities and equipment:

(1) The exhaust ventilation system will be designed so that chemical agents or other chemical compounds in amounts harmful to humans or the environment are not discharged to the atmosphere. To achieve this, it is necessary to incinerate, filter, or scrub with a neutralizing solution or other approved technology all exhaust air from such areas before it is discharged. If chemical agent contamination is not reasonably expected, an alternative to filtering or scrubbing is to monitor the exhaust stack effluent to prevent continued release of agent vapors. Exhaust stacks will comply with the latest guidelines contained in ACGIH's Industrial Ventilation: A Manual of Recommended Practice. Systems should be designed and installed so that exposure of ventilation equipment mechanics to chemical agents is minimized.

(2) When a single filter or scrubber is employed, a gas life indicator or another suitable method to predict filter life will be used to allow filter change out before allowable SELs are exceeded.

(3) When high concentrations of chemical agent are involved and breakthrough of agent can be expected, preprocessing through a series of scrubbers or use of redundant (series) filters will be employed.

(4) Where ventilation is a sole or primary method of personnel protection, backup emergency power (automatic start generator) or other fail-safe systems will be installed to prevent a release of chemical agent in the event of an unplanned power outage.

(5) Exhaust ventilation system effectiveness will be measured (air velocity, static pressure, vacuum, and so forth) at least every 6 months or prior to initiation of operations when any changes in production, process, or control are made. This requirement is not necessary when ventilation system performance is continuously measured.

(6) New construction will meet all applicable DoD and Army regulations (such as U.S. Army Corps of Engineers and U.S. Army National Guard design specifications, and so forth) and appropriate national consensus standards (such as the criteria of the ACGIH, the NFPA, and ASHRAE). The APHC IH Field Services Program (MCHB–PH–IHF), 5158 Blackhawk Road, Aberdeen Proving Ground, MD 21010–5403 is available for consultation with regards to the application of facility construction criteria and concept development and design. Specific construction criteria must be adapted to protect the health of workers and the surrounding communities in chemical agent situations. Chemical agent air exhaust filters will be leak tested in accordance with the latest version of American Society of Mechanical Engineers (ASME) N511 (In-Service Testing of Nuclear Air Treatment, Heating, Ventilating, and Air Conditioning Systems).

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

c. The area where munitions are punched, drilled, or drained must be maintained under negative pressure during chemical agent operations and for as long as agent levels would exceed the levels in this pamphlet without the negative-pressure or ventilation system in operation.

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

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

f. Exits must be sufficient in size and number, in compliance with NFPA 101, to permit rapid evacuation of all personnel in the event of fire, explosions, or spills.

g. In laboratories and industrial operations, and in other places where chemical agent emergency showers and eyewash fountains are located, floor drains, if used, will be installed in accordance with Federal, State, and local regulations.

(1) All drains that could possibly receive chemical agent will be provided with liquid seals (traps), and they should be connected to a sump or collection tank where liquid can be sampled for chemical agent analysis and further neutralized if chemical agent is present.

(2) Vents from holding tanks and drain lines must be engineered to preclude chemical agent leakage to the atmosphere.

(3) Wherever floor drains are provided, all floors will slant toward drains at an incline sufficient to provide surface drainage.

h. The electrical system will comply with NFPA 70.

i. In any operation where a power failure would give rise to a hazardous situation, an auxiliary electrical power source or a fail-safe system will be used.

(1) The auxiliary electrical power source or fail-safe system will be tested at least annually or in accordance with the requirements of NFPA 70B and NFPA 110.

(2) The test will involve insuring that pressure differential gradients are maintained and can be developed locally.

j. Regarding construction materials, the following apply:

(1) Nonporous steel, glass-brick, and reinforced concrete are approved materials.

(2) Materials such as wood or other porous materials that absorb chemical agent are difficult to decontaminate and should be minimized in the construction of buildings where chemical agent is to be stored, handled, or processed.

(3) Stainless steel and enameled steel are good materials for doors, cabinets, and furniture in chemical agent areas.

(4) Existing facilities constructed of porous materials should be sealed, as appropriate, to enhance decontamination.

k. An audible and visual warning system should be used to provide an immediate warning to all personnel near the operational facility and within the one percent lethality distance, based on the worst-case risk in the event of a known or potential chemical agent release.

l. These ventilation procedures apply:

(1) Local exhaust ventilation is the most effective and preferred method of controlling chemical agent vapor.

(2) Dilution ventilation may be required for specific conditions where local exhaust ventilation is not practical.

(3) In general, ventilation airflow should be from clean areas to areas of increasing potential or actual contamination.

(4) Filtration units must incorporate differential pressure monitoring devices across, and test ports between, each individual filter and pre-filter. Airflow gauges or alarms should be used to verify proper ventilation conditions.

(5) Chemical agent operating areas will be provided with an appropriate ventilation system to:

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

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

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

(6) The SELs provided in table 9–1 are primarily an engineering guideline. These limits should be attainable by a well-operated facility, give an early indication of upset conditions, and be accurately measurable in a timely manner.

Table 9–1
Source emission limits

Chemical symbol	GD	GA/GB	VX	H, HD, HT[3]	L
SELs (mg/m^3)[1,2]	.0001	.0003	.0003	.03	.03

Notes:

[1] No individual will be intentionally exposed to direct skin or eye contact with any amount of solid or liquid chemical agent or to solid materials contaminated with chemical agent.

[2] The SELs are primarily an engineering guideline. These limits should be attainable by a well-operated facility, give an early indication of upset condition, and accurately measurable in a timely manner.

[3] HT is measured as HD.

m. Gloveboxes used for containment of chemical agent will provide the following:

(1) Pressure within gloveboxes will be a minimum of 0.25 inches of water as static pressure.

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

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

(4) If a glovebox has large or permanent openings to the surrounding lab, it should be considered a ventilation hood and subject to criteria in paragraph 8–3*b*.

(5) If a chemical agent operation will involve pressurized vessels within a nonventilated or closed-system glovebox, that glovebox will be capable of containing the maximum credible pressure release from the vessels and will be leak-tested prior to each operation. A glove box with air that is supplied and exhausted by means of permanent integration to the facility ventilation system does not fall within the scope of this requirement.

(6) Gloveboxes must have a maximum leakage rate of 0.5 percent of glovebox volume per hour when tested at a negative pressure differential of 1.5 inches water gauge.

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

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

chemical agent extend outside engineering controls, double-walled lines, or equivalent redundancy will be used.

9–7. Design, construction, and testing of chemical agent ductwork

The following are mandatory requirements for chemical agent ductwork materials, construction, and leak test performance. These requirements apply to exhaust ductwork systems for fixed location chemical agent facilities.

a. The default materials and construction will be as described in paragraphs 9–7*d*(1) and 9–7*d*(2). The default gasket, sealant, and duct flow test plug materials will be as described in paragraph 9–7*e*.

b. Variations from the default requirements are appropriate for some applications, but will only be approved via a documented risk assessment with concurrence from, but not limited to, the designer, the end user, operational subject matter experts, IH, safety, and maintenance personnel. Factors to be considered in the risk assessment will include, but not be limited to—

(1) Identification of potential chemical agents and their decontamination and degradation reaction products, and evaluation of their chemical properties with respect to ductwork system materials, including deterioration and absorption.

(2) Concentrations and frequency of chemical agents expected in duct systems based on the application or service. Examples include—

(a) Laboratory – dilute agent only.

(b) Laboratory – neat agent, small quantities.

(c) Agent synthesis.

(d) Decontamination operations.

(3) Connected devices such as gloveboxes or hoods.

(4) The need for pre-filtration at the outlets of connected devices, where applicable.

(5) Environmental factors such as exposure to weather.

(6) The potential for novel chemical agents or changes in applications over life of duct system.

c. A new risk assessment is required for any variation from the selected materials during construction and for any change in system layout or application. Construction specifications will include this requirement.

d. These are the minimum requirements for ductwork materials and construction:

(1) *General.*

(a) Flanged and collared joints. Provide flanged or collared gasketed joints where required to enable future changes in duct and equipment arrangement, or to install prefabricated components and equipment such as air valves or silencers. Flanged and collared joints will be accessible on all sides for visual inspection and for gasket or component replacement. Collars will be products specified by the prefabricated component or equipment manufacturer and be installed within the manufacturer's stated tolerances for alignment.

(b) Dampers. Isolation dampers will be tested and certified as "zero leakage," in accordance with Air Movement and Control Association (AMCA) 511-13 and AMCA 500–D.

(c) Ductwork. Ductwork should be designed to be easily decontaminated during renovations and demolition using liquid, aerosol, or other accepted methods. The method of proposed decontamination will be addressed in the risk assessment.

(2) *Default materials and construction.*

(a) Material: stainless steel Type 304 or 316.

(b) General construction: in accordance with applicable Sheet Metal and Air Conditioning Contractors' National Association (SMACNA) standards.

(c) Thickness: minimum 18 gauge thickness and otherwise in accordance with SMACNA, to accommodate design over- or under-pressure limits, including the ends of prefabricated components (such as silencers) that are butt welded to duct ends.

(d) Finish: No. 2B Bright, cold rolled in accordance with American Society for Testing and Materials (ASTM) A480.

(e) Joints and seams of ducting and prefabricated components: butt welded except where flanged or collared gasketed joints are provided to allow for future changes in duct and equipment arrangement, or to install prefabricated components (such as air valves).

(3) *Alternative materials and construction.*

(a) General: alternative materials and construction must be approved through the risk assessment procedure described in paragraph 9–7*b*.

(b) Construction: in accordance with applicable SMACNA and ASTM International standard(s) and manufacturer's recommendations.

(c) Galvanized steel: minimum Class G90 coating in accordance with ASTM A653.

(d) Repair of damaged coating materials: After fabricating galvanized or corrosion-resistant coated steel duct sections, interior and exterior will be inspected for coating damage and uncoated surfaces. Damaged and uncoated surfaces of galvanized steel will be repaired with materials and methods in accordance with ASTM A780. Other coatings will be repaired as recommended by the coating manufacturer.

e. For gasket, sealant, and duct flow test plug materials, the specific formulations for materials used in ductwork construction and in prefabricated equipment will be verified by the ODASAF as adequate for intended use.

(1) Default materials: Butyl rubber (isobutylene isoprene rubber) 98% or ethylene propylene diene monomer (formulation).

(2) Alternative materials selected as part of the risk assessment will be approved by the ODASAF.

(3) Silicone gaskets and sealants will be used only in locations that are fully contained within the ductwork.

f. The ductwork system leakage rate tested in accordance with ASME AG–1 will be no greater than the maximum leakage rate of any individual connected filtration unit housing or glovebox. Note: ASME AG–1 specifies a positive pressure test. The same method can be used for exhaust ductwork by negatively pressurizing it.

9–8. Criteria for containment of operations

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

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

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

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

(3) Removal, installation, and/or replacement of fuzewell plugs, supplementary charges, bursters, and so forth, after the burster well has been sampled within vapor containment and found to be free of chemical agent. Note: if components are stuck and require abnormal methods to remove, paragraph 9–8*c*(1) applies.

c. The two types of containment are total containment and vapor containment. With both types of containment, the containment structure or facility will be equipped with a means of entrapping or detoxifying the evaporated or aerosolized chemical agent. This is accomplished using filters, scrubbers, incinerators, or other appropriate means. The types of containment are described as follows:

(1) *Total containment.* Total containment will be provided by equipment or facility of an approved design that ensures sufficient capacity and strength to contain all combustion and detonation gases, fragments, and chemical agent from the largest explosion that could occur based upon the propagation characteristics of the ammunition. Reference DDESB Technical Paper 15 for approved total containment systems.

(2) *Vapor containment.* Vapor containment will be provided by facilities or equipment of a design approved by DDESB that will prevent the release of detectable quantities of chemical agent by the use of one or more of the following: negative pressure, controlled pressure, single- or multiple-walled enclosures. Designs for such vapor containment are usually tailored to the operation involved. Examples are hoods, gloveboxes, cabinets, rooms, buildings, and double-walled pipes.

d. The selection of the type of containment is dependent upon the nature of the operation involved. Types of containment for various operations are total containment and vapor containment. Total containment is required for those operations involving ammunition that contains explosive components and chemical agents whenever the operation may subject the explosive components to a potential initiating stimulus. Vapor containment is required for those operations involving intentional release of chemical agents in bulk or in ammunition containing both chemical agent and explosive components wherein the operations do not subject the explosive components to a potential initiating stimulus. Examples of disassembly, demilitarization, and disposal operations that normally require total or vapor containment are listed in paragraphs 9–8*d*(1) and 9–8*d*(2) For situations not specifically listed, adherence to the principles mentioned in paragraph 9–8*c* will provide the necessary guidance for proper selection of the required type of containment.

(1) Operations requiring total containment include:

(a) Machine tool operations (such as cutting, sawing, drilling, punching, and shearing of ammunition) if the operation requires the cutting tool to remove or displace metal before or after contact with the explosives.

(b) Situations in which the ammunition arming and functioning environments can be duplicated by the sequence of operations or process machinery.

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

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

(e) Disassembly of explosive components from ammunition where undue force is required to accomplish the disassembly. For example, tools used for disassembly must not apply significantly greater leverage, torque, extraction, or compression force than those required for the assembly. Undue force is any force that could cause any explosive component of the explosive train to be damaged and/or initiated.

(2) Operations requiring vapor containment include:

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

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

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

(d) Other than normal surveillance inspections, removal of fuzes, lifting plugs, or other components that result in access to areas of munitions where chemical agent may be present. Note: In the event bursters or other explosives components are stuck and require abnormal methods for removal, the requirements in paragraph 9–8*c*(1) will be followed or the chemical agent will be removed (drill, drain, and detoxify) and the burster destroyed by demolition methods.

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

(f) Opening containerized leaking munitions.

9–9. General separation distance criteria

a. The risk to personnel at any point in the path of a chemical agent cloud released from munitions, containers, or processing facilities as a result of a mishap or leakage is a function of the chemical agent

and its concentration. The mean concentration is influenced by the general climatic conditions, particular temperature gradient near the ground, and the topo-graphical features.

b. Persistent chemical agent concentrations are even more affected by natural conditions because, in view of the time factor involved, much wider variations are likely to occur, alter diffusion, and cloud travel characteristics. Evaporation from the source is an additional factor that varies considerably with temperature, wind speed, and the vapor pressure of the agent.

c. The accidental functioning of the burster charge in a chemical munition results in the greatest aerosolizing of the chemical agent filler requiring prompt action to identify the path and downwind concentration of the agent cloud.

d. In consideration of the variables involved, operational facilities, activities, and storage sites must be sited in compliance with the DESR 6055.09 to provide the maximum separation distance (for example, public access exclusion distance (PAED)) to unrelated personnel.

9–10. Maximum credible event

a. In accordance with DESR 6055.09 and this pamphlet, the potential for a mishap or incident must be carefully analyzed to determine the MCE that could occur and cause chemical agent release.

b. The MCE must be realistic with a reasonable probability of occurrence considering the explosion propagation, burning rate characteristics, and physical protection given to the items involved. For chemical munitions that are explosively configured, the MCE will be based on functioning of the most disruptive explosive component present that would produce the maximum release of chemical agent. The potential for functioning of the explosive component, the propagation characteristics of the munitions given packaging, and the potential for damage to adjacent munitions sufficient to cause a sympathetic detonation or release of the chemical agent filler must be considered and should be addressed. The MCE evaluated on this basis may then be used as a basis for effects calculations and casualty predictions.

c. For chemical munitions that are not explosively configured, the potential for spillage or leakage of the chemical agent fill usually provides the basis for the MCE. Other factors affecting the MCE are rate of release, puddle size, time of decontamination, type of surface, and the chemical agent's characteristics.

9–11. Public access exclusion distance

a. PAED is defined as the greater of the IBD (based on the fragment hazard distance or the net explosive weight of the munitions) or the one percent lethality distance defined below. For siting purposes, personnel not directly associated with chemical operations are not to be allowed within the PAED. Personnel who have a means of evacuation, a briefing on evacuation procedures, and access to a warning system (automated, radios, or manual) that would enable them to escape prior to chemical agent exposure may be allowed within the PAED in lieu of absolute exclusion. Details of the evacuation procedures will be included in the CSP and MRCSS.

b. One percent lethality distance.

(1) The one percent lethality distance is calculated from a given MCE and meteorological conditions (temperature, wind speed, and so forth) and is established as the distance at which the dosage from an MCE or actual chemical agent release would be 150 mg-minute/m3for H and HD agents, 75 mg-minute/m3 for HT agent, 150 mg-minute/m3 for L, 10 mg-minute/m3 for GB agent, 4.3 mg-minute/m3 for VX vapor, and 0.1 mg for inhalation or deposition of liquid VX.

(2) The meteorological conditions used will be the existing conditions in the event of an actual chemical agent release or the realistic, worst-case conditions used will be the existing conditions for siting purposes.

(a) Meteorological information must be obtained from an accurate source, with the methodology presented in DDESB Technical Paper 10.

(b) Use of a computer program or model (such as D2PC, D2Puff) to predict downwind hazards must be consistent with DDESB Technical Paper 10.

(3) Downwind hazard prediction model requires approval at Headquarters, DA level. Requests for approval to use a new model or to modify an approved model will be sent to Director, U.S. Army Nuclear and Combating Weapons of Mass Destruction Agency (MONA–CAB) and ODASAF for technical review.

(a) Submissions will include the rationale and benefits of using the proposed model.

(b) Requests will contain a copy of the documentation to include source codes, verification and validation test results, and any other test data, to include field trials.

(c) U.S. Army Nuclear and Combating Weapons of Mass Destruction Agency will conduct necessary technical and operational review staffing and forward justification and recommendation to ODASAF.

9–12. Inhabited building distances

IBD for chemical munitions containing both explosive components and chemical agent filler will be as shown in applicable tables of DA Pam 385–64, based on the hazard class involved. This distance category is applicable to separation of nonrelated operations, conventional ammunition storage, and installation boundaries from chemical operations.

9–13. Intraline distance

ILD for chemical munitions containing both explosive components and chemical agent filler will be as shown in tables of DA Pam 385–64 based on the hazard class of the munitions involved. This distance category is applicable to separation of related operations, facilities, and support facilities within chemical agent operating areas such as maintenance buildings, change-houses, lunchrooms, field offices, laboratories, laundries, and storage magazines. ILD will be a minimum of 66 feet from potential source of chemical agent release to the other facilities, whether or not explosive components are involved.

9–14. Magazine distance

Magazine distance for chemical munitions containing both explosive components and chemical agent filler will be as shown in tables of DA Pam 385–64 based on the hazard class of the munitions involved. For storage of dissimilar class 6.1 poison agents (without explosives) the magazine distance is 50 feet.

9–15. Public traffic route distance

For chemical hazard distance computation purposes, all state and multilane interstate highways and major passenger railroad lines will be considered as public traffic route areas and the greater of the public traffic route distance per DA Pam 385–64 or one percent lethality distance will apply. With respect to the application of one percent lethality distance, other roads and railroads will be evaluated on a case-by-case basis, with consideration given to the traffic density for peak periods.

9–16. Site planning before and response to a chemical agent mishap

a. For site planning purposes a hazard zone (one percent lethality distance) will be calculated in accordance with DESR 6055.09. Positive controls are required to exclude, evacuate, or otherwise protect personnel in that hazard zone in the event of a chemical agent mishap. CSPs submitted for DDESB approval will describe these positive control measures.

b. In the event of an actual chemical agent release that threatens unprotected personnel, every effort must be made, in proper coordination with civil authorities, to evacuate or take other appropriate protective action in accordance with the following (as applicable):

(1) Federal Emergency Management Agency Chemical Stockpile Emergency Preparedness Program guidance. Protective actions should be directed toward preventing or reducing exposures above the AEGL–2. A protective action recommendation should be provided stating that no action is required to protect the public from AEGL–1 exposure, but the projected AEGL–1 plume should be provided to local emergency management officials for use at their discretion.

(2) Approved MRCSS (with amendments) for the site. Protective actions may be prescribed in the MRCSS (with amendments) approved by the USATCES and/or DDESB.

(3) Agreements with local emergency management officials. Protective actions may be prescribed in written agreements with local emergency management officials. The criteria and rationale should be documented and coordinated with all affected parties.

c. Site emergency response plans may consider populations for which protective actions are not necessary due to their increased distance from the site. This is acceptable and demonstrates planning is thorough even if protective actions are deemed unnecessary.

9–17. Quantity distance criteria specific to chemical munitions

The requirements of this paragraph apply to facilities for which CSPs are produced or modified after the publication date of this pamphlet. CSPs that were produced and approved prior to the publication of this pamphlet need not be modified for the sole purpose of adhering to these requirements. The following criteria are applicable to chemical munitions:

a. The PAED will be applied from chemical facilities, storage, and operations to unrelated facilities and their related support facilities.

b. As a minimum, the IBD will be applied from conventional munitions storage, operations, and facilities to chemical facilities and their related support facilities.

c. Combined chemical and explosive change-houses will be partitioned and will be separated by the appropriate one percent lethality distance or IBD from each area served.

d. Facilities for housing security personnel who are required by their mission to have a quick reaction capability in the immediate vicinity of a potential mishap or incident site will be sited not less than barricaded ILD based on the amount of explosives stored in nearby magazines. If sited inside a 60-degree angle from the unbarricaded door end of an igloo, unbarricaded ILD will be used. In any case, the distance will not be less than 150 feet.

e. Conventional ammunition storage magazines and chemical storage magazines are required to be separated by magazine distance.

f. Drinking water or other suitable replenishment liquid may be located 100 feet upwind, based on local risk assessment.

g. Eating, drinking, chewing, and smoking areas must be located at no less than unbarricaded ILD.

h. For siting of chemical facilities that present different hazards, PAED will be applied. Where similar hazards are presented, unbarricaded ILD is appropriate. Barricaded ILD is not appropriate when personnel are exposed.

i. For siting chemical facilities and operations, the PAED calculated in accordance with paragraph 9–11 will not extend beyond the boundaries of Government-controlled land. Operational and meteorological restrictions need to be applied to keep hazard distances on post.

Chapter 10
Shipping

10–1. Shipping requirements

a. Movements involving chemical agents must comply with applicable Federal, State, and local laws, including Section 1512a, Title 50, United States Code (50 USC 1512a), 49 CFR 172, AR 200–1, DTR 4500.9–R, AR 190–59, AFMAN 24–204/TM 38–250/NAVSUP PUB 505/MCO P4030.19I/DLAI 4145.3, and with the notification requirements of the CWC.

b. Chemical agent munitions and containers are classified by the DoT as Class 1.2 explosive or, if without explosives components, 6.1 poison. In addition to identifying the proper shipping name, hazard class or storage compatibility group, United Nations serial number, packaging group, and EX-number (a DoT-assigned reference number), the following rules apply:

(1) Military munitions containing poison materials but not equipped or packaged with ignition elements, bursting charges, detonating fuzes, or explosive components must be labeled with the applicable poison label and marked nonexplosive (49 CFR 172.101).

(2) Military munitions containing poison materials and equipped with ignition elements, bursting charges, detonating fuzes, or explosive components must be labeled with the applicable poison label and the applicable explosive label (49 CFR 172.101).

c. Commanders, directors, and program executive officers or program managers of NTA defense facilities or their designated representative in the grade of colonel or above, or the civilian equivalent, are responsible for approving NTA moves between or within Army entities.

10–2. Transportation

The following are prohibited from transport in privately owned vehicles: neat chemical agents, NTAs, chemical precursors, dilute chemical agents, chemical agent related environmental samples, and items and/or equipment that do not meet the definition of clean.

a. Technically qualified personnel will conduct a hazard analysis for on-post movements of chemical agent and NTAs. Such movements will be governed by an approved SOP and the supporting hazard analysis.

b. The hazard analysis should include—

(1) Personnel protection.

(2) MHE.

(3) Procedures used in removal from storage.

(4) Item containment.
(5) Loading and unloading of the transportation vehicle.
(6) Suitability of the transportation vehicle (such as truck bed, open truck bed, or closed van).
(7) Transportation route to include distances involved, population exposure, surface types, and traffic to be encountered.
(8) Monitoring requirements.
(9) Emergency response procedures.

c. Materials contaminated with chemical agents may be transported from one location to another. The material will be encapsulated within a chemical agent tight barrier. The below items must be placed in compatibly lined drums or provided with other suitably tested containment before being transported.
(1) Items potentially contaminated with liquid chemical agent.
(2) Items suspected of presenting hazards of inhalation or percutaneous exposure to a chemical agent.

10–3. Shipment of environmental samples

a. Environmental samples may consist of soils and other solids, liquids, sludge, and vegetation. The chemical agent hazard of potentially contaminated samples will be characterized using headspace monitoring, extraction methods, generator knowledge, or other appropriate method prior to shipment to a laboratory for analysis. Prior to shipment the sender will document the chemical agent hazard level and the laboratory chemical hygiene controls that adequately protect against that hazard. If unprotected exposure to the chemical agent hazard (for example, chemical hygiene controls fail) could be life threatening, the sample should be sent to a laboratory accustomed to working with chemical agents. In all cases, it is recommended that the sender notify the receiving laboratory that environmental samples are coming from a potential chemical agent site.

b. All on-post movement of environmental samples must conform to the requirements listed in paragraph 10–2.

c. Off-post shipments of environmental samples must be prepared and transported in accordance with all DoT requirements for hazardous materials (49 CFR). Consideration must be given to the suspected chemical agents when determining the proper shipping name.

10–4. Shipment of dilute chemical agents

a. Chemical agents, including dilute chemical agents, must be shipped in accordance with DOT requirements for hazardous materials (49 CFR). For dilute chemical agents, consideration must be given to the chemical agents and the solvent present when determining the proper shipping name.

b. Chemical agent (to include dilute chemical agent) shipments must be shipped in a Laboratory Sample Container (LSC). Each LSC must be overpacked in a wooden box. The inner packaging must be an impact-resistant receptacle of glass, earthenware, plastic, or metal securely cushioned with a nonreactive, absorbent material. Receptacles that are not flame-sealed will have a closure which is physically held in place by any means capable of preventing back-off or loosening of the closure by impact or vibration during transportation.

c. The following packaging requirements are mandatory for all on-post NTA shipments.
(1) A vial, compatible with the NTA being transported, with a screw cap that is sealed with parafilm or a similar device will be the primary container. The primary container must be visually inspected for leaks.
(2) Each primary container will be placed in an unbreakable, leak-proof sealed secondary container with enough absorbent material (such as vermiculite) between the two containers to contain liquids in the event the primary container breaks or leaks. A sample mailing tube with screw top lid or similar device will be used as secondary container. Each secondary container may contain only one primary container.
(3) The secondary container will be placed in a tertiary container. An absorbent material (such as vermiculite) will be placed between the two containers. A metal can with a screw top lid, or similar device, will be used as a tertiary container.
(4) The tertiary container is placed in a carrier (such as a butyl rubber bucket) for transport.

d. NTAs will be accompanied by at least two Chemical Personnel Reliability Program-certified personnel.

Chapter 11
Chemical Agent Training

11–1. Training overview

a. The provisions of this chapter are applicable only to—

(1) Military training operations involving toxic chemical G-series agents and VX at the Chemical Defense Training Facility (CDTF) at the U.S. Army CBRN School, Fort Leonard Wood, MO.

(2) Operations directly associated with, and in support of military chemical agent training at the CDTF.

(3) Operation of the CDTF.

b. Where conflicts exist between the requirements of this chapter and other parts of this pamphlet, the requirements of this chapter have precedence.

c. Special usage of terms applicable only to the CDTF.

(1) *Short-term exposure limit.* As used at the CDTF, monitoring at this concentration occurs in two general locations: in the chemical agent area where no agent is introduced and in unprotected worker work areas as outlined in the CDTF Air Monitoring plan. Within the unprotected worker work areas, this level of chemical agent concentration is used as an action level at which workers must evacuate or wear respiratory protection.

(2) *Chemical defense training facility maximum concentration limit.* The chemical defense training facility maximum concentration limit (CMCL) is the maximum level at which a NATO/U.S. Military-approved APR may be worn during chemical agent training operations. The CMCL is the concentration level at which chemical agent vapor is monitored in chemical agent areas. Any use of commercial NIOSH CBRN certified APR will be consistent with manufacturer's guidelines.

11–2. Airborne exposure limits

a. Personnel working or training in areas where chemical agent may be present will not be exposed to concentrations exceeding the criteria specified below (see table 11–1).

b. Unrelated personnel will not be knowingly exposed to concentrations of GB above 0.000001 mg/m3 or VX above 0.0000006 mg/m3, averaged over 24 hours (GPL).

c. There will be no deliberate release from the facility that exceeds the applicable SEL.

d. No individual will be intentionally exposed to direct skin or eye contact with any amount of liquid chemical agent.

11–3. Chemical agent monitoring during training exercises and operations

a. A quality assurance plan for monitoring will be developed in accordance with paragraph 3–2*d*.

b. When monitoring indicates exceedances of a chemical agent above the 8-hour TWA WPL in areas where exceedances are not expected, then the actions in paragraph 3–8 will be followed.

c. Adhere to the requirements in paragraphs 3–2 and 3–3.

d. A monitoring plan will be developed in accordance with paragraph 3–7.

e. Records of monitoring will be maintained in accordance with paragraph 3–4.

f. Toxic chemical agent area (training bays) monitoring will be accomplished with the lightweight, portable, real-time (MINICAMS®) to CMCL and STEL levels in accordance with the facility Air Monitoring Plan and locally developed deliberate risk assessments.

g. Continuous monitoring with NRT monitors or real-time monitors to the STEL level is required for the following areas: the laboratory, the medical room, in cold laundry when the door is open to hot laundry, the cold corridor during chemical agent operations and training, Laboratory vestibule during chemical agent operations, mask check vestibule during chemical agent operations, and the filter bank building during change out of v-bed carbon filters, pre-filters, and high-efficiency particulate absorbing filters. The Half Source Emission Limits (HSEL) is the chemical agent concentration that is used to monitor the exhaust stack and all levels of the filter banks.

h. Historical monitoring to the WPL will be accomplished with DAAMS or other approved historical monitoring method in the nonagent work areas in accordance with locally developed policy.

i. Potentially contaminated equipment and protective clothing (for example, MPPCAH) that has been decontaminated in accordance with chapter 5 and locally developed procedures, will be monitored with a NRT monitor or DAAMS. Equipment and/or clothing will be managed as MPPCAH until inspected and documented as either MDCAH or MDAS. MDCAH may only be released to chemical agent workers

wearing the proper PPE. Equipment and tools that are documented as MDAS (see chap 5), which may be released to the public, do not require monitoring.

11–4. Personal protective equipment

a. For chemical agent training and support operations, the following levels of protection are defined. Increased levels of protection may be used to support specialized training or high-risk operations, as determined by the CDTF commander or director.

(1) *Level 1.* NIOSH CBRN certified or NATO/military-approved mask; approved chemical protective overgarment with hood; coveralls or trousers (optional during warm weather); optional chemical splash apron; chemical protective boots (optional steel-toed chemical protective boot); chemical protective glove set; undershirt; drawers;

Table 11–1
Training airborne exposure limits

Occupational scenario	Chemical agents	
	GB (mg/m^3)	VX (mg/m^3)
Unmasked personnel in work areas monitored at up to the WPL[1]	0.00003	0.000001
Unmasked personnel in areas monitored to the STEL[2,3]	0.0001	0.00001
Masked personnel in the "Hot Area" (training bays) monitored to the CMCL[4,5]	0.2	0.02

Notes:

[1] WPL is an 8-hour TWA. This WPL applies only to selected work areas of the training building as identified in the Air Monitoring Plan. Exceedances are handled in accordance with paragraph 3–8 of this pamphlet.

[2] At this level of chemical agent concentration, unprotected workers must evacuate or wear respiratory protection.

[3] At any time that a STEL concentration is detected in unprotected worker work areas, personnel must evacuate or wear protective masks. A NATO or military approved protective mask may be worn at levels up to the CMCL.

[4] Personnel in areas exceeding this concentration must either evacuate to an area of lower concentration or be outfitted in Level A.

[5] See definition of CMCL in paragraph 11–1c(2).

socks; combat boots or other foot gear designated as part of the duty uniform for training.

(2) *Level 2.* NIOSH CBRN certified or NATO/military-approved mask; approved chemical protective overgarment with hood; coveralls or trousers (optional during warm weather); chemical protective boots (optional steel-toed chemical protective boot); chemical protective glove set; undershirt; drawers; socks; combat boots or other foot gear designated as part of the duty uniform for training.

(3) *Level 3.* NIOSH CBRN certified or NATO/military-approved mask with hood; coveralls or duty uniform; optional chemical splash apron; chemical protective boots (optional steel-toed chemical protective boot); chemical protective glove set; undershirt; drawers; socks; combat boots or other foot gear designated as part of the duty uniform for training.

(4) *Level 4.* NIOSH CBRN certified or NATO/military-approved mask slung or readily available; coveralls; chemical protective boots (optional steel-toed chemical protective boot); undershirt; socks; drawers, and gloves as specified in the CDTF Toxicological Chemical Agent Safety Plan or CDTF SOPs.

(5) *Level 5.* NIOSH CBRN certified or NATO/military-approved mask readily available except when specified elsewhere in this chapter; street clothing. In the laboratory, a lab coat may be worn during chemical agent operations or when required.

(6) *Gloves.* TAP gloves will be worn when specified in this chapter or in the CDTF Toxicological Chemical Agent Safety Plan or CDTF SOPs.

b. Nonstandard gloves may be used in place of standard TAP gloves for chemical agent operations requiring special handling consideration, such as laboratory operations where good hand dexterity is essential for glovebox operations, subject to the following requirements and in accordance with a locally approved glove use and change-out plan:

(1) The nonstandard glove selected is limited to use in operations where standard gloves cannot be used because of safety or operational considerations.

(2) The nonstandard glove selected will have its chemical agent penetration resistance ascertained by testing each purchased lot under an AQL plan, as described in paragraph 4–7.

(3) Nonstandard gloves will be used only in a manner that does not pose a high probability for liquid agent contamination of the gloves. In the event of actual or potential liquid contamination, the gloves will be decontaminated and removed as soon as feasible. They will be disposed of in accordance with chapter 5.

(4) Nonstandard gloves used in the laboratory hood may be cleaned, removed, and left inside the hood by the edge if no known liquid contamination is observed. These gloves will be replaced in accordance with locally written and approved procedures. In the event of actual or potential liquid contamination, the gloves will be decontaminated and removed as soon as feasible.

c. Commercially available EEDs may be used under certain conditions for the protection of transient personnel. These devices are an acceptable alternative to issuing the NATO/military-approved mask as an escape device.

(1) They must be oxygen supplying and NIOSH-certified as an escape device.

(2) Upon approval by the OTSG, alternative respirators may be substituted, as appropriate.

d. The required level of protection will be determined for each operation and must be specified in an SOP. Conditions under which the various levels of protection are required will be described in the CDTF Toxicological Chemical Agent Safety Program document and local SOPs and will take into account such factors as the level of concentration of chemical agent present, whether liquid or aerosol contact is reasonably possible, and the activity being performed.

e. Local policy will determine required PPE for nonchemical agent workers.

f. For CDTF operations, NATO/U.S. military-approved APR may be worn in chemical agent environments up to the CMCL concentration levels. NIOSH CBRN certified respirators will meet the NIOSH APF.

g. Protective clothing must be in serviceable condition and properly fit the wearer. Unserviceable clothing will not be used for chemical agent training.

h. All TAP clothing used in chemical agent operations must be sent to the laundry for inspection and testing semiannually. All TAP gloves and boots will be leak tested prior to issue and use, in any of the following circumstances:

(1) When they are newly removed from stock.

(2) After each laundering.

(3) When they have not been tested within the previous 6-month period.

(4) Whenever there is evidence of deterioration or damage that might cause leakage.

i. The glove set, glovebox gloves, and military approved chemical over-boots will be leak tested in accordance with local procedures and TMs. Masks, coveralls, aprons, and so forth may be marked by affixing flexible plastic tags or similar devices to the item or by stenciling in ink, in accordance with TMs. Each wearer will assure serviceability of their PPE by visual inspection before use.

j. The requirements for decontamination and laundering of protective clothing will be as follows:

(1) The TAP clothing, worn in known or suspected chemical agent vapor contaminated areas, will be in accordance with locally approved procedures.

(2) Clothing will be placed in a container or bag sealed to prevent escape of chemical agent vapors.

(3) After at least 4 hours at a location providing a minimum ambient temperature of 70 degrees F (or 21 degrees C), the atmosphere inside the container will be monitored for chemical vapor concentrations. Monitoring will be performed using an approved method to verify that chemical agent vapor concentrations do not exceed the STEL concentrations specified in table 2–1. No items must be evacuated to unprotected worker work areas until this standard is met.

(4) The CDTF will inspect the integrity of protective clothing in accordance with appropriate TMs.

k. Autoclaving overgarments and reissue of chemical PPE for chemical agent training is authorized within the limits of approval granted to the CDTF.

l. Chemical protective overgarments (excluding gloves and boots) that have been exposed to a liquid chemical agent or are otherwise unserviceable will be segregated, decontaminated, monitored to the STEL, bagged, and manifested for incineration.

m. Butyl rubber protective clothing contaminated with petroleum base products, including solvents or lubricants, will be disposed of in accordance with CDTF SOP.

n. In activities where respiratory protection is required, a program for selection, use, inspection, testing, and maintenance that complies with AR 11–34, and TM 3–4240–349–13&P, TM 3–4240–350–13&P, and other applicable guidance will be established. The program will include the following essential elements:

(1) *Selection.* Mask selection for chemical agent training at the CDTF will conform to military lesson plans which specify the mask to be used for military training.

(a) Quantitative fit-testing will be performed for the NATO/military-approved masks that are used at the CDTF. CDTF will conduct the sixth quantitative fit test step of "walking in place" in addition to those described in applicable mask's technical manual.

(b) Protective mask canister or filter elements must be approved for their intended use and meet serviceability requirements of applicable TMs and SBs. Military mask filters may be used for one chemical agent training exercise iteration only with no reuse. A training iteration begins upon entering the chemical agent area and ends upon doff-out from the chemical agent area.

(2) *Wearer instructions.* The wearer will be properly fitted and trained in the use and care of the device, and the means by which it gives protection.

(3) *Mask seal checks.* To ensure proper seal of masks prior to entering areas of known or suspected chemical agent contamination, mask seal checks will be conducted in accordance with local procedures and any applicable regulatory guidance.

11–5. Decontamination

a. Marking, tracking, and segregation of potentially contaminated tools, items, and equipment.

(1) The CDTF will use and follow a standard method of marking and tracking of decontaminated potentially contaminated tools and equipment that have been exposed to chemical agent. The method used will be defined in locally developed procedures or plans.

(2) Any item taken into the hot area will be considered to be exposed above STEL, unless it is documented that the item was never in an area with concentration above STEL (such as through use of air monitoring records, tracking logs for its movement within the hot area, and so forth). Before being removed from the hot area these items will be decontaminated and monitored to below STEL in accordance with CDTF SOPs and/or a CDTF material decontamination plan. These items will be tracked, per paragraph 11–5*a* and stored in a manner which precludes access by transient or nonchemical agent workers. If an item is to be released to nonchemical agent workers or to the public, it must be monitored to the level prescribed in chapter 5.

(3) When removed from the hot zone, these items will be marked, tracked, and stored as potentially contaminated items. The tracking marking will include identification of the item in some manner (such as by use of a serial number, paint, or other means). Smaller items, which cannot reasonably be marked or etched with a serial number or other marking, may be identified by a written description of the item in the tracking log. All the potentially contaminated items will be tracked as identified in local SOPs and Work Instructions by being logged by item, degree of decontamination (STEL, WPL), and all potentially contaminated items will be tracked, as outlined in local SOPs and Work Instructions, and logged by item, degree of decontamination (STEL, WPL), and personnel to whom the items may be released. The tracking of items will also include the date when it the item was first exposed to a chemical agent environment (taken into the hot area). Before being removed from the hot area, all such items will be decontaminated and monitored in accordance with CDTF SOPs and/or a CDTF material decontamination plan. The items will then be logged and/or marked to indicate the degree of decontamination (STEL, WPL) as identified in local SOPs and Work Instructions. The items will be stored in a manner which precludes access by transient or nonchemical agent workers. Subsequent entries of the item into the hot area do not have to be logged or tracked because, when in the hot area, the item will be assumed to be contaminated to at least STEL level and the item will not be removed from the hot area without first being decontaminated and monitored. Items ultimately processed for disposal will have an entry indicating the date the item was manifested for disposal and therefore removed from tracking.

(4) If an item is very small (such as small tools or pens used in training) and is a part of a tool kit or other assembly of items, it may be tracked by including its identification (description or other means of identification) in the tracking log. The larger item (such as a toolbox) will be marked appropriately (once removed from the hot area) and the assembly of items (such as toolbox and items in it) will be segregated according to the degree of decontamination and/or monitoring.

(5) Items decontaminated to the STEL may only be handled by chemical workers. Nonchemical workers may only handle items decontaminated to the WPL. Personnel who work at the CDTF under medical surveillance for nerve agent exposure are considered chemical workers and therefore may handle any and all items decontaminated to the STEL or lower. If a potentially contaminated item is to be released to nonchemical agent workers or to the public, it must be monitored to the level prescribed in chapter 5.

b. Decontamination agents. Standard decontaminating agents that are acceptable for decontaminating equipment or spills include the following:

(1) The STB slurry or HTH solution for agent VX.

(2) 10 percent sodium hydroxide or sodium carbonate solution for agent GB.

(3) Commercial liquid bleach (nominal 5 percent solution of sodium hypochlorite) for either GB or VX.

(4) Other approved decontaminants (such as DoD and NATO).

c. Decontamination equipment. Decontamination equipment procedures will be in accordance with applicable TMs and locally approved procedures.

d. Verification. Training-facility staff will verify the serviceability of decontaminating equipment.

e. Locations. Decontamination equipment will be positioned in locations that allow ready access to decontamination and emergency response personnel.

f. Chlorine-based decontaminants. Chlorine-based decontaminants will be tested in accordance with chapter 5.

11–6. Additional safety criteria for training facilities

a. Hazard analyses will be completed in accordance with this pamphlet and local guidance.

b. SOPs.

(1) The SOPs will be prepared in accordance with this pamphlet and local guidance.

(2) Where reliable communication between instructors or cadre and operations control is in effect, SOPs need not be posted within chemical agent training or operating areas (such as CDTF chemical agent training bays).

c. All bays in which GB or VX is used for training and/or for operations to support chemical agent training will be designed to prevent chemical agent release exceeding the limits specified in table 11–1.

d. To prevent the possibility of a contaminated item being removed from Government control, personal items (such as watches, rings, hairpins, currency, earrings, body piercings, and other personal effects) will not be taken into the chemical agent area of the CDTF. Any such items taken into the chemical agent area will be decontaminated, monitored to a level below STEL concentration, and processed for destruction.

e. A heat stress plan will be developed for CDTF operations and must be approved by the installation medical department activity and the Maneuver Support Center of Excellence Safety Office. This plan will include guidance for maximum wear times for chemical PPE.

11–7. Emergency response

a. Emergency response will be performed by Fort Leonard Wood Emergency Services trained responders. CDTF personnel will notify Fort Leonard Wood Emergency Services when there is a recognized emergency incident that exceeds the scope of internal mitigation.

(1) One ATNAA per person with assigned escape mask.

(2) The CDTF will pre-stage ATNAAs within chemical agent training area in accordance with local SOPs and work instructions.

b. The following emergency response equipment will be immediately available at any site or facility where training operations involving nerve-agent items are conducted:

(1) A communication system with which to summon aid.

(2) Suitable decontaminating materials.

(3) A supply of clean water for decontaminating purposes.

(4) Equipment and supplies to render first aid.

(5) Suitable, operable chemical agent detection equipment, appropriate for the type of agent (GB and VX) present.

c. The following additional emergency equipment, as a minimum, will be available for emergency use by trained personnel (quantities will be sufficient for the operation being performed as determined by the supporting medical department activity):

(1) Atropine.

(2) Pralidoxime (2–PAM chloride).

(3) Commercial liquid bleach (nominal 5 percent solution of sodium hypochlorite) for equipment decontamination.

(4) Clean water for flushing eyes and skin.

11–8. Laboratory safety

a. Chemical agent containment. Containment of chemical agent liquid and vapors is required at all times within a laboratory. Within the CDTF, transferring chemical agent from the laboratory hood, by the pass-through chute, into the service gallery, and subsequently to the training bays, is not considered removal from chemical agent containment engineering controls. When a chemical agent must be removed from the containment provided by engineering controls, the provisions of paragraph 8–1 apply.

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

(a) A double containment system.

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

(2) For quantities in excess of 1 ml of neat chemical agent, a double containment system is required.

b. Sample analysis. The DAAMS sample analysis may be conducted outside the ventilation hood within the engineering controls of the laboratory.

c. Chemical agent monitoring.

(1) The use of real-time or NRT monitors on a continuous basis capable of detecting concentrations of GB and VX at the STEL and CMCL level will be employed within the laboratory.

(2) During the first 5 days of new chemical agent operations, (for example, introduction of new chemical agents, significant material changes to any existing chemical agent operations), monitoring to the WPL will be conducted to verify the adequacy of engineering controls. Additional monitoring will be conducted at a minimum for 1 operating day quarterly, following any significant changes in the operation, or following any damage or repairs to the facility's primary ventilation system. Additionally, the laboratory is continually monitored by MINICAMS® to the STEL and CMCL as outlined in the CDTF air monitoring plan.

(3) First entry monitoring will be conducted in accordance with this chapter and chapters 3, 6, and 7.

d. Personal protective equipment. PPE, such as eye protection, butyl/protective gloves and, lab coats necessary to protect personnel during chemical agent operations will be available in the lab.

e. Scope. If chemical agent operations are conducted in open type system or a glove box with air that is supplied and exhausted by means of permanent integration to the facility ventilation system as such within the CDTF, then the requirement outlined in paragraph 9–6*m*(5) does not fall within the scope of this requirement.

f. Gloves. The nonstandard gloves used in the CDTF laboratory glove box which have undergone AQL testing will be destroyed and disposed of when the nonstandard glove comes in contact with liquid agent contamination or when the wear-time of 3 years upon placing into service expires. The nonstandard glove box gloves will be changed out monthly and undergo a recertification process via approved procedures, and re-issued for use in the lab glove box in accordance with local SOP.

11–9. Chemical agent storage safety

The CDTF will implement the following storage procedures:

a. Bulk synthesized agent may be re-packaged to smaller containers, and stored in these containers. Storage quantities of chemical agent will not exceed 1 liter in any single vessel or vial. Labeling will be in accordance with requirements of this publication and DA Pam 385–10.

b. Agent containers will be stored in a single containment system within a laboratory hood or in a double containment system.

11–10. Firefighting requirements

a. Firefighting personnel should wear full firefighter protective clothing (without TAP clothing) during chemical agent firefighting and rescue operations in buildings or areas containing agents GB or VX. Respiratory protection is required. Positive-pressure, full-facepiece, NIOSH-certified SCBA will be worn where there is a danger of oxygen deficiency, when a potential for chemical agent release exists, or when directed by the fire chief or chemical mishap incident response officer.

b. In cases where firefighters are responding to a chemical agent incident for rescue or hazardous material response, rather than firefighting, they will wear appropriate levels of PPE as described in paragraph 4–3*a* (level A), or as specified by the chemical mishap incident response officer in consult with the fire chief. For mishap or incident situations, the chemical mishap incident response officer may determine the proper level of protection required for initial entry teams and may modify existing levels of protective clothing to meet emergency requirements.

c. When firefighters respond to a chemical agent spill or other chemical agent incident, while wearing fully encapsulated (level A) PPE, the clothing and equipment worn under the level A suits will be

considered clean (never contaminated), provided that the level A PPE has not been breached, is properly decontaminated prior to removal, and that removal takes place in an environment below STEL concentration. The PPE worn under the level A may be reused.

d. Spill clean-up or remediation of contaminated areas in areas other than the medical treatment room, chemical agent training bays, rotunda, and service gallery, will be performed by the installation Fire and Emergency Services personnel, outfitted in OSHA level A PPE, including SCBA.

11–11. Emergency response for rescue purposes

The CDTF nonmedical personnel designated to perform emergency rescue operations in the event of an exposure or potential exposure of one or more personnel to chemical agent at the CDTF will comply with the following:

a. They will perform only emergency rescue actions (such as removal of an exposed student from a training bay or an exposed lab technician from the laboratory, cutting the individual out of his or her clothing and PPE, and disposing in accordance with local SOP, conduct a soap and water wash down of the casualty, and delivery of the individual to awaiting medical personnel). Spill clean-up or remediation will only be undertaken within the chemical agent training bays, rotunda, or service gallery area by CDTF personnel.

b. They will wear CDTF level 1 PPE (equivalent to Mission Oriented Protective Posture IV level).

c. They will meet the training or experience requirements for First Responder Operations Level personnel, under OSHA's HAZWOPER standard (29 CFR 1910.120), having at least 8 hours of training or sufficient experience to objectively demonstrate competency in the areas listed in 29 CFR 1910.120(q)(6)(ii).

d. They will not enter the contaminated area (training bay, lab, and so forth) if the concentration of chemical agent in the area exceeds the CMCL, the maximum limit at which use of the military approved protective mask is authorized.

e. They will not enter the contaminated area if, due to failure of or lack of monitoring equipment, the concentration of chemical agent in the area is unknown or cannot be determined.

Chapter 12
Meteorological Support to Chemical Incident or Mishap Response and Assistance Operations

12–1. General

a. This chapter provides guidance for meteorological support to CIMRA operations (see AR 50–6). It applies to chemical agent storage facilities, demilitarization and disposal facilities, and facilities for which the MCE and supporting risk assessment include an atmospheric chemical hazard after a chemical agent release.

b. Responsibilities and requirements for meteorological support to CIMRA operations will be defined in CIMRA plans (see para 6–8*c*).

c. After a chemical release, chemical agents may appear in the field as vapors, aerosols (droplets), or liquids. To understand the effect of chemical agents in the environment, the activity commander or director must also understand how weather and terrain affect those agents. The best way to be prepared for a chemical hazard is to do both of the following:

(1) Establish a network of meteorological sensors.

(2) Use approved meteorological and hazard assessment models per paragraph 12–3.

d. The Defense Threat Reduction Agency (DTRA) Operations Center has a robust modeling capability that is available 24 hours a day, 7 days a week. It is recommended that commanders of chemical facilities ensure DTRA Operations Center contact information is available in the event of an emergency: (877) 240–1187 or (703) 767–2003 (DSN 427-); dtra.belvoir.cz.mbx.joint-ops-center@mail.mil.

12–2. Factors affecting chemical incident or mishap response and assistance operations

a. Meteorological scales that affect CIMRA operations can be classified as synoptic, mesoscale, and microscale. All classifications are important for understanding the development of an atmospheric chemical hazard.

b. It is necessary to quantitatively determine the direction and extent of an atmospheric chemical hazard. To do so, the meteorological variables affecting the travel of such a hazard must be accurately

measured and plotted. Horizontal wind velocity, barometric pressure, temperature, humidity, and precipitation must be recorded.

c. A chemical storage or demilitarization facility should have a minimum of one meteorological station and associated meteorological network to provide the necessary data in a timely manner. A meteorologist can help determine how many stations are required to properly characterize the potential area of plume travel. A network can consist of stations or towers of meteorological instruments, data control platforms (computers) that calculate the meteorological data values, and telemetry equipment for remote access. Data can be averaged in different time periods (such as 5, 10, 15, or 60 minutes).

d. At a minimum, an adequately equipped meteorological system would include the following sensors, systems, and maintenance capabilities:

(1) Meteorological network covering areas at potential risk.

(2) Automatic real-time transmission of meteorological information to a hazard assessment system.

(3) Hazard-assessment system that uses computers, and meteorological and hazard assessment models.

(4) Maintenance and quality-assurance program.

12–3. Dispersion meteorological models

The plume model provides timely information for real-time assessment of a hazard. Models can be designed to provide accurate or conservative estimates of the hazard.

a. The hazard analyst performs assessments to determine the potential hazard created by releases of chemical agent. The hazard analyst has a basic understanding of the physical and toxicological properties of chemical agents, potential mishaps that could occur, the effects of meteorology on chemical plumes, and basic protective actions (sheltering and evacuation) needed to protect workers and the general public. The hazard analyst typically uses chemical plume models and protective action algorithms to project the chemical hazard. Ideally, the hazard analyst has education or experience in dispersion meteorology, but does not need to be a meteorologist to perform the function.

b. The meteorological models must include the effects of the wind, stability, temperature, mixing layer height, terrain, and meteorological trends. The models must be able to resolve those scales of features that are important for that particular location, for all meteorological conditions. Until other models are validated, two models are currently accredited for use:

(1) *WebPuff.* The U.S. Army Chemical Materials Activity WebPuff system is accredited for potential chemical stockpile and nonstockpile mishaps and incidents. The D2-Puff software algorithm in WebPuff predicts dispersion patterns, travel times, and concentration levels in the atmosphere of possible releases of chemical agents stored at chemical storage sites, chemical demilitarization sites, chemical test laboratories or toxic chemicals at industrial chemical facilities.

(2) *Joint Effects Model.* This model is accredited for all other CBRN release scenarios. The model incorporates algorithms from various dispersion models (such as the Hazard Prediction and Assessment Capability; the Vapor, Liquid, and Solid Tracking Model; and 02-Puff) for most types of dispersed chemical agent.

12–4. Forecasting for hazard duration

During a large release exposed to the atmosphere, the direction and speed of the wind will likely change. Therefore, to predict the best option for protective action (sheltering or evacuation), it is important to be able to predict the resulting direction and speed of the chemical agent cloud's travel.

a. It is critical that personnel are not evacuated to a zone where the chemical agent cloud will follow. Similarly, the sheltering times must be tracked to avoid unnecessarily prolonged durations within the shelters because low levels of chemicals can become trapped within a shelter. The meteorological and dispersion forecast must account for such planning.

b. When sufficient information is not available, the forecast can be presented in terms of probability of occurrence of the possible outcomes. However, deterministic modeling results and emergency response directions for the general public will be more easily understood and implemented.

c. Forecasts must be made, posted, and communicated to the command and important organizational elements at least daily. Forecasts should include hourly values of winds, atmospheric stability, temperature, precipitation, cloud cover and type, humidity, and severe weather warnings for a minimum 24-hour period.

d. Forecasts must be timely.

12–5. Operations at a chemical mishap or incident site

a. Each chemical agent material installation should have the services of a trained hazard analyst familiar with hazardous materials and meteorological modeling. This individual will be responsible for providing operational support, guidance, and advice on the safety of chemical operations. The hazard analyst should also be available to provide assistance in cases of nonroutine operations and chemical mishaps or incidents.

b. Meteorological operations and hazard assessment capabilities will be incorporated into exercises at least annually and included in the written after-action reports for the exercise.

c. Chemical agent storage or demilitarization facilities should be surveyed by an organization with the capability and knowledge of meteorological, transport and diffusion, and hazard assessment systems. Although needs vary depending on climate, terrain, operations, and population proximity, a depot typically needs information provided by towers with wind, temperature, solar radiation, pressure, and humidity sensors, as well as the ability to detect lightning occurrences in the area through a local lightning detection system or access to a national lightning detection database system.

(1) Lightning protection systems should be employed to protect data collection instruments and computers, especially on towers. A dedicated computer is required to perform the model calculations. Suitable communications must be available to send the data from the sensors to the model calculation computer.

(2) Independent, uninterruptible power sources should be used to enhance the reliability of operations and equipment. Contingency plans should be documented in support of chemical operations to account for the potential loss of the meteorological network or key data.

d. The hazard analyst should establish an SOP that will include daily briefings to the command or command representative. These routine operations will establish familiarity with the type of meteorological influences in the local area. These SOPs will also provide operational support for chemical operations to minimize the potential for mishaps or the chemical consequences of a mishap. For example, the SOP may prohibit chemical agent operations involving munitions handling during weather periods in which the MCE mishap would produce a projected concentration exceeding established protective exposure criterion beyond the boundary of the installation (see para 9–11).

e. Plans should include provisions for nonroutine operations and chemical mishap or incident procedures. The designated hazard analyst should coordinate these actions.

Appendix A

References

Section I

Required Publications

Unless otherwise stated, Army publications are available at the Army Publishing Directorate website (https://armypubs.army.mil/). DoD publications are available on the Executive Services Directorate website (https://www.esd.whs.mil/dd/). CFR material is available at https://www.ecfr.gov/.

ACGIH Heat Stress and Strain Documentation
Heat Stress and Strain: TLV(R) Physical Agents 8th Edition Documentation (Available at https://www.acgih.org.) (Cited in para 4–14*c*(1).)

ACGIH TLVs/BEIs Guidelines
American Council of Government Industrial Hygienists (Available at https://www.acgih.org.) (Cited in para 4–14.)

AFMAN 24–204/TM 38–250/NAVSUP PUB 505/MCO P4030.19I/DLAI 4145.3
Preparing Hazardous Materials for Military Air Shipments (Cited in para 10–1*a*.)

AMCA 500–D
Laboratory Methods of Testing Dampers for Rating (Available at https://www.amca.org.) (Cited in para 9–7*d(1)(b).)*

AMCA 511–13
Certified Ratings Program - Product Rating Manual for Air Control Devices (Available at https://www.amca.org.) (Cited in para 9–7*d(1)(b).)*

ANSI/ASSP Z9.5-2022
Laboratory Ventilation (Available at https://webstore.ansi.org/.) (Cited in para 8–3*b*(3)*.)*

ANSI/ASQ Z1.4
Sampling Procedures And Tables For Inspection By Attributes (Available at https://webstore.ansi.org/.) (Cited in para 4–7*b.)*

AR 11–34
The Army Respiratory Protection Program (Cited in para 4–2*a*.)

AR 15–39
Department of the Army Intergovernmental and Intragovernmental Committee Management Program (Cited in title page.)

AR 25–30
Army Publishing Program (Cited in title page.)

AR 40–400
Patient Administration (Cited in para 7–5*f*.)

AR 50–6
Chemical Surety (Cited in para 1–5*a*(4).)

AR 70–1
Army Acquisition Policy (Cited in para 5–5*b*.)

AR 190–45
Law Enforcement Reporting (Cited in para 7–5*b*.)

AR 190–59
Chemical Agent Security Program (Cited in para 7–5*b*.)

AR 200–1
Environmental Protection and Enhancement (Cited in para 10–1*a*.)

AR 385–10
The Army Safety Program (Cited in para 1–1.)

AR 700–68/DLAR (JS) 4145.25/NAVSUPINST 4440.128/MCO 1033.2D
Storage and Handling of Liquefied and Gaseous Compressed Gasses and their Full and Empty Cylinders (Cited in para 8–7*g*.)

Army Public Health Center Fact Sheet 63–006–0916
Chemicals, Contact Lenses, and Respirators (Available at https://phc.amedd.army.mil.) (Cited in para 4–6*d*.)

ANSI 110
Laboratory Fume Hoods Performance Testing (Available at https://ansi.org.) (Cited in para 8–3*b*(2)(*c*).)

ASME AG–1
Code on Nuclear Air and Gas Treatment (Available at https://www.asme.org.) (Cited in para 9–7*f*.)

ASME N511
In-Service Testing of Nuclear Air-Treatment, Heating, Ventilating, and Air-Conditioning Systems (Available at https://www.asme.org.) (Cited in para 9–6*a*(6).)

ASTM A480
Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip (Available at https://www.astm.org.) (Cited in para 9–7*d*(2)(*d*).)

ASTM A653
Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process (Available at https://www.astm.org.) (Cited in para 9–7*d*(3)(*c*).)

ASTM A780
Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings (Available at https://www.astm.org.) (Cited in para 9–7*d*(3)(*d*).)

29 CFR 1910
Occupational Safety and Health Administration (Available at https://www.osha.gov.) (Cited in para6-15.)

40 CFR 136
Guidelines Establishing Test Procedures for the Analysis of Pollutants (Cited in glossary.)

40 CFR
Protection of Environment (Cited in glossary.)

49 CFR 172
Experimental Use Permits (Cited in para 10–1*a*.)

Convention on the Prohibition of the Development, Production, Stockpiling and Use of Chemical Weapons and on their Destruction (Chemical Weapons Convention)
Organization for the Prohibition of Chemical Weapons (Available at https://www.opcw.org.) (Cited in para 1–5*a*.)

DA Pam 25–403
Army Guide to Recordkeeping (Cited in para 1–4.)

DA Pam 40–11
Army Public Health Program (Cited in para 6–7.)

DA Pam 385–10
Army Safety Program (Cited in para 5–5*b*.)

DA Pam 385–40
Army Accident Investigations and Reporting (Cited in para 7–5*a*.)

DA Pam 385–64
Ammunition and Explosives Safety Standards (Cited in para 1–7*b*.)

DA Pam 742–1
Ammunition Surveillance Procedures (Cited in para 6–13*c*(2).)

DDESB Technical Paper 10
Methodology for Chemical Hazard Prediction (Available at https://denix.osd.mil.) (Cited in para 9–11*b*(2)(*a*).)

DDESB Technical Paper 15
Approved Protective Construction (Available at https://denix.osd.mil.) (Cited in para 6–16*b*(1).)

Deputy Assistant Secretary of the Army (Environment, Safety, and Occupational Health) Memorandum
Interim Guidance for Chemical Warfare Material Responses. (Available at https://www.milsuite.mil/.) (Cited in para 1–5*c*(3).)

Deputy Assistant Secretary of the Army (Environment, Safety, and Occupational Health) Memorandum
Interim Guidance on Occupational Health Practices for the Evaluation and Control of Occupational Exposures to Nerve Agents GA, GB, GD, GF and VX and Mustard Agents H, HD, and HT dated 23 Jan 2013. (Available at https://www.milsuite.mil/.) (Cited in para 5–8*a*.)

DESR 6055.09
Defense Explosives Safety Regulation (Cited in para 1–1.) (Available at https://www.denix.osd.mil.)

DoDI 4140.62
Material Potentially Presenting an Explosive Hazard (MPPEH) (Cited in para 5–1*e*.)

DoDI 5210.65
Security Standards for Safeguarding DoD Chemical Agents (Cited in glossary.)

DTR 4500.9–R
Cargo Movement (Cited in para 10–1*a*.) (Available at https://www.ustranscom.mil.)

DIN EN 943–1:2002
Protective clothing against liquid and gaseous chemicals, including liquid aerosols and solid particles-Part 1: Performance requirements ventilated and non-ventilated ‘gas-tight’ (Type 1) and ‘non-gas-tight’ (Type 2) chemical protective suits (foreign standard) (Available at https://webstore.ansi.org.) (Cited in para 4–13.)

DIN EN 943–2:2019
Protective clothing against dangerous solid, liquid and gaseous chemicals, including liquid and solid aerosols - Part 2: Performance requirements for Type 1 (gas-tight) chemical protective suits for emergency teams (ET); German version EN 943-2:2019 (Available at https://webstore.ansi.org.) (Cited in para 4–13*b*(8).)

DIN EN 14325:2018
Protective clothing against chemicals – test methods and performance classification of chemical protective clothing materials, seams, joins and assemblages (Available at https://webstore.ansi.org.) (Cited in para C–8*f*(1).)

DIN EN 14605:2009
Protective clothing against liquid chemicals – performance requirements for clothing with liquid-tight (Type 3) or spray-tight (Type 4) connections, including items providing protection to parts of the body only (Types PB[3] and PB[4] (Available at https://webstore.ansi.org.) (Cited in para 4–13*c*(6).)

Directive 89/686/EEC
Use of Personal Protective Equipment (Available at https://osha.europe.eu.) (Cited in para C–5*f*(3).)

Federal Emergency Management Agency Chemical Stockpile Emergency Preparedness Program Guidance
(Available at https://www.fema.gov.) (Cited in para 9–16*b*(1).)

68 FR 58348
Final Recommendations for Protecting Human Health from Potential Adverse Effects of Exposure to Agents GA (Tabun), GB (Sarin), and VX (Available at https://www.govinfo.gov.) (Cited in para 2–3*a*(1).)

69 FR 24164
Interim Recommendations for Airborne Exposure Limits for Chemical Warfare Agents H and HD (Sulfur Mustard) (Available at https://www.govinfo.gov.) (Cited in para 2–3*a*(2).)

Fundamentals of Industrial Hygiene Online Course
Available from the National Safety Council (Available at https://www.nsc.org.) (Cited in glossary.)

Industrial Ventilation
A Manual of Recommended Practice for Operation and Maintenance (Available at https://www.acgih.org). (Cited in para 9–6*a*(1).)

MIL–STD 282
Department of Defense Test Method Standard: Filter Units, Protective Clothing, Gas-Mask Components and Related Products: Performance Test Methods (Available at https://www.dsp.dla.mil.) (Cited in para 4–7*b*.)

MIL–STD–1916
Department of Defense Test Method Standard: DoD Preferred Methods for Acceptance of Product (Available at https://www.dsp.dla.mil.) (Cited in para 4–7*b*.)

NFPA 70
National Electrical Code (Available at https://www.nfpa.org.) (Cited in para 9–3*c*.)

NFPA 70B
Standard for Electrical Equipment Maintenance (Available at https://www.nfpa.org.) (Cited in para 9–6*i*(1).)

NFPA 101
Life Safety Code (Available at https://www.nfpa.org.) (Cited in para 3–4*b*.)

NFPA 110
Standard for Emergency and Standby Power Systems (Available at https://www.nfpa.org.) (Cited in para 9–6*i*(1).)

NFPA 1991
Standard on Vapor-Protective Ensembles for Hazardous Materials Emergencies and CBRN Terrorism Incidents (Available at https://www.nfpa.org.) (Cited in para 4–13*b*(3).)

NFPA 1994
Standard on Protective Ensembles for First Responders to Hazardous Materials Emergencies and CBRN Terrorism Incidents (Available at https://www.nfpa.org.) (Cited in para 4–13.)

NIOSH Publication 86–113
Criteria for a Recommended Standard: Occupational Exposure to Hot Environments (Available at https://www.cdc.gov.) (Cited in para 4–14*c*(2).)

OSHA Instruction TED 01–00–015
OSHA Technical Manual (OTM) (Available at https://www.osha.gov/.) (Cited in para 4–14*c*.)

TB MED 507
Heat Stress Control and Heat Casualty Management (Cited in para 4–14*c*(4).)

TB MED 577
Sanitary Control and Surveillance of Field Water Supplies (Cited in para D–4*d*.)

TM 3–4240–346–10
Operator's Manual for Mask, Chemical-Biological: Field, M40A1 (NSN 4240–01–370–3821 - Small) (4240–01–370–3822 - Medium) (4240–01–370–3823 - Large) Chemical-Biological Mask: Combat Vehicle, M42A2 (4240–01–413–4100 - Small) (4240–01–413–4101 - Medium) (4240–01–413–4102 - Large) (Cited in para 4–4*a*.)

TM 3–4240–349–13&P
Operator and Field Maintenance Manual including Repair Parts and Special Tools List for Protection Assessment Test System, M41 (NSN 4220–01–365–8241) (EIC 5MP) (Cited in para 4–4*i*(1).)

TM 3–4240–350–13&P
Operator and Field Maintenance Manual including Repair Parts and Special Tools List for Protection Assessment Test System, M41A1, NSN 4240–01–665–1803 (EIC 59Z) (Cited in para 4–4*i*(1).)

TM 3–4240–542–13&P
Operator and Field Maintenance Manual (including Repair Parts and Special Tools List) for Mask, Chemical-Biological: Joint Service General Purpose, Field, M50 (4240–01–512–4431) Small (4240–01–512–4434) Medium (4240–01–512–4437) Large and Mask, Chemical-Biological: Joint Service General Purpose, Combat Vehicle, M51 (4240–01–512–4429) Small (4240–01–512–4435) Medium (4240–01–512–4436) Large {to 14P4–20–1, TM 09204G/09205G–OI/1, S6470–AD–OMP–010} (Cited in para 4–4*a*.)

TM 10–8415–210–13&P
Operator's, Unit and Direct Support Maintenance Manual including Repair Parts and Special Tools List for the Toxicological Agent Protective (TAP) Ensemble (Cited in para 4–9*g*.)

TM 38–250
Preparing Hazardous Materials for Military Air Shipments (Cited in para 10–1*a*.)

UFC 3–600–01
Fire Protection Engineering for Facilities (Available at https://www.wbdg.org/.) (Cited in para 9–4*b*.)

50 USC 1512a
Destruction of existing stockpile of lethal chemical agents and munitions (Cited in para 10–1*a*.)

Section II

Prescribed Forms
This section contains no entries.

Appendix B

Chemical Agent Information

B–1. Overview

a. Chemical agents are not gases, although poison gas is a term commonly used to refer to them. The first lethal chemical used in combat, in 1915, was the gas chlorine, and gas became the common term. Most chemical agents in the Army chemical munitions stockpile are liquids that were intended to be dispersed either as droplets or as vapors.

b. Chemical agents produce various physiological effects on the human body. They will produce a harmful physiological and/or psychological reaction when applied to the body externally, when inhaled, or when taken internally at sufficient doses. Most chemical agents cause a disruption of normal body functions, as described in this appendix.

c. The two significant types of known modern chemical agents are blister agents and nerve agents.

(1) Blister agents are persistent agents that act on the eyes, lungs, and skin; they burn and blister the skin or any other part of the body they contact. The common names and chemical names of examples of blister agents are as follows:

(a) H–Levinstein mustard: 70 percent bis(2–chloroethyl) sulfide, 30 percent polysulfides.

(b) HD—distilled mustard: bis(2–chloroethyl) sulfide.

(c) HT—mixture of 60 percent bis(2–chloroethyl) sulfide (HD) and 40 percent bis(2-(2-chloroethylthio)diethyl)ether(T).

(d) L–Lewisite: dichloro (2–chlorovinyl) arsine.

(2) Nerve agents are organophosphorus compounds chemically related to pesticides and include the G and V agents. The G agents were developed in the 1930s and 1940s and attack primarily through the respiratory system. The V agents were developed in the early 1950s and are absorbed through the skin. G agents can also be absorbed through the skin and eyes, particularly if they have been mixed with a thickener that slows evaporation and keeps them in liquid form for a longer time. All nerve agents injure and kill by binding to cholinesterase, an enzyme of the human body that is essential for functioning of the nervous system. They also produce a range of neurological disorders followed by paralysis and cardiovascular or respiratory failure. The common name and chemical name of examples of nerve agents are as follows:

(a) GA—tabun: ethyl N, N-dimethylphosphoramidocyanidate.

(b) GB—sarin: O-isopropyl methylphosphonofluoridate.

(c) GD—soman: pinacolyl methylphosphonofluoridate.

(d) VX–O-ethyl S-(2-diisopropylaminoethyl) methylphosphonothiolate.

B–2. Types of hazards

a. Hazards from mustard agents (H, HD, and HT) are through vapor contact with the eyes or respiratory tract and liquid contact with skin. The most common acute hazard is that of liquid contact with the skin. Mustard vapor may be absorbed readily through the respiratory tract and eyes, and, if ingested, through the gastrointestinal tract. The severity of the effects depends on the degree of liquid contamination, the vapor concentration, and the associated exposure time. Mustard agents may persist as liquid contamination on nonporous surfaces for long periods because of their low volatilities. They can also wick into porous surfaces and emit vapor over a long period of time. Chemical Agents on contaminated surfaces can be transferred to personnel by direct contact.

b. The hazards from L are similar to those of mustard agents. The most severe effect results from liquid contact with the eyes and skin. Injury to the respiratory tract because of vapor exposure is similar to that of mustard, and in large amounts, L causes pulmonary edema. L on the skin, as well as inhaled vapor, is absorbed and may cause systemic poisoning.

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

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

B–3. Mechanism of action and physiological effects

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

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

(2) L is a vesicant agent and is considered a suspect carcinogen. Exposure to L causes intense pain on contact. Exposure to the eyes, if not decontaminated immediately, will result in permanent injury or possible blindness within 1 minute of exposure. When inhaled in high concentrations, it may be fatal in as short a time as 10 minutes. L can cause sensitization and chronic lung impairment.

(3) The chemical G-agents are anticholinesterase compounds. Their effects are referable to stimulation of the autonomic and central nervous systems resulting from the inhibition of the cholinesterase enzymes in the tissues and the resultant accumulation of acetylcholine at its various sites of action.

(4) The chemical agent VX is an anticholinesterase compound similar to GB in its mechanism of action and effects. Since VX has a low volatility, liquid droplets on the skin do not evaporate quickly, thereby facilitating effective percutaneous absorption. By this route, VX is approximately 10 times as toxic as GB. By the inhalation route, VX is estimated to be twice as toxic as GB.

b. Signs and symptoms.

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

(2) *Lewisite.* The signs and symptoms of L are similar to those of mustard, but they occur more rapidly. As with mustard agents, the eye is vulnerable. Mild exposure to the eye produces reversible eye damage if decontaminated instantly; otherwise, more permanent injury or blindness is possible within 1 minute of exposure. Contact with the skin results in immediate stinging pain increasing in severity with time. Erythema (skin reddening) appears within 30 minutes after exposure, accompanied by pain with itching and irritation for 24 hours. Blisters appear within 12 hours after exposure with more pain, which is diminished after 2 to 3 days. Skin burns are much deeper than with HD. Tender and moist skin (mucous membrane or perspiration-covered skin) absorbs more L; therefore, it is more sensitive. L is irritating to nasal passages, and produces a burning sensation followed by a profuse nasal secretion and violent sneezing. Prolonged exposure causes coughing and the production of large quantities of froth mucus. L acts as a systemic poison, causing pulmonary edema, diarrhea, restlessness, weakness, subnormal temperature, and low blood pressure.

(3) *G agents and VX.* The first indications of exposure to liquid G agents, or VX agent, may be a reaction at the point of contact (such as localized sweating, muscular twitching, and pinpoint eye pupils (miosis) if liquid gets into the eye). For mild exposures, symptoms may not progress beyond the local reaction. However, if absorption is sufficient to produce systemic poisoning, the following signs and symptoms, the quantity and severity of which will depend upon the degree of exposure, can be expected:

(a) If exposure is from aerosol or vapor, early signs and symptoms may be pinpointing of eye pupils and dimness of vision (these symptoms may be absent entirely in cases of skin absorption), runny nose, and tightness in the chest.

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

(c) Later signs and symptoms (indicating severe exposure) include nausea and possible vomiting, diarrhea, weakness, coma, and cessation of breathing. Death can result from both respiratory and skin exposure. These agents in vapor form are rapidly absorbed through the respiratory system, and death can occur in less than 10 minutes. Symptoms appear much more slowly when the dose is acquired by absorption through the skin; however, if the dose is large, the response can be very rapid. The intact skin acts as a barrier to these agents in the vapor state. However, the vapor may quickly pass through the eyes, and meiosis may result from very low concentrations of vapor alone. The effects of repeated exposures can be cumulative and workers may experience severe cholinesterase (ChE) depressions from repeated exposure to low concentrations of agent. The rate of regeneration of ChE within the body is slow.

B–4. Persistency

The persistency of chemical agents is categorized as nonpersistent (G-class nerve agents) and persistent (mustard (H) and L blister agents and V-class nerve agents (VX)).

B–5. Vapor pressure

a. Vapor pressure, a property of interest listed on the SDS, is defined as the pressure exerted by a vapor in thermodynamic equilibrium with its condensed phases (solid or liquid) at a given pressure in a closed system. Vapor pressure is relative to how quickly a chemical will evaporate. Chemicals with a higher vapor pressure evaporate more quickly and build up to a higher concentration rapidly when released from their containers. Conversely, these chemicals do not remain for long because they evaporate and disperse. Chemicals with a lower vapor pressure evaporate more slowly. Vapor pressure also depends on the temperature of the chemical and the pressure of the air around the chemical: the warmer a chemical is, the quicker it evaporates and the lower the atmospheric pressure is around the chemical, the more quickly the chemical evaporates (this is why water boils at a lower temperature at higher altitudes).

b. Toxic chemicals with higher vapor pressures are dangerous because they quickly become an inhalation hazard when released from their containers. Explosive chemicals with a higher vapor pressure become explosive hazards more quickly than those with a lower vapor pressure. Chemicals with lower vapor pressures persist in the environment longer than chemicals with higher vapor pressures. Vapor pressure is also inversely associated with the effectiveness of CBRN protective mask filters. Chemicals with extremely high vapor pressures such as anhydrous ammonia, hydrogen cyanide and cyanogen chloride are not well filtered by organic vapor filters unless a special reagent is added for those chemicals.

c. For reference, the following table shows the vapor pressure of selected chemical agents. Blood agents cyanogen chloride and hydrogen cyanide, and water and ethanol, are also given for comparisons. Note that chemical warfare agents considered to be persistent have lower vapor pressures, and chemical warfare agents considered to be nonpersistent have higher vapor pressures. See table B–1.

Table B–1
Vapor pressure of selected chemical agents-

Chemical	Vapor pressure @ 1 atm and 20 ° C
CK (Cyanogen Chloride)	704.4 mm Hg
AC (Hydrogen Cyanide)	630 mm Hg
Ethanol	48.0 mm Hg
Water	17.5 mm Hg
GB (Sarin)	2.96 mm Hg
HD (Distilled Mustard)	0.06 mm Hg
VX	0.0006 mm Hg

B–6. Stability of chemical agents

The stability of chemical agents depends on weather variables such as wind, temperature, temperature gradient, humidity, and precipitation. The magnitude of the effect of each variable depends upon the synoptic situation and is locally influenced by topography, vegetation, and soil and may also determine possible downwind hazards. Although the travel distance and diffusion of an agent cloud are not significantly affected by meteorological elements during the first 30 seconds, the dosages and the rate of dosage buildup are influenced by weather. At high wind speeds, the dosages are reduced during all time intervals. At high air temperatures, the rate of dosage buildup from volatile agents is faster, and total dosage may be obtained within 15 seconds.

a. Chemical agent cloud characteristics. Chemical agents may appear as vapors, aerosols, and liquids.

(1) *Vaporous chemical agents.* If a chemical agent is disseminated as a vapor from a bursting-type munition, initially the cloud expands, grows cooler and heavier, and tends to retain its form. If the vapor density of the released agent is less than the vapor density of air, the cloud will rise rapidly, mix with the surrounding air, and dissipate. If the vapor density of the released agent is greater than the vapor density of air, the cloud will pancake, sink, and cling to the surface of the earth. Generally, during the first 30 seconds, the cloud growth will be independent of ambient meteorological conditions, although the rate of dosage buildup is affected by the existing weather. Shortly after release (30 seconds or so), a chemical agent cloud will assume the temperature, direction, and speed of the surrounding air. The chemical cloud then will be subjected to forces that act to tear it apart and dilute its concentration. The heavier the agent, the longer the cloud will retain its integrity. Under stable atmospheric conditions (favorable temperature gradient and low wind speed), the chemical agent cloud will travel great distances with little decrease in its vapor concentration. As turbulence (mechanical and/or thermal) increases, the chemical agent cloud will dissipate faster.

(2) *Aerosolized chemical agents.* An aerosol can be either a liquid or a solid substance consisting of finely divided particles suspended in the atmosphere. Airborne aerosols behave in much the same manner as vaporized agents. Initially, aerosol clouds will have a higher temperature than vapor clouds; this vapor may cause some initial rise of the cloud at the release point. Aerosol clouds are heavier than vapor clouds, and they tend to retain their form and settle back to earth. Because they are heavier than vapor clouds, they are affected to a lesser extent by turbulence. (However, as the aerosol cloud travels downwind, the larger, heavier particles will settle out, and many of the particles may be removed by impaction on surfaces.)

(3) *Liquid chemical agents.* Evaporation of liquid agent will cause the agent to form into vapor. Once evaporated, the chemical agent vapor plume will have about the same temperature and vapor density as the ambient air. The vapor concentration will depend on the volatility of the chemical agent and the temperature. The resultant chemical vapor plume will exhibit essentially neutral buoyancy (that is, it will not have a tendency to either rise or sink). However, depending on surrounding terrain contours or obstacles (such as buildings), the vapor plume may settle into terrain or obstacle cavities in light or calm winds, especially near the source.

b. Diffusion of a chemical cloud.

(1) *Lateral spread.* When a chemical cloud is released into the air, it is blown from side to side by shifting air currents and mechanical turbulence. These currents cause a lateral spread as the cloud moves downwind. In steady winds, the spread of the cloud amounts to about 15 percent of the distance traveled, while under ordinary conditions the spread is about 20 percent of the distance from the source. In a fishtail wind (one frequently changing direction), the spread is much greater.

(2) *Drag effect.*

(a) Turbulent drag effect. Wind currents carry chemical clouds along the ground with a rolling motion, since the wind velocity increases rapidly from a negligible value near the ground to an appreciable one at gradient wind level (about 2,500 feet). This effect (called drag effect), together with the interference of vegetation and other ground objects, causes the base of the cloud to be retarded and to stretch out in length. When clouds are released on the ground, the drag effect causes lengthening of the cloud by about 10 percent of the distance traveled over grass, plowed land, or water and about 20 percent over gently rolling terrain covered with bushes, growing crops, or small patches of scattered timber. In heavy timber, the drag effect is greatly increased.

(b) Layering. With turbulence and light to moderate winds, the friction of the lower layers of air against the earth causes wind speeds to decrease gradually as the surface is approached. Under these

conditions, a chemical cloud is carried along faster than it can diffuse downward. As a result, air near the ground on the forward edge of the cloud may not be contaminated while the air a few feet up is heavily contaminated. This condition (layering) becomes more pronounced and increases proportionately with the distance of the forward edge of the cloud from the source.

(3) *Vertical rise.* The vertical rise of a chemical cloud depends on weather variables such as temperature gradient, wind speed, and differences between the densities of the cloud and the surrounding air. The chemical cloud particles are not appreciably affected by the radiation of the sun because they are small.

B–7. Weather and terrain

a. Weather. Weather (particularly temperature, temperature gradient, wind speed, and direction) directly influences the effectiveness and persistency of a chemical agent.

(1) *Temperature.* The evaporation of liquid chemical agents increases as the temperature rises.

(2) *Wind speed.* High winds increase the rate of evaporation of liquid chemical agents, and dissipate chemical clouds more rapidly than low winds do.

(3) *Direction.* Wind and terrain control the travel of chemical clouds.

b. Terrain.

(1) *Contour.* Under stable conditions, chemical clouds tend to flow over rolling terrain around large hills and up and down valleys.

(2) *Trees and vegetation.* Chemical Agent clouds tend to pass around and over heavily wooded areas with little or no chemical agent penetrating any depth into the woods.

B–8. Hydrolysis

Hydrolysis is the reaction of any chemical substance with water, whereby decomposition of the substance occurs, and one or more new substances are produced.

a. Rate of hydrolysis. The rate of hydrolysis is the rate at which the various chemical agents or compounds are decomposed by water. Rapid hydrolysis is also an important factor in lowering the duration of effectiveness of chemical agents. (For example, L is rapidly hydrolyzed; therefore, it has a shorter duration of effectiveness than HD, which hydrolyses very slowly at ordinary temperatures.)

b. Hydrolysis products. Hydrolysis products are those new substances formed when a chemical agent or compound reacts with or is decomposed by water. In certain cases, hydrolysis does not completely destroy the toxicity of a chemical agent or compound (as in the case of L, and most other chemical agents containing arsenic) because the hydrolysis product is also toxic.

B–9. Rate of detoxification

The rate of detoxification is the rate at which the body is able to counteract the effects of a poisonous substance. It is an important factor in determining the hazards of repeated exposure to low concentrations of chemical agents. Continued exposure of personnel to low concentrations of HD may result in sensitivity to very low concentrations of HD. Some chemical agents are not detoxified at appreciable rates by the human body. For example, an exposure of 1 hour to HD followed within a few hours by another exposure of 1 hour has approximately the same effect as a single exposure of 2 hours duration. The disabling or lethal dosage in the case of such cumulative agents is proportional to the time factor within reasonable limits. While having a cumulative toxic effect, GB also has a detoxification effect that is important (such as the median lethal dosage of GB is approximately 70 mg-min/m3 over periods of 30 seconds to several minutes). However, if the concentration breathed is so high that 15 to 25 mg are received in one breath, this amount can be lethal because there is no time for any appreciable amount of detoxification to occur.

B–10. Rate of action

a. The rate of action of a chemical agent is the rate at which the body reacts to, or is affected by that agent. There is a wide variation in the rate of reaction to the chemical agents, even to those of similar classification. For example, HD causes no immediate sensation on the skin and causes no noticeable effect for several hours (in a few cases, effects have been delayed for 10 to 12 days). L, on the contrary, produces an immediate burning sensation on the skin upon contact and blistering in about 12 hours. None of the blister agents are as delayed in their noticeable effects as HD.

b. Decontamination of blister agents must be accomplished within 2 minutes after contamination if serious effects are to be prevented. The nerve agents are characterized by the great rapidity with which they

act. First-aid measures, such as administering antidotes, generally must be carried out within a few minutes after lethal dosages of these agents have been absorbed if death is to be averted.

B–11. Dosage

a. Vapor dosage is the concentration of a chemical agent in the atmosphere (C) multiplied by the time (t) that the concentration remains, expressed as mg-min/m3. Dosage is often referred to as Ct. The dosage received by a person depends upon how long he or she is exposed to the concentration. That is, the respiratory dosage in mg-min/m3 is equal to the time in minutes an individual is unmasked in a chemical agent cloud multiplied by the concentration of the cloud. The skin dosage is equal to the time of exposure in minutes of an individual's unprotected skin multiplied by the concentration of the chemical agent cloud. (This is generally understood as being the effect upon the whole body.) The physiological effectiveness of skin and respiratory aerosol dosages are influenced by particle size as well as time and concentration, since retention by the lungs and impingement upon the skin are functions of particle size. They are usually expressed in mg-min/m3 for a particle size.

b. Liquid dosage is the weight of liquid agent received by a person on his or her skin and is usually expressed as dosage in mg of contaminant per kilogram (kg) of body weight (mg/kg).

c. After exposure to a chemical agent, an individual may show signs and symptoms that are less or more than expected for a given dosage (Ct), depending upon some of the following variables:

(1) How long the breath was held during short exposure.
(2) Speed with which mask was donned (put on).
(3) Ability to fit mask and mask leakage factors.
(4) Whether the chemical agent was also absorbed through the skin.
(5) Whether the chemical agent stimulated the rate of breathing.
(6) Rate and depth of breathing of the individual at the time of exposure.
(7) Amount of physical exertion of the individual at the time of exposure.
(8) Rate of detoxification, especially if exposure was long.

Note. For tabulation purposes, such variables are ignored, and the Ct values are assumed to measure the amount of chemical agent received by an individual breathing at a normal rate in a temperate climate with average humidity. These values provide a basis of comparison for the chemical agent.

Appendix C

Chemical Agent Personal Protective Equipment Standards

Section I

Level A

C–1. National Institute for Occupational Safety and Health chemical, biological, radiological, and nuclear level A reuse

a. Manufacturer and model: All NIOSH CBRN open-circuit SCBA.

b. Protection level: OSHA/Environmental Protection Agency (EPA) Level A.

c. Chemical agents: GA, GB, GD, GF, VX, HD, H, and HT.

d. Use scenarios:

(1) Any work activity and hazard environment consistent with the manufacturer's recommendations and also supported with a hazard analysis or risk assessment specific to both the work activity and hazard environment.

(2) Respirators may be used for training purposes even if the shelf life and service life dates have passed as long as no additional hazard is created for the user. Such respirators must be clearly marked for training purposes and kept segregated from respirators to be used for chemical agent protection. Cylinders and other pressure systems with hydrostatic test requirements may not be used for training if the shelf life, service life, or hydrostatic test date is expired.

e. Reuse: NIOSH CBRN standards establish requirements for respirators that are worn for a single exposure to chemical agent. The standard cautions users against reuse after exposure, particularly if the effectiveness of decontamination cannot be determined. With decades of operating experience in diverse use scenarios, the Army has safely reused respirators because of the multi-faceted approach to worker protection described in Army safety standards.

(1) Reuse is not authorized if the respirator has ever been contaminated with chemical agent liquid or aerosol.

(2) If the respirator has never been contaminated with chemical agent liquid or aerosol, reuse is authorized only if one of the following conditions is satisfied:

(a) A determination has been made in accordance with Army chemical agent safety standards that the respirator is not contaminated or potentially contaminated, or

(b) The respirator has been decontaminated to a safe level and successful decontamination has been verified with a monitoring or analytical method.

(3) Reuse is authorized only if the respirator is maintained in accordance with written procedures, and those written procedures are consistent with the manufacturer's recommendations for testing, maintenance, and inspection. The respirator must not be used or reused if it has an unrepaired defect. The respirator must not be used or reused if it has a condition that would generally require an evaluation to determine whether or not repair is required but the evaluation has not yet been completed.

f. Limitations and additional requirements:

(1) NIOSH CBRN approval includes several statements of caution and limitations. This approval does not modify any of those cautions and limitations except as stated above for reuse.

(2) The NIOSH standard requires labeling of CBRN approved respirators. Users must be informed of the labeling, and the labeling must be readily visible to users for review.

(3) The NIOSH standard requires listing of CBRN approved respirators. Users must be informed of the listing, and the listing must be readily available to users for review.

(4) Users must be informed of the safety alert and product recall systems. The written system descriptions as well as any relevant safety alerts and product recalls must be readily available to users for review.

C–2. United States Army demilitarization protective ensemble

a. The DPE is a totally-encapsulating chemical protective ensemble manufactured for use in the demilitarization program.

b. Regarding temperature restrictions, the DPE is approved for use as follows:

(1) At temperatures at or below 90 degrees F (32 degrees C), the DPE constructed of 30 thousandths of an inch (mil) thick material is approved for use in chemical agent environments not to exceed 2 hours.

(2) At temperatures at or below 90 degrees F (32 degrees C), the DPE constructed of 20-mil thick material is approved for use in nerve agent environments not to exceed 2 hours.

(3) At temperatures above 90 degrees F (32 degrees C), the DPE is approved for use as shown in table C–1.

Table C–1
Approved demilitarization protective ensemble use for elevated temperatures

Agent	Thickness	Maximum temperature	Not to exceed
G-series	20 mil	100 degrees F (38 degrees C)	45 minutes
V-series	20 mil	120 degrees F (49 degrees C)	60 minutes
H-series	30 mil	120 degrees F (49 degrees C)	45 minutes

c. Mustard agent. Only in unusual circumstances when no other suitable protective ensemble is available, the DPE constructed of 20-mil material may be used in mustard agent environments as follows:

(1) At temperatures at or below 80 degrees F (27 degrees C), the DPE constructed of 20–mil material may be used not to exceed 1 hour.

(2) At temperatures between 80 degrees F (27 degrees C) and 90 degrees F (32 degrees C), the DPE constructed of 20–mil material may be used not to exceed 45 minutes.

d. Quality Assurance. DPE specifications, quality assurance requirements, and other DPE information is available from the Program Office for Assembled Chemical Weapons Alternatives, Anniston Field Office, SFAE–ACW–AN, 7 Frankford Ave, Building 75, Anniston Army Depot, AL 36201–4199.

C–3. National Fire Protection Association 1991, Level A

a. Manufacturer and model: NFPA 1991 vapor-protective ensembles and ensemble elements.

b. Protection level: OSHA/EPA Level A.

c. Chemical agents: GA, GB, GD, GF, VX, HD, H, and HT. Note: A request to use with another chemical agent must describe the chemical permeation resistance test method and include the test results. See specific sections of NFPA 1991, Chapter 7, Performance requirements, and Chapter 8, Test methods, that pertain to chemical agent permeation testing. The request must describe how it will be verified that chemical permeation resistance for that chemical agent continues to be adequate in the future. See NFPA 1991 Section 4.4, Annual Verification of Product Compliance.

d. Use scenarios:

(1) Any work activity and hazard environment consistent with the manufacturer’s recommendations and also supported with a hazard analysis or risk assessment specific to both the work activity and hazard environment.

(2) Ensembles must be relied upon for protection no more than one hour from initial exposure or potential exposure to chemical agent liquid or aerosol. The one-hour limit is based on duration of the NFPA chemical permeation resistance test and is not meant to imply the ensemble or ensemble element is not protective for more than one hour. Note: A request to use for longer than one hour must describe the chemical permeation resistance test method and include the test results. See specific sections of NFPA 1991, Chapter 7, Performance requirements, and Chapter 8, Test methods, that pertain to chemical agent permeation testing. The request must describe how it will be verified that chemical permeation resistance for longer than one hour continues to be adequate in the future. See NFPA 1991 Section 4.4, Annual Verification of Product Compliance.

(3) Ensembles must be relied upon for protection only at or between -25 deg C (-13 deg F) and 32 deg C (90 deg F). Note: A request to use at higher temperatures must describe the chemical permeation resistance test method and include the test results. See specific sections of NFPA 1991, Chapters 7 and 8, that pertain to chemical agent permeation testing. The request must describe how it will be verified that chemical permeation resistance at higher temperatures continues to be adequate in the future. See NFPA 1991 Section 4.4, Annual Verification of Product Compliance.

(4) Ensembles may be used for training purposes even if the shelf life and service life dates have passed as long as no additional hazard is created for the user. Such ensembles must be clearly marked for training purposes and kept segregated from ensembles to be used for chemical agent protection. Cylinders and other pressure systems with hydrostatic test requirements may not be used for training if the shelf life, service life, and hydrostatic test dates have passed.

e. Reuse: NFPA 1991 establishes requirements for protective ensembles and ensemble elements that are worn for a single exposure to chemical agent. The standard cautions users against reuse after exposure, particularly if the effectiveness of decontamination cannot be determined.

(1) Reuse is not authorized if the ensemble has ever been contaminated with chemical agent liquid or aerosol.

(2) If the ensemble has never been contaminated with chemical agent liquid or aerosol, reuse is authorized only if one of the following conditions is satisfied:

(a) A determination has been made in accordance with Army chemical agent safety standards that the ensemble is not contaminated or potentially contaminated, or

(b) The ensemble has been decontaminated to a safe level and successful decontamination has been verified with a monitoring or analytical method.

(3) Reuse is authorized only if the ensemble or ensemble element is maintained in accordance with written procedures, and those written procedures are consistent with the manufacturer's recommendations for testing, maintenance, and inspection. The ensemble or ensemble element must not be used or reused if it has an unrepaired defect. Holes, cuts, tears, delamination, and cloudy visors are examples of defects that would generally require repair (if possible) before use or reuse. Discoloration and abnormal smells are examples of conditions that would generally require evaluation to determine whether or not repair is required before use or reuse.

f. Limitations and additional requirements:

(1) The NFPA standard requires the ensemble or ensemble element label to identify the manufacturer. The NFPA standard also requires the manufacturer to furnish a technical data package and evidence of certification upon request. Users must be informed of the technical data package and evidence of certification, and the technical data package and evidence of certification must be readily available to users for review.

(2) The NFPA standard requires the ensemble or ensemble element label to identify the certification organization. The NFPA standard also requires the certification organization to publish a listing of certified ensembles. Users must be informed of the listing, and the listing must be readily available to users for review.

(3) The NFPA standard requires the manufacturer to establish a written safety alert system and a written product recall system. Users must be informed of the safety alert and product recall systems, and the written system descriptions as well as any relevant safety alerts and product recalls must be readily available to users for review.

C–4. National Fire Protection Association 1994, Level A

a. Manufacturer and model: NFPA 1994 Class 1 protective ensembles and ensemble elements.

b. Protection level: OSHA/EPA Level A.

c. Chemical agents: GA, GB, GD, GF, VX, HD, H, and HT. Note: A request to use with another chemical agent must describe the chemical permeation resistance test method and include the test results. See specific sections of NFPA 1994, Chapter 7, Garment requirements, and Chapter 8, Test methods, which pertain to chemical agent permeation testing. The request must describe how it will be verified that chemical permeation resistance for that chemical agent continues to be adequate in the future. See for example NFPA 1994 Section 4.4, Annual Verification of Product Compliance.

d. Use scenarios:

(1) Any work activity and hazard environment consistent with the manufacturer's recommendations and also supported with a hazard analysis or risk assessment specific to both the work activity and hazard environment.

(2) Ensembles must be relied upon for protection no more than one hour from initial exposure or potential exposure to chemical agent liquid. The one-hour limit is based on duration of the NFPA chemical permeation resistance test and is not meant to imply the ensemble or ensemble element is not protective for more than one hour. Note: A request to use for longer than one hour must describe the chemical permeation resistance test method and include the test results. See specific sections of NFPA 1994, Chapter

7, Garment requirements, and Chapter 8, Test methods, that pertain to chemical agent permeation testing. The request must describe how it will be verified that chemical permeation resistance for longer than one hour continues to be adequate in the future. See for example NFPA 1994 Section 4.4, Annual Verification of Product Compliance.

(3) Ensembles must be relied upon for protection only at or between -25 degrees C (-13 degrees F) and 32 degrees C (90 degrees F). Note: A request to use at higher temperatures must describe the chemical permeation resistance test method and include the test results. See specific sections of NFPA 1994, Chapter 7, Garment requirements, and Chapter 8, Test methods, that pertain to chemical agent permeation testing. The request must describe how it will be verified that chemical permeation resistance at higher temperature continues to be adequate in the future. See for example NFPA 1994 Section 4.4, Annual Verification of Product Compliance.

(4) Ensembles may be used for training purposes even if the shelf life and service life have passed as long as no additional hazard is created for the user. Such ensembles must be clearly marked for training purposes and kept segregated from ensembles to be used for chemical agent operations. Cylinders and other pressure systems with hydrostatic test requirements may not be used for training if the shelf life, service life, and hydrostatic test dates have passed.

e. Reuse:

(1) Reuse is not authorized if the ensemble or ensemble element has ever been contaminated with chemical agent liquid or aerosol.

(2) If the ensemble or ensemble element has never been contaminated with chemical agent liquid or aerosol, reuse is authorized only if one of the following conditions is satisfied:

(a) A determination has been made in accordance with Army safety standards that the ensemble or ensemble element is not contaminated or potentially contaminated, or

(b) The ensemble or ensemble element has been decontaminated to a safe level and successful decontamination has been verified with a monitoring or analytical method.

(3) Reuse is authorized only if the ensemble or ensemble element is maintained in accordance with written procedures, and those written procedures are consistent with the manufacturer's recommendations for testing, maintenance, and inspection. The ensemble or ensemble element must not be used or reused if it has an unrepaired defect. Holes, cuts, tears, delamination, and cloudy visors are examples of defects that would generally require repair (if possible) before use or reuse. Discoloration and abnormal smells are examples of conditions that would generally require evaluation to determine whether or not repair is required before use or reuse. Note: NFPA 1994 establishes requirements for protective ensembles and ensemble elements that are worn for a single exposure to chemical agent. The standard cautions users against reuse after exposure, particularly if the effectiveness of decontamination cannot be determined. With decades of operating experience in diverse use scenarios, the Army has safely reused protective ensembles and ensemble elements because of the multi-faceted approach to worker protection described in Army safety standards.

f. Limitations and additional requirements:

(1) The NFPA standard requires the ensemble or ensemble element label to identify the manufacturer. The NFPA standard also requires the manufacturer to furnish a technical data package and evidence of certification upon request. Users must be informed of the technical data package and evidence of certification, and the technical data package and evidence of certification must be readily available to users for review.

(2) The NFPA standard requires the ensemble or ensemble element label to identify the certification organization. The NFPA standard also requires the certification organization to publish a listing of certified ensembles. Users must be informed of the listing, and the listing must be readily available to users for review.

(3) The NFPA standard requires the manufacturer to establish a written safety alert system and a written product recall system. Users must be informed of the safety alert and product recall systems, and the written system descriptions as well as any relevant safety alerts and product recalls must be readily available to users for review.

(4) 29 CFR 1910.120(g)(4) requires ensemble testing regarding positive pressure and inward leakage. Ensemble users must be informed of the test reports, and relevant test reports must be readily available to users for review.

C–5. European Level A

a. Manufacturer and model:

(1) DIN EN 943–1.

(a) Type 1a "gas-tight" chemical protective suits (breathing apparatus worn inside the chemical protective suit).

(b) Type 1b "gas-tight" chemical protective suits (using a facemask permanently joined to the suit; breathing apparatus worn outside the chemical protective suit).

(c) Type 1c "gas-tight" chemical protective suits (not using the air inside the suit as breathing air; NIOSH uses the term "air-fed ensembles" to refer to chemical protective suits that use the air inside the suit as breathing air).

(2) DIN EN 943–2.

(a) Type 1a-ET "gas-tight" chemical protective suits (breathing apparatus worn inside the chemical protective suit).

(b) Type 1b-ET "gas-tight" chemical protective suits (using a facemask permanently joined to the suit; breathing apparatus worn outside the chemical protective suit).

b. Protection level: OSHA/EPA Level A.

c. Chemical agents:

(1) Nerve agents GA, GB, GD, and VX if and only if the performance level obtained is at least Class 3 (normalized breakthrough time greater than 60 minutes) in permeation resistance testing through continuous contact with liquid GB, in accordance with DIN EN 943–1.

(2) Sulfur mustards HD, HT, and H if and only if the performance level obtained is at least Class 3 (normalized breakthrough time greater than 60 minutes) in permeation resistance testing through continuous contact with liquid HD, in accordance with DIN EN 943–1.

(3) Blister agent L if and only if the performance level obtained is at least Class 3 (normalized breakthrough time greater than 60 minutes) in permeation resistance testing through continuous contact with liquid L, in accordance with DIN EN 943–1.

d. Use scenarios:

(1) Any work activity and hazard environment consistent with the manufacturer's recommendations and also supported with a hazard analysis or risk assessment specific to both the work activity and hazard environment.

(2) For IDLH atmospheres, 29 CFR 1910.134(d)(2) requires either a full-facepiece pressure-demand SCBA with a minimum (nominal) service life of thirty minutes or a combination full-facepiece pressure-demand SAR with auxiliary self-contained air supply.

(3) The respirator must fit the chemical protective suit. The respirator must physically interface or interconnect with or become an integral part of the chemical protective ensemble without compromising worker protection. The respirator must be selected based on recommendation from the suit manufacturer, a Certified Industrial Hygienist (www.abih.org), or a Certified Safety Professional (www.bcsp.org) qualified in respirator selection.

(4) The suit must not be relied upon for protection more than one hour from the initial contact or suspected contact with chemical agent liquid or aerosol; the one hour duration must also include sufficient time to process through personnel decontamination stations (remove or neutralize chemical contaminants or doff the suit). The one-hour limit is based on the minimum breakthrough time of the Class 3 performance level (the lowest performance level authorized) and is not meant to imply the suit does not provide protection for more than one hour.

(5) If permeation resistance testing is performed in accordance with DIN EN 943–1, then the suit must not be relied upon for protection above 23 deg C (73 deg F). However, if permeation resistance testing is performed in accordance with DIN EN 943–1 but at a higher temperature (up to 32 deg C or 90 deg F), then the suit may be relied upon for protection up to that higher temperature. The performance level obtained at the higher temperature is still required to be at least Class 3 (normalized breakthrough time greater than 60 minutes).

(6) Suits may be used for training purposes even if the shelf life and service life dates have passed as long as no additional hazard is created for the user. Such suits must be clearly marked for training purposes and kept segregated from suits to be used for chemical agent protection.

e. Reuse: EN establish two variants of chemical protective clothing—reusable and limited-use. Reusable clothing can be cleaned and reused. Limited-use clothing is intended for a single use or limited reuse,

for example, to be worn until hygienic cleaning becomes necessary or chemical contamination has occurred.

(1) Reuse is not authorized if the suit has ever been contaminated with chemical agent liquid or aerosol.

(2) Reuse is authorized only for a reusable suit and only if one of the following conditions is satisfied:

(a) A determination has been made in accordance with Army chemical agent safety standards that the ensemble is not contaminated or potentially contaminated, or

(b) The ensemble has been decontaminated to a safe level and successful decontamination has been verified with a monitoring or analytical method.

(3) Reuse is authorized only if the suit is maintained in accordance with written procedures and those written procedures are consistent with the manufacturer's recommendations for testing, maintenance, and inspection. The suit must not be reused if it has an unrepaired defect. Holes, cuts, tears, delaminating, and cloudy visors are examples of defects that would generally require repair (if possible) before reuse. Discoloration and abnormal smells are examples of conditions that would generally require evaluation to determine whether or not repair is required before reuse. (These concerns obviously apply to initial use as much as they apply to reuse.)

f. Limitations and additional requirements:

(1) Permeation resistance testing with relevant chemical agents (such as GB and HD) in accordance with DIN EN 943–1, must have been conducted no more than 5 years prior to the manufacturing date of the suit. If more than 5 years have elapsed since testing was completed, then continued use is not authorized without re-testing. The intent of this additional requirement is to periodically check for performance issues not otherwise detected.

(2) The DIN EN 943–1 and DIN EN 943–2 standards require the suit manufacturer to supply a list of chemicals to which the protective clothing has been tested and the performance levels obtained in permeation and/or penetration testing. Users must be informed of this test data, and the test data for relevant chemical agents (such as GB and HD) must be readily available to users for review. The test data must be made available in English or with a translation into English.

(3) Directive 89/686/EEC (with amendments) requires the suit manufacturer to obtain an EC Type-Examination Certificate from a Notified Body. The Certificate demonstrates that an independent Notified Body has examined technical information and suit specimens and thereby determined that the suit model satisfies the relevant standard(s). Users must be informed of this Certificate, and the Certificate must be readily available to users for review. The Certificate must be made available in English or with a translation into English.

(4) Directive 89/686/EEC (with amendments) requires the suit manufacturer to issue a Declaration of Conformity. The Declaration identifies the Notified Body monitoring the quality of suit manufacturing. The Declaration demonstrates that an independent Notified Body is either monitoring the product quality ("Article 11 Point A") or monitoring the production quality control system ("Article 11 Point B"). (Note: Under Article 11 Point A, the Notified Body selects random samples and conducts the required testing. Under Article 11 Point B, the Notified Body verifies that the suit manufacturer is selecting random samples and conducting the required testing. The same testing is required for both.) Users must be informed of this Declaration, and the Declaration must be readily available to users for review. The Declaration must be made available in English or with a translation into English.

(5) Users must be informed how their organization would be notified if the suit manufacturer or its authorized representative or the Notified Body or the Member State took action in order to safeguard users (such as safety alert and/or product recall). A written description of this notification system as well as any relevant safety notices must be readily available to users for review. The system description and safety notices (if any) must be made available in English or with a translation into English.

(6) The following documents provide information for developing a heat stress plan:

(a) ACGIH Heat Stress and Strain Documentation.

(b) NIOSH Publication #2016–106.

(c) OSHA Technical Manual #TED–01–00–015, Section III, Chapter 4.

(d) TB MED 507.

Section II

Level B

C–6. National Institute for Occupational Safety and Health chemical, biological, radiological, and nuclear Level B reuse

a. Manufacturer and model: All NIOSH CBRN open circuit SCBA.

b. Protection level: OSHA/EPA Level B.

c. Chemical agents: GA, GB, GD, GF, VX, HD, H, and HT.

d. Use scenarios:

(1) Any work activity and hazard environment consistent with the manufacturer's recommendations and also supported with a hazard analysis or risk assessment specific to both the work activity and hazard environment.

(2) Respirators may be used for training purposes even if the shelf life and service life dates have passed as long as no additional hazard is created for the user. Such respirators must be clearly marked for training purposes and kept segregated from respirators to be used for chemical agent protection. Cylinders and other pressure systems with hydrostatic test requirements may not be used for training if the shelf life, service life, and hydrostatic test dates have passed.

e. Reuse: NIOSH CBRN standards establish requirements for respirators that are worn for a single exposure to chemical agent. The standard cautions users against reuse after exposure, particularly if the effectiveness of decontamination cannot be determined. With decades of operating experience in diverse use scenarios, the Army has safely reused respirators because of the multi-faceted approach to worker protection described in Army safety standards.

(1) Reuse is not authorized if the respirator has ever been contaminated with chemical agent liquid or aerosol.

(2) If the respirator has never been contaminated with chemical agent liquid or aerosol, reuse is authorized only if one of the following conditions is satisfied:

(a) A determination has been made in accordance with Army chemical agent safety standards that the respirator is not contaminated or potentially contaminated, or

(b) The respirator has been decontaminated to a safe level and successful decontamination has been verified with a monitoring or analytical method.

(3) Reuse is authorized only if the respirator is maintained in accordance with written procedures, and those written procedures are consistent with the manufacturer's recommendations for testing, maintenance, and inspection. The respirator must not be used or reused if it has an unrepaired defect. The respirator must not be used or reused if it has a condition that would generally require an evaluation to determine whether or not repair is required but the evaluation has not yet been completed.

f. Limitations and additional requirements:

(1) NIOSH CBRN approval includes several statements of caution and limitations. This approval does not modify any of those cautions and limitations except as stated above for reuse.

(2) The NIOSH standard requires labeling of CBRN-approved respirators. Users must be informed of the labeling, and the labeling must be readily visible to users for review.

(3) The NIOSH standard requires listing of CBRN-approved respirators. Users must be informed of the listing, and the listing must be readily available to users for review.

(4) Users must be informed of the safety alert and product recall systems. The written system descriptions as well as any relevant safety alerts and product recalls must be readily available to users for review.

C–7. National Fire Protection Association 1994, level B

a. Manufacturer and model: NFPA 1994 Class 2 and Class 2R (ruggedized) protective ensembles and ensemble elements.

b. Protection level: OSHA/EPA Level B/C (as determined by respiratory protection).

c. Chemical agents: GA, GB, GD, GF, VX, HD, H, and HT. Note: A request to use with another chemical agent must describe the chemical permeation resistance test method and include the test results. See specific sections of NFPA 1994, Chapter 7, Ensembles, and Chapter 8, Test methods, which pertain to chemical agent permeation testing. The request must describe how it will be verified that chemical

permeation resistance for that chemical agent continues to be adequate in the future. See NFPA 1994 Section 4.4, Annual Verification of Product Compliance.

d. Use scenarios:

(1) Any work activity and hazard environment consistent with the manufacturer's recommendations and also supported with a hazard analysis or risk assessment specific to both the work activity and hazard environment.

(2) Ensembles must be relied upon for protection no more than one hour from initial exposure or potential exposure to chemical agent liquid. Ensembles must not be relied upon for protection against chemical agent aerosol. The one-hour limit is based on duration of the NFPA chemical permeation resistance test and is not meant to imply the ensemble or ensemble element is not protective for more than one hour. Note: A request to use for longer than one hour must describe the chemical permeation resistance test method and include the test results. See specific sections of NFPA 1994, Chapter 7, Ensembles, and Chapter 8, Test methods, which pertain to chemical agent permeation testing. The request must describe how it will be verified that chemical permeation resistance for longer than one hour continues to be adequate in the future. See NFPA 1994 Section 4.4, Annual Verification of Product Compliance.

(3) Ensembles must be relied upon for protection only at or between -25 deg C (-13 deg F) and 32 deg C (90 deg F). Note: A request to use at higher temperatures must describe the chemical permeation resistance test method and include the test results. See specific sections of NFPA 1994, Chapter 7, Ensembles, and Chapter 8, Test methods, that pertain to chemical agent permeation testing. The request must describe how it will be verified that chemical permeation resistance at higher temperatures continues to be adequate in the future. See NFPA 1994 Section 4.4, Annual Verification of Product Compliance.

(4) Ensembles may be used for training purposes even if the shelf life and service life dates have passed as long as no additional hazard is created for the user. Such ensembles must be clearly marked for training purposes and kept segregated from ensembles to be used for chemical agent protection. Cylinders and other pressure systems with hydrostatic test requirements may not be used for training if the shelf life, service life, and hydrostatic test dates have passed.

e. Reuse: NFPA 1994 establishes requirements for protective ensembles and ensemble elements that are worn for a single exposure to chemical agent. The standard cautions users against reuse after exposure, particularly if the effectiveness of decontamination cannot be determined. With decades of operating experience in diverse use scenarios, the Army has safely reused protective ensembles and ensemble elements because of the multi-faceted approach to worker protection described in Army safety standards.

(1) Reuse is not authorized if the ensemble has ever been contaminated with chemical agent liquid or aerosol.

(2) If the ensemble has never been contaminated with chemical agent liquid or aerosol, reuse is authorized only if one of the following conditions is satisfied: a determination has been made in accordance with Army chemical agent safety standards that the ensemble is not contaminated or potentially contaminated, or the ensemble has been decontaminated to a safe level and successful decontamination has been verified with a monitoring or analytical method.

(3) Reuse is authorized only if the ensemble or ensemble element is maintained in accordance with written procedures, and those written procedures are consistent with the manufacturer's recommendations for testing, maintenance, and inspection. The ensemble or ensemble element must not be used or reused if it has an unrepaired defect. Holes, cuts, tears, delamination, and cloudy visors are examples of defects that would generally require repair (if possible) before use or reuse. Discoloration and abnormal smells are examples of conditions that would generally require evaluation to determine whether or not repair is required before use or reuse.

f. Limitations and additional requirements:

(1) The NFPA standard requires the ensemble or ensemble element label to identify the manufacturer. The NFPA standard also requires the manufacturer to furnish a technical data package and evidence of certification upon request. Users must be informed of the technical data package and evidence of certification, and the technical data package and evidence of certification must be readily available to users for review.

(2) The NFPA standard requires the ensemble or ensemble element label to identify the certification organization. The NFPA standard also requires the certification organization to publish a listing of certified ensembles. Users must be informed of the listing, and the listing must be readily available to users for review.

(3) The NFPA standard requires the manufacturer to establish a written safety alert system and a written product recall system. Users must be informed of the safety alert and product recall systems, and the written system descriptions as well as any relevant safety alerts and product recalls must be readily available to users for review.

C–8. European Level B

a. Manufacturer and model:

(1) DIN EN 943–1; Type 1b "gas-tight" chemical protective suits (using a facemask not permanently joined to the suit; breathing apparatus worn outside the chemical protective suit).

(2) DIN EN 943–2; Type 1b-ET "gas-tight" chemical protective suits (using a facemask not permanently joined to the suit; breathing apparatus worn outside the chemical protective suit).

(3) DIN EN 14605; Type 3 "liquid-tight" chemical protective suits.

b. Protection level: OSHA/EPA Level B.

c. Chemical agents:

(1) Nerve agents GA, GB, GD, and VX if and only if the performance level obtained is at least Class 3 (normalized breakthrough time greater than 60 minutes) in permeation resistance testing through continuous contact with liquid GB, in accordance with DIN EN 943–1.

(2) Sulfur mustards HD, HT, and H if and only if the performance level obtained is at least Class 3 (normalized breakthrough time greater than 60 minutes) in permeation resistance testing through continuous contact with liquid HD, in accordance with DIN EN 943–1.

(3) Blister agent L if and only if the performance level obtained is at least Class 3 (normalized breakthrough time greater than 60 minutes) in permeation resistance testing through continuous contact with liquid L, in accordance with DIN EN 943–1.

d. Use scenarios:

(1) Any work activity and hazard environment consistent with the manufacturer's recommendations and also supported with a hazard analysis or risk assessment specific to both the work activity and hazard environment.

(2) For IDLH atmospheres, 29 CFR 1910.134(d)(2) requires either a full-facepiece pressure-demand SCBA with a minimum (nominal) service life of thirty minutes or a combination full-facepiece pressure-demand SAR with auxiliary self-contained air supply.

(3) The respirator must fit the chemical protective suit. The respirator must physically interface or interconnect with or become an integral part of the chemical protective ensemble without compromising worker protection. The respirator must be selected based on recommendation from the suit manufacturer, a certified industrial hygienist (www.abih.org), or a certified safety professional (www.bcsp.org) qualified in respirator selection.

(4) The suit must not be relied upon for protection more than one hour from the initial contact or suspected contact with chemical agent liquid or aerosol; the one hour duration must also include sufficient time to process through personnel decontamination stations (remove or neutralize chemical contaminants or doff the suit). The one-hour limit is based on the minimum breakthrough time of the Class 3 performance level (the lowest performance level authorized) and is not meant to imply the suit does not provide protection for more than one hour.

(5) If permeation resistance testing is performed in accordance with DIN EN 943–1, then the suit must not be relied upon for protection above 23 deg C (73 deg F). However, if permeation resistance testing is performed in accordance with DIN EN 943–1 but at a higher temperature (up to 32 deg C or 90 deg F), then the suit may be relied upon for protection up to that higher temperature. The performance level obtained at the higher temperature is still required to be at least Class 3.

(6) Suits may be used for training purposes even if the shelf life and service life dates have passed as long as no additional hazard is created for the user. Such suits must be clearly marked for training purposes and kept segregated from suits to be used for chemical agent protection.

e. Reuse: EN establish two variants of chemical protective clothing—reusable and limited-use. Reusable clothing can be cleaned and reused. Limited-use clothing is intended for a single use or limited reuse, for example, to be worn until hygienic cleaning becomes necessary or chemical contamination has occurred.

(1) Reuse is not authorized if the suit has ever been contaminated with chemical agent liquid or aerosol.

(2) Reuse is authorized only for a reusable suit and only if one of the following conditions is satisfied:

(a) A determination has been made in accordance with Army chemical agent safety standards that the ensemble is not contaminated or potentially contaminated, or

(b) The ensemble has been decontaminated to a safe level and successful decontamination has been verified with a monitoring or analytical method.

(3) Reuse is authorized only if the suit is maintained in accordance with written procedures and those written procedures are consistent with the manufacturer's recommendations for testing, maintenance, and inspection. The suit must not be reused if it has an unrepaired defect. Holes, cuts, tears, delaminating, and cloudy visors are examples of defects that would generally require repair (if possible) before reuse. Discoloration and abnormal smells are examples of conditions that would generally require evaluation to determine whether or not repair is required before reuse. (These concerns obviously apply to initial use as much as they apply to reuse.)

f. Limitations and additional requirements:

(1) Permeation resistance testing with relevant chemical agents (such as GB and HD) in accordance with DIN EN 14325, must have been conducted no more than 5 years prior to the manufacturing date of the suit. If more than 5 years have elapsed since testing was completed, then continued use is not authorized without re-testing. The intent of this additional requirement is to periodically check for performance issues not otherwise detected.

(2) The DIN EN 943–1 and DIN EN 943–2 standards require the suit manufacturer to supply a list of chemicals to which the protective clothing has been tested and the performance levels obtained in permeation and/or penetration testing. Users must be informed of this test data, and the test data for relevant chemical agents (such as GB and HD) must be readily available to users for review. The test data must be made available in English or with a translation into English.

(3) Directive 89/686/EEC (with amendments) requires the suit manufacturer to obtain an EC Type-Examination Certificate from a Notified Body. The Certificate demonstrates that an independent Notified Body has examined technical information and suit specimens and thereby determined that the suit model satisfies the relevant standard(s). Users must be informed of this Certificate, and the Certificate must be readily available to users for review. The Certificate must be made available in English or with a translation into English.

(4) Directive 89/686/EEC (with amendments) requires the suit manufacturer to issue a Declaration of Conformity. The Declaration identifies the Notified Body monitoring the quality of suit manufacturing. The Declaration demonstrates that an independent Notified Body is either monitoring the product quality ("Article 11 Point A") or monitoring the production quality control system ("Article 11 Point B"). (Note: Under Article 11 Point A, the Notified Body selects random samples and conducts the required testing. Under Article 11 Point B, the Notified Body verifies that the suit manufacturer is selecting random samples and conducting the required testing. The same testing is required for both.) Users must be informed of this Declaration, and the Declaration must be readily available to users for review. The Declaration must be made available in English or with a translation into English.

(5) Users must be informed how their organization would be notified if the suit manufacturer or its authorized representative or the Notified Body or the Member State took action in order to safeguard users (such as safety alert and/or product recall). A written description of this notification system as well as any relevant safety notices must be readily available to users for review. The system description and safety notices (if any) must be made available in English or with a translation into English.

Section III

Level C

C–9. National Institute for Occupational Safety and Health chemical, biological, radiological, and nuclear Level C reuse

a. Manufacturer and model: All NIOSH CBRN APRs and PAPR.

b. Protection level:

(1) OSHA/EPA Level C.

(2) NFPA 1994 Class 3 and Class 3R (ruggedized).

c. Chemical agents: GA, GB, GD, GF, VX, HD, H, and HT.

d. Use scenarios:

(1) Any work activity and hazard environment consistent with the manufacturer's recommendations and also supported with a hazard analysis or risk assessment specific to both the work activity and hazard environment.

(2) For operational purposes, the respirators are restricted to the same maximum use limits—concentration and duration—as the NATO/military approved masks. See paragraph 4–4 of this pamphlet. (This restriction does not obviate any of the manufacturer's recommendations, and the manufacturer's recommendations may be more restrictive.)

(3) For escape purposes, the respirators are authorized for a maximum of 50 times the STEL concentration for periods not to exceed 15 minutes. Compare with paragraph 4–4 of this pamphlet. (This restriction does not obviate any of the manufacturer's recommendations, and the manufacturer's recommendations may be more restrictive.)

(4) Respirators may be used for training purposes even if the shelf life and service life dates have passed as long as no additional hazard is created for the user. Such respirators must be clearly marked for training purposes and kept segregated from respirators to be used for chemical agent protection.

e. Reuse: NIOSH CBRN standards establish requirements for respirators that are worn for a single exposure to chemical agent. The standard cautions users against reuse after exposure, particularly if the effectiveness of decontamination cannot be determined. With decades of operating experience in diverse use scenarios, the Army has safely reused respirators because of the multi-faceted approach to worker protection described in Army safety standards.

(1) Reuse is not authorized if the respirator has ever been contaminated with chemical agent liquid or aerosol.

(2) If the respirator has never been contaminated with chemical agent liquid or aerosol, reuse is authorized only if one of the following conditions is satisfied:

(a) A determination has been made in accordance with Army chemical agent safety standards that the respirator is not contaminated or potentially contaminated, or

(b) The respirator has been decontaminated to a safe level and successful decontamination has been verified with a monitoring or analytical method.

(3) Reuse is authorized only if the respirator is maintained in accordance with written procedures, and those written procedures are consistent with the manufacturer's recommendations for testing, maintenance, and inspection. The respirator must not be used or reused if it has an unrepaired defect. The respirator must not be used or reused if it has a condition that would generally require an evaluation to determine whether or not repair is required but the evaluation has not yet been completed.

(4) Filter media canisters or cartridges must be replaced in accordance with the manufacturer's recommendations.

f. Limitations and additional requirements:

(1) NIOSH CBRN approval includes several statements of caution and limitations. This approval does not modify any of those cautions and limitations except as stated above for reuse.

(2) The NIOSH standard requires labeling of CBRN approved respirators. Users must be informed of the labeling, and the labeling must be readily visible to users for review.

(3) The NIOSH standard requires listing of CBRN approved respirators. Users must be informed of the listing, and the listing must be readily available to users for review.

(4) Users must be informed of the safety alert and product recall systems. The written system descriptions as well as any relevant safety alerts and product recalls must be readily available to users for review.

C–10. National Fire Protection Association 1994, Level C

a. Manufacturer and model: NFPA 1994 Class 3 and 3R (ruggedized) protective ensembles and ensemble elements.

b. Protection level: OSHA/EPA Level C.

c. Chemical agents: GA, GB, GD, GF, VX, HD, H, and HT. Note: A request to use with another chemical agent must describe the chemical permeation resistance test method and include the test results. See specific sections of NFPA 1994, Chapter 7 and Chapter 8, that pertain to chemical agent permeation testing. The request must describe how it will be verified that chemical permeation resistance for that chemical agent continues to be adequate in the future. See NFPA 1994 Section 4.4, Annual Verification of Product Compliance.

d. Use scenarios:

(1) Any work activity and hazard environment consistent with the manufacturer's recommendations and also supported with a hazard analysis or risk assessment specific to both the work activity and hazard environment.

(2) Ensembles must be relied upon for protection no more than one hour from initial exposure or potential exposure to chemical agent liquid. Ensembles must not be relied upon for protection from chemical agent aerosols and/or vapor above the IDLH-concentration. The one-hour limit is based on duration of the NFPA chemical permeation resistance test and is not meant to imply the ensemble or ensemble element is not protective for more than one hour. Note: A request to use for longer than one hour must describe the chemical permeation resistance test method and include the test results. See specific sections of NFPA 1994, Chapter 7, Ensembles, and Chapter 8, Test methods, which pertain to permeation testing. The request must describe how it will be verified that chemical permeation resistance for longer than one hour continues to be adequate in the future. See NFPA 1994 Section 4.4, Annual Verification of Product Compliance.

(3) Ensembles must be relied upon for protection only at or between -25 deg C (-13 deg F) and 32 deg C (90 deg F). Note: A request to use at higher temperatures must describe the chemical permeation resistance test method and include the test results. See specific sections of NFPA 1994, Chapter 7, Ensembles, and Chapter 8, Test methods, which pertain to chemical agent permeation testing. The request must describe how it will be verified that chemical permeation resistance at higher temperatures continues to be adequate in the future. See NFPA 1994 Section 4.4, Annual Verification of Product Compliance.

(4) Ensembles may be used for training purposes even if the shelf life and service life dates have passed as long as no additional hazard is created for the user. Such ensembles must be clearly marked for training purposes and kept segregated from ensembles to be used for chemical agent protection.

e. Reuse: NFPA 1994 establishes requirements for protective ensembles and ensemble elements that are worn for a single exposure to chemical agent. The standard cautions users against reuse after exposure, particularly if the effectiveness of decontamination cannot be determined. With decades of operating experience in diverse use scenarios, the Army has safely reused protective ensembles and ensemble elements because of the multi-faceted approach to worker protection described in Army safety standards.

(1) Reuse is not authorized if the ensemble has ever been contaminated with chemical agent liquid or aerosol.

(2) If the ensemble has never been contaminated with chemical agent liquid or aerosol, reuse is authorized only if one of the following conditions is satisfied:

(a) A determination has been made in accordance with Army chemical agent safety standards that the ensemble is not contaminated or potentially contaminated, or

(b) The ensemble has been decontaminated to a safe level and successful decontamination has been verified with a monitoring or analytical method.

(3) Reuse is authorized only if the ensemble or ensemble element is maintained in accordance with written procedures, and those written procedures are consistent with the manufacturer's recommendations for testing, maintenance, and inspection. The ensemble or ensemble element must not be used or reused if it has an unrepaired defect. Holes, cuts, tears, delamination, and cloudy visors are examples of defects that would generally require repair (if possible) before use or reuse. Discoloration and abnormal smells are examples of conditions that would generally require evaluation to determine whether or not repair is required before use or reuse.

f. Limitations and additional requirements:

(1) The NFPA standard requires the ensemble or ensemble element label to identify the manufacturer. The NFPA standard also requires the manufacturer to furnish a technical data package and evidence of certification upon request. Users must be informed of the technical data package and evidence of certification, and the technical data package and evidence of certification must be readily available to users for review.

(2) The NFPA standard requires the ensemble or ensemble element label to identify the certification organization. The NFPA standard also requires the certification organization to publish a listing of certified ensembles. Users must be informed of the listing, and the listing must be readily available to users for review.

(3) The NFPA standard requires the manufacturer to establish a written safety alert system and a written product recall system. Users must be informed of the safety alert and product recall systems, and the written system descriptions as well as any relevant safety alerts and product recalls must be readily available to users for review.

C–11. European Level C

a. Manufacturer and model: DIN EN 14605; Type 4 “spray-tight” chemical protective suits.

b. Protection level: OSHA/EPA Level C.

c. Chemical agents:

(1) Nerve agents GA, GB, GD, and VX if and only if the performance level obtained is at least Class 3 (normalized breakthrough time greater than 60 minutes) in permeation resistance testing through continuous contact with liquid GB, in accordance with DIN EN 943–1.

(2) Sulfur mustards HD, HT, and H if and only if the performance level obtained is at least Class 3 (normalized breakthrough time greater than 60 minutes) in permeation resistance testing through continuous contact with liquid HD, in accordance with DIN EN 943–1.

(3) Blister agent L if and only if the performance level obtained is at least Class 3 (normalized breakthrough time greater than 60 minutes) in permeation resistance testing through continuous contact with liquid L, in accordance with DIN EN 943–1.

d. Use scenarios:

(1) Any work activity and hazard environment consistent with the manufacturer’s recommendations and also supported with a hazard analysis or risk assessment specific to both the work activity and hazard environment.

(2) The respirator must fit the chemical protective suit. The respirator must physically interface or interconnect with or become an integral part of the chemical protective ensemble without compromising worker protection. The respirator must be selected based on recommendation from the suit manufacturer, a certified industrial hygienist (www.abih.org), or a certified safety professional (www.bcsp.org) qualified in respirator selection.

(3) The suit must not be relied upon for protection more than one hour from the initial contact or suspected contact with chemical agent liquid or aerosol; the one hour duration must also include sufficient time to process through personnel decontamination stations (remove or neutralize chemical contaminants or doff the suit). The one-hour limit is based on the minimum breakthrough time of the Class 3 performance level (the lowest performance level authorized) and is not meant to imply the suit does not provide protection for more than 1 hour.

(4) If permeation resistance testing is performed in accordance with DIN EN 943–1, then the suit must not be relied upon for protection above 23 deg C (73 deg F). However, if permeation resistance testing is performed in accordance with DIN EN 943–1 but at a higher temperature (up to 32 deg C or 90 deg F), then the suit may be relied upon for protection up to that higher temperature. The performance level obtained at the higher temperature is still required to be at least Class 3.

(5) Suits may be used for training purposes even if the shelf life and service life dates have passed as long as no additional hazard is created for the user. Such suits must be clearly marked for training purposes and kept segregated from suits to be used for chemical agent protection.

e. Reuse: EN establish two variants of chemical protective clothing—reusable and limited-use. Reusable clothing can be cleaned and reused. Limited-use clothing is intended for a single use or limited reuse, for example, to be worn until hygienic cleaning becomes necessary or chemical contamination has occurred.

(1) Reuse is not authorized if the suit has ever been contaminated with chemical agent liquid or aerosol.

(2) Reuse is authorized only for a reusable suit and only if one of the following conditions is satisfied:

(a) A determination has been made in accordance with Army chemical agent safety standards that the ensemble is not contaminated or potentially contaminated.

(b) The ensemble has been decontaminated to a safe level and successful decontamination has been verified with a monitoring or analytical method.

(3) Reuse is authorized only if the suit is maintained in accordance with written procedures and those written procedures are consistent with the manufacturer’s recommendations for testing, maintenance, and inspection. The suit must not be reused if it has an unrepaired defect. Holes, cuts, tears, delaminating, and cloudy visors are examples of defects that would generally require repair (if possible) before reuse. Discoloration and abnormal smells are examples of conditions that would generally require evaluation to determine whether or not repair is required before reuse. (These concerns obviously apply to initial use as much as they apply to reuse.)

f. Limitations and additional requirements:

(1) Permeation resistance testing with relevant chemical agents (such as GB and HD) in accordance with DIN EN 14325, must have been conducted no more than 5 years prior to the manufacturing date of the suit. If more than 5 years has elapsed since testing was completed, then continued use is not authorized without re-testing. The intent of this additional requirement is to periodically check for performance issues not otherwise detected.

(2) The DIN EN 943–1 and DIN EN 943–2 standards require the suit manufacturer to supply a list of chemicals to which the protective clothing has been tested and the performance levels obtained in permeation and/or penetration testing. Users must be informed of this test data, and the test data for relevant chemical agents (such as GB and HD) must be readily available to users for review. The test data must be made available in English or with a translation into English.

(3) Directive 89/686/EEC (with amendments) requires the suit manufacturer to obtain an EC Type-Examination Certificate from a Notified Body. The Certificate demonstrates that an independent Notified Body has examined technical information and suit specimens and thereby determined that the suit model satisfies the relevant standard(s). Users must be informed of this Certificate, and the Certificate must be readily available to users for review. The Certificate must be made available in English or with a translation into English.

(4) Directive 89/686/EEC (with amendments) requires the suit manufacturer to issue a Declaration of Conformity. The Declaration identifies the Notified Body monitoring the quality of suit manufacturing. The Declaration demonstrates that an independent Notified Body is either monitoring the product quality ("Article 11 Point A") or monitoring the production quality control system ("Article 11 Point B"). (Note: Under Article 11 Point A, the Notified Body selects random samples and conducts the required testing. Under Article 11 Point B, the Notified Body verifies that the suit manufacturer is selecting random samples and conducting the required testing. The same testing is required for both.) Users must be informed of this Declaration, and the Declaration must be readily available to users for review. The Declaration must be made available in English or with a translation into English.

(5) Users must be informed how their organization would be notified if the suit manufacturer or its authorized representative or the Notified Body or the Member State took action in order to safeguard users (such as safety alert and/or product recall). A written description of this notification system as well as any relevant safety notices must be readily available to users for review. The system description and safety notices (if any) must be made available in English or with a translation into English.

Section IV

Emergency Escape Devices

C–12. National Institute for Occupational Safety and Health chemical, biological, radiological, and nuclear emergency escape devices

a. Manufacturer and model: All NIOSH CBRN Air-Purifying Escape Respirators and Self-Contained Escape Respirators.

b. Protection level: Emergency escape only.

c. Chemical agents: GA, GB, GD, GF, VX, HD, H, and HT.

d. Use scenarios:

(1) Emergency escape consistent with the manufacturer's recommendations and also supported with a hazard analysis or risk assessment specific to both the work activity and hazard environment.

(2) EEDs are authorized for escape purposes only and for a maximum of 50 times the STEL concentration for periods not to exceed 15 minutes. (This restriction does not obviate any of the manufacturer's recommendations, and the manufacturer's recommendations may be more restrictive.)

(3) EEDs may be used for training purposes even if the shelf life and service life dates have passed as long as no additional hazard is created for the user. Such EEDs must be clearly marked for training purposes and kept segregated from EEDs to be used for chemical agent protection. Cylinders and other pressure systems with hydrostatic test requirements may not be used for training if the shelf life, service life, and hydrostatic test dates have passed.

e. Reuse: NIOSH CBRN standards establish requirements for respirators that are worn for a single exposure to chemical agent. The standard cautions users against reuse after exposure, particularly if the effectiveness of decontamination cannot be determined. With decades of operating experience in diverse use scenarios, the Army has safely reused respirators because of the multi-faceted approach to worker protection described in Army safety standards.

(1) Reuse is not authorized if the EED has ever been contaminated with chemical agent liquid or aerosol.

(2) If the EED has never been contaminated with chemical agent liquid or aerosol, reuse is authorized only if one of the following conditions is satisfied:

(a) A determination has been made in accordance with Army chemical agent safety standards that the EED is not contaminated or potentially contaminated, or

(b) The EED has been decontaminated to a safe level and successful decontamination has been verified with a monitoring or analytical method.

(3) Reuse is authorized only if the EED is maintained in accordance with written procedures, and those written procedures are consistent with the manufacturer's recommendations for testing, maintenance, and inspection. The EED must not be used or reused if it has an unrepaired defect. The EED must not be used or reused if it has a condition that would generally require an evaluation to determine whether or not repair is required but the evaluation has not yet been completed.

(4) Filter media canisters or cartridges must be replaced in accordance with the manufacturer's recommendations.

f. Limitations and additional requirements:

(1) NIOSH CBRN approval includes several statements of caution and limitations. This approval does not modify any of those cautions and limitations except as stated above for reuse.

(2) The NIOSH standard requires labeling of CBRN approved EEDs. Users must be informed of the labeling, and the labeling must be readily visible to users for review.

(3) The NIOSH standard requires listing of CBRN approved EEDs. Users must be informed of the listing, and the listing must be readily available to users for review.

(4) Users must be informed of the safety alert and product recall systems. The written system descriptions as well as any relevant safety alerts and product recalls must be readily available to users for review.

Section V

Approval of Alternate Personal Protective Equipment

C–13. Process for model-specific approval of personal protective equipment

a. Background. The DACASC is responsible for advising the Director of Army Safety on the suitability of alternate chemical PPE for use in Army chemical agent operations. This process allows users to tailor their operational requirements and select the best available respiratory protection. This process also allows for requesting the use of commercial ensembles and NIOSH-certified commercial respirators in work environments where both chemical agents and toxic industrial chemicals (TICs), such as chlorine, phosgene, cyanogen chloride, mercury, and hydrogen cyanide may be encountered. Commercial respirators that are not NIOSH-certified will not be considered. All components and filters must be compatible with the agent(s) and industrial contaminant(s) of concern.

b. Process.

(1) In order to comply with Federal, DoD, and DA safety and health standards, the DACASC, on behalf of the Director of Army Safety and DASA (ESOH), developed a review and approval program to allow the use of commercially available chemical protective equipment (clothing and respirators) during chemical agent operations. The requirements in paragraph C–13 identify the specific testing and documentation necessary for approval to use commercially available protective clothing in chemical agent operations and require development of supporting use scenarios and safety analyses.

(2) The intent of this process is to allow users to tailor their requirements and select the best available equipment. Approval for the use of alternate PPE gives Army commanders and directors, contractors, and others more options to address the variety of chemical hazards that may exist both on and off Army installations. This process does not prevent the use of Army type-classified PPE such as the Joint Service Lightweight Integrated Suit Technology and NATO/military approved masks .

(3) Paragraph C–13 contains the required and recommended information to be included in all requests to use alternate PPE in Army chemical agent operations.

C–14. Submission requirements for use of commercial protective clothing and equipment in chemical agent environments

a. Requests for use of commercial protective clothing and equipment with chemical agents will be submitted for approval to the ODASAF, DACS–SF, 200 Army Pentagon, Washington, DC 20319–0200. Requests must include all required information (such as test data and use scenario). Each requester must forward all materials, including the "use scenario" to ODASAF. The ODASAF will forward the request to the DACASC Protective Clothing and Equipment PPE Subgroup for review. The PPE Subgroup will provide a recommendation to the ODASAF, which will review and forward a concurrence, disapproval, or limited approval to the requester.

b. In order to prevent duplications of effort, ODASAF will maintain a file of respirator test results on the Army Knowledge Online website.

c. Format for commercial protective clothing and equipment request submission:

(1) *Title of request.* Include name of the respirator and manufacturer; cartridge, filter, air source; positive or negative pressure; location of use.

(2) *Compelling reason.* Describe the benefit(s) reasonably anticipated as a result of ODASAF approval.

(3) *References.* Include previous ODASAF approval-for-use memoranda, pertinent manufacturer information, and challenge agent or testing reports.

(4) *Item description.*

(a) Commercial protective clothing item description. Completely describe the PPE. Include the type of material, manufacturer, make, and model. Identify if the PPE is approved for vapor only, vapor and liquid, splash, escape only, entry and escape from hazardous atmospheres, entry and use in IDLH environments, and so forth. Describe how monitoring will be used to establish and dictate PPE use. Include breakthrough test data, mathematical estimates, and manufacturer data.

(b) Commercial respirator description. Completely describe the respirator. Include the type of filter(s) or breathing air source, the respirator's capabilities, and the make, model, and NIOSH certification number. Identify whether the respirator is approved for escape only, entry and escape from hazardous atmospheres, entry and use in IDLH environments, and so forth. Describe the cartridge change-out schedule including how monitoring will be used to establish and dictate cartridge change. Include breakthrough test data, mathematical estimates, and manufacturer data.

(5) *Use scenario(s).*

(a) Fully describe how and why the PPE will be used. This includes description of the work activities, hazardous environments (such as hot areas), use restrictions (such as lock-out tag-out or confined space entry permits required), and sources of contaminants, including specific chemical agent(s) and industrial chemicals and particulates.

(b) Describe how the PPE was selected. For respirators you must include information on the APF for a full facepiece negative or positive pressure device and manufacturer use limitations for the device, facepiece, and cartridge or filter.

(c) Types and potential airborne concentrations of chemical agent, toxic industrial chemicals, toxic industrial materials, and other airborne hazards involved as applicable. Include a list of contaminants and upper use limits with which the respirator and cartridges or filters are designed to be used. The worksite characterization must list the type of known or anticipated hazards (including oxygen deficient atmospheres, contaminants other than chemical agent and IDLH environments, and so forth).

(d) Type of NRT and documentation on monitoring that will be conducted during operations.

(e) Contingencies and the steps that will be taken should the monitor alarm.

(f) Steps to recognize when limits are being exceeded.

(g) Whether or not there is a potential for contact with liquid chemical agents.

(6) *Hazard analysis.* A hazard analysis of the use scenario must be performed. If the use scenario has an SOP, then the hazard analysis for that SOP should be included. Include a discussion of the following in the hazard analysis: ergonomic hazards, heat stress, and impacts from other chemicals.

(7) *Ensembles.* Discuss the respirator and protective clothing that will be used as part of any ensembles. Discuss the respirator use with the protective hood, if applicable. Be certain that any testing performed on the hood material matches the use scenario. For instance, if the scenario has the potential for exposure to liquid lewisite, then the request must include test data that demonstrates the effectiveness of the material to protect against that hazard. Permeation test data from the hood manufacturer should be reviewed for applicability and submitted with the request.

(8) *Test data.* If you are using existing test data then you should indicate that here, otherwise all of the test data must be forwarded as an enclosure.

(9) *Training and certification.* Describe any special inspection, repair, or maintenance certification that is required by the manufacturer for the personnel maintaining or repairing the PPE.

(10) *Maintenance.* Discuss how the PPE will be maintained and stored. Include any quality assurance testing procedures and operational quality program information.

(11) *Scope and duration.* Discuss the timeframe the requested use of the commercial respirator is intended. (DACASC PPE approvals will typically cover a period of time not to exceed 5 years from date of approval.)

(12) *Point of contact.* A technical point of contact that can answer questions regarding the installation or requester's submission will be provided.

(13) *Other information.* Include additional information as needed.

Appendix D

Types of Chemical Agent Health-Based Criteria for Determining Suitability for Public Release

D–1. Purpose and scope

Table D–1 summarizes the types of health-based concentration criteria that may be used in risk assessments to determined suitability of public (unrestricted) release of items, equipment, or facilities exposed to chemical agents. It also describes the situations and applications when such criteria can be used. The criteria includes various air monitoring concentration levels (mg/m3) as well as concentration levels that would be used to assess extracts from soil or other solid media (mg/kg). Depending on the item, site, or scenario, a single criterion may be selected, or a combination of criteria and sampling approaches may be chosen. Specific sampling procedure will typically require item or site-specific considerations.

D–2. Introduction

While DA's approaches to managing chemical agent-contaminated items, equipment, facilities, and waste have provided adequate and effective protection to workers and the public, the Army has taken steps to expand the mechanisms for ensuring the protection of public health to address evolving concerns, inconsistencies at different Army sites, and alternative decontamination management practices.

a. Part of the problem is that Federal, State, and local regulators as well as the public are not generally familiar with DA safety procedures, as these do not always parallel activities associated with toxic industrial compounds. While non DoD entities often voice concern over DA-unique procedures, some of the criteria used by DA to assess and manage items or waste are actually overly conservative. For other situations the procedures need greater flexibility to address matrix unique issues or local requirements. While DA is committed to ensuring that its activities are performed in a manner that protects and preserves human health and the environment, it also wishes to ensure that environmental management decisions are balanced with appropriate scientific rationale and identified health benefits. This process includes procedures that more closely mirror those used by other Federal and State environmental health agencies.

b. Management and disposition of chemical agent-contaminated equipment, tools, facilities, and waste (or even potentially contaminated equipment, tools, facilities, and waste) have often relied on different measures, including concentration limits, analytical sensitivity, and decontamination or treatment technologies. Quite often, different types of concentration levels and terms have been applied erroneously. The terms that have been associated with some of the concentration levels and procedural requirements for managing contaminated waste or media include: agent-free, risk- free, zero agent, detection limits, field drinking water standards (FDWS), waste control limits (WCL), 3X and 5X, and risk based or health-based. Many of these terms have been or are being used interchangeably, or without clear or uniform definition. In many cases, the interpretations of these terms have been negotiated with local regulators for specific purposes, which results in the same term having a different meaning in different states.

D–3. Health-based approach

This document prescribes future applications of more situation-specific, health-based criteria for assessing the safety and appropriateness of environmental management decisions (see chap 5). Specifically, the use of health-based criteria is required over some of the historical approaches and terms described in paragraph D–5. Health-based criteria are developed by considering a specific chemical, a specific scenario in which individuals may be exposed: characteristics regarding those individuals and their activities result in an estimate of the overall dose of the chemical they are going to be receiving. That dose is compared with existing reference toxicity thresholds. This comparison allows the characterization or quantification of the degree of risk to which a person is exposed, and allows risk managers to determine how much to limit exposure in order to reduce risk to acceptable levels. In order to address several areas of scientific uncertainty, there are several steps to ensure conservative (protective) criteria are determined through the health risk assessment process. Use of a health-based approach ensures appropriate use of science and consistency with other Federal agencies (such as EPA) in environmental or health decision making.

D–4. Existing terminology and applications

a. 3X and 5X. As described in chapter 5, the Army's use of these decontamination level terms is no longer prescribed (except as described in para 5–1), largely due to the lack of parallel terminologies or procedures used by regulators and industry for toxic industrial chemicals. The 5X level has historically been the criteria cited for determining suitability for public or unrestricted release. Meeting this criterion was essentially defined as a specific procedure involving high temperature incineration to achieve complete decontamination. Other means of ascertaining complete decontamination (sometimes referred to as agent-free) were alluded to without specific guidance. As a result, the ability to achieve the 5X level was limited.

b. Agent-free, risk-free, or zero agent. The DA, civilian regulators, and the public have not interpreted these terms consistently. The terms agent-free and zero agent can be read as absolutes and in several instances have been interpreted as removal of every molecule. Likewise, while decisions should be risk-based, it is generally impossible to prove a completely risk-free environment. Thus, risk-free is also seen as too absolute a statement. Despite theoretical beliefs, successful achievement of such absolutes is difficult if not impossible to prove. The only occasions where such terminology may be appropriate is where evidence is available to indicate that no contamination has occurred. In such cases, agent-free may be an acceptable description.

c. Detection and quantification limits. As detection limits can vary per laboratory, equipment, analytical method, matrix sampled, specific sample, and other factors, use of these criteria requires clarification. More importantly, the use of the detection limit in risk management decisions is not health-based and in some cases could result in significant expenditure of resources for limited or no health benefit. In fact, the EPA is incorporating health-based approaches in nearly all its new initiatives and only defers to detection limits when a health-based value is below analytical sensitivity. Unless a health-based assessment can delineate the need for specific detection requirements or goals, the detection limit should not be cited as a required standard.

d. Field drinking water standards and waste control limits. The FDWS were developed to address the potential intentional contamination of Soldier drinking water supplies on the battlefield (see TB MED 577). These levels were based on the assumption that Soldiers consume up to 15 liters per day for up to 7 days. For many years, the FDWS were the only documented chemical agent concentration limits for media other than air. For lack of an alternative, these concentration levels (20 parts per billion (ppb) for nerve agents and 200 ppb for HD) have been used as the acceptable levels for disposal of chemical agent waste off Army sites as well as to ascertain effectiveness of decontamination procedures. These FDWS have also been referred to as WCL. Application of safe drinking water levels as the WCL is overly conservative (overly protective) when applied to a waste stream which is clearly not consumed.

D–5. Specific guidance

As the term "health-based" refers to criterion that is suited to protecting human health and the environment under a given set of circumstances, it is important not to misapply one set of criteria to an unrelated scenario. The use of scientifically accepted, and preferably EPA-endorsed, environmental risk-assessment methodology (such as EPA Region IX) is currently recommended as the means to tailor certain criteria to specific applications, such as for waste management decisions and environmental cleanup decisions. The user is referred to table D–1 for key criteria and their particular applications.

Table D–1
Types of health-based criteria that may be used in risk assessment to determine suitability of public (unrestricted) release of items, equipment, or facilities exposed to chemical agent 1, 2

Criteria name	Description of criteria	Application purpose	Considerations for appropriate use	Sample scenarios
GPL	A highly protective vapor exposure criterion (mg/m^3) for 24 hours daily, lifetime exposure of the general population including those more susceptible individuals: a no observed ad-verse effect level represents	May be used with appropriate sampling (that is, item is contained, with proper heating or temperature to facilitate off-gassing and collection of potential contaminant release to air) to demonstrate no risk of a continued (daily,	May be particularly useful if there is concern that a matrix or item of porous or semi-porous material that may (theoretically) contain absorbed residual agent could off-gas over time at low concentrations. Also, if item or	Facility or equipment routinely exposed to agent vapors and potential liquid agent, decontaminated by involving many parts or types of material—use proper sampling and use of GPL as screening criteria for unrestricted release.

Table D–1
Types of health-based criteria that may be used in risk assessment to determine suitability of public (unrestricted) release of items, equipment, or facilities exposed to chemical agent 1, 2

	an exposure at or below which there are no anticipated adverse health effects from either short- or long-term repeated exposures (that is, that occur 24 hours daily for up to 70 years).	multiple year) release of agent at levels of public health concern.	equipment includes complex surface or construction (composites, different parts with crevices, and so forth) that may at least theoretically contain residual agent deposits. Particularly appropriate application if such (porous or complex) items have been in contact with liquid or aerosol agent.	
AEGL–1 to 8 hours	A protective vapor exposure criterion (mg/m^3) for a one-time exposure of the general population including those more susceptible individuals: based on estimate of no observed effect level or threshold at or below which there are no anticipated noticeable effects.	May be used with appropriate sampling (that is, item is contained with proper heating or temperature to facilitate off-gassing and collection of potential contaminant release to air) to demonstrate unlikelihood of chemical agent being released from item at levels of public health concern.	Can be an appropriately protective health-based vapor screening criteria for releasing items, equipment, or facilities that have not been contaminated by liquid or aerosol agent or which includes simple nonporous items or surfaces that have undergone decontamination. Based on material or construction, such decontaminated items would not be expected to have absorbed significant agent that would pose contact hazard or that would be continuously re-leased over period of time.	If an accidental release occurred and vapors (but no liquid) were detected in area otherwise not routinely exposed containing equipment or vehicles—could use AEGL–1 to 8 hour to ensure area and/or items cleared for unrestricted public use.
Health-based environmental screening level - residential	A highly protective soil or solid matrix exposure criterion (mg/kg) for 24 hours daily, lifetime exposure of the general population including those more susceptible individuals: a no observed adverse effect level—represents an exposure at or below which there are no anticipated adverse health effects from either short- or long-term repeated exposures (that is, that occur 24 hours daily up to 70 years).	May be used alone or in conjunction with vapor exposure criteria de-scribed above (GPL or AEGL 1) to assess possible existence of residual agent in semi-porous or porous media and demonstrate unlikelihood of chemical agent being present in or on an item or material at levels of public health concern.	May be particularly useful if vapor off-gassing is not considered adequate or appropriate. Sampling should include procedures to ensure representative samples of media are obtained from specific media or area of concern.	Facilities or areas with concentrate or soil of potential (liquid) contamination or adsorption from extended high vapor concentrations could be sampled and extract analyzed (such as through gas chromatography-mass spectrometry) for presence of agents. This approach also allows assessment of potential breakdown products as well.
Nonhazardous waste exemption level	A soil or solid matrix exposure criterion (mg/kg) derived as an estimate at or below which a worker at a municipal landfill or construction debris	For waste management — to support release to a non-RCRA permitted treatment, storage, and disposal facility—may be used alone or in	May be particularly useful if vapor off-gassing is not considered adequate or appropriate. Sampling should include procedures to ensure	To support decision[3] to manage and dispose of concrete and pallets as a nonhazardous waste.

Table D–1
Types of health-based criteria that may be used in risk assessment to determine suitability of public (unrestricted) release of items, equipment, or facilities exposed to chemical agent 1, 2

	facility (nonhazardous waste) would not be expected to have adverse health effect even from occasional repeated exposures over several years.	conjunction with vapor exposure criteria.	representative samples of media are obtained from specific media or area of concern.	

Notes:

[1] Not all inclusive: other health-based criteria may be applicable for various situations: these represent most commonly anticipated.

[2] Specific selection of a criteria is site- or scenario-dependent and must be assessed in accordance with specific sampling procedures and anticipated use knowledge.

[3] Ultimately waste management decisions are subject to State-specific laws and regulations.

Glossary of Terms

Activity commander
The military or civilian responsible for the installation executing an assigned mission.

Administrative control
Policies and procedures used to limit access and/or to reduce chemical exposures.

Aerosol
Micron-size liquid droplets or solid particles dispersed in air. When liquid droplets reach micron dimensions, their behavior becomes similar to solid particles of the same size. A suspension or dispersion of small particles (solids or liquids) in a gaseous medium (air).

Agent operation
Any operation that involves chemical agent, including storage, shipping, handling, manufacturing, maintenance, test chamber activities, laboratory or monitoring group activities, surveillance, demilitarization, decontamination, disposal, and training.

Airborne exposure limits
Allowable concentrations in the air for workplace and general population exposures. AELs include WPLs, STELs, IDLH values, and GPLs.

Annually
From the month of the current year to the same month of the following year. However, the time period will not exceed 13 months. This does not apply to items covered under the Army Maintenance Management System.

Army chemical agent
Term includes Schedule 1 chemicals in Army possession, as listed in the Convention on the Prohibition of the Development, Production, Stockpiling, and Use of Chemical Weapons and on their Destruction (also known as the CWC); NTA in Army possession as defined in DoDI 5210.65; or munitions with a chemical fill at the declared chemical weapons storage facilities.

Blister agent
A chemical agent that injures the eyes and lungs and burns or blisters the skin.

Chemical agent area
A physical location where entry and exit are restricted and controlled; and where chemical agents are manufactured, processed, packaged, demilitarized, released, handled, stored, used, and/or disposed.

Chemical agent identification sets
Also known as war gas identification sets, training sets produced and widely distributed by DoD between the 1930s and 1960s for use by the military to safely train military personnel (such as Soldiers) to identify, handle, and decontaminate chemical agents. Chemical agent identification set components are glass ampules or bottles that contain small amounts of both neat and dilute chemical agents and/or industrial chemicals that simulate chemical agents.

Chemical agent mishap
An event in which the failure of facilities, equipment, or procedures may allow the possible unintentional exposure of personnel or the work environment to chemical agent, including dilute chemical agents, and NTAs.

Chemical agent operating area
The portion of a chemical agent area where workers are actively conducting chemical agent operations.

Chemical agent worker
An employee who, by virtue of duties, duty locations, job description, and operations, could reasonably be exposed to a chemical agent above the WPL from normal or emergency workplace activities. These employees are provided: chemical agent training; chemical agent workplace monitoring; and medical surveillance appropriate with the probability of chemical agent exposure.

Chemical contamination
The presence of a chemical agent on a person, object, or area. Contamination density of a chemical agent is usually expressed either in mg or grams per square meter (mg/m2, g/m2) or in pounds per hectare (lb/ha). Hectare is 10,000 square meters.

Chemical defense training facility maximum concentration limit
The maximum concentration of a nerve agent to which personnel conducting chemical agent training operations may be exposed while wearing a full-face air-purifying chemical protective mask, such as the M40 mask. At concentrations above the CMCL, personnel must wear either a full-face positive-pressure SCBA or a positive-pressure airline respirator with an auxiliary SCBA. For practical purpose, the CMCL concentrations are used for chemical agent training purposes. The CMCL agent levels are as follows:
a. VX: 0.02 mg/m3.
b. GB: 0.2 mg/m3.

Chemical exclusion area
The chemical exclusion area for a chemical munitions area will be the outer portions of doors, walls, floors, and ceiling of a storage structure (such as igloo) declared under the CWC inside which access to DoD chemical agents is possible. The space in which the DoD chemical agent is stored (such as container, hood, vault) is designated as the chemical exclusion area when the site-specific risk assessment at the research development test and evaluation laboratory, or training facility, determines that access under the two-person rule is required.

Chemical limited area
The area between the boundaries of the exclusion areas and the perimeter boundary (such as the inner fence at a chemical storage activity or demilitarization facility); the inside of a laboratory room and/or where chemical agents (neat or dilute chemical agents) are stored in secure containers or used; and for live agent training facilities, the laboratory, indoor training areas, or other areas of the training facility designated as red or hot on the live agent training facility model.

Chemical munition
DoD munitions with a chemical fill at the chemical weapons storage facilities and their associated chemical weapons destruction facilities as declared per the CWC. A munition with a chemical agent fill.

Chemical warfare material
For the purposes of this pamphlet, an item configured as a munition containing a chemical agents that is intended to kill, seriously injure, or incapacitate a person through its physiological effects. Also includes V- and G-series nerve agent, H-series blister agent, and L in other-than-munition configurations. Due to their hazards, prevalence, and military unique application, although chemical agent identification set items are not weaponized in munitions those chemical agent identification set items containing neat mustard agent or dilute nerve agents are considered recovered CWM. CWM does not include riot control agents, chemical herbicides, industrial chemicals (such as hydrogen cyanide (AC), cyanogens chloride (CK), or carbonyl dichloride) not configured as a munition, smoke, and other obscuration-producing items, flame and incendiary producing items, or soil, water, debris, or other media contaminated with low concentrations of chemical agents where no chemical agent hazards exist. (Soil, water, debris, or other media contaminated with dispersed V- and G- series nerve agent, H- and HN-series (nitrogen mustards) blister agent, or L will be considered and managed in accordance with 40 CFR.)

Chemical Weapons Convention
The CWC, officially the Convention on the Prohibition of the Development, Production, Stockpiling, and Use of Chemical Weapons and on their Destruction, is an arms control treaty administered by the Organization for the Prohibition of Chemical Weapons. The treaty prohibits the large-scale use, development, production, stockpiling, and transfer of chemical weapons and their precursors, except for very limited purposes (research, medical, pharmaceutical, or protective). The main obligation of member states under the convention is to effect this prohibition, as well as the destruction of all current chemical weapons. All destruction activities must take place under Organization for the Prohibition of Chemical Weapons verification.

Class 6.1 poison
As defined by 49 CFR 173.132, a division of toxic chemicals that are known or presumed to afford a hazard to health during transportation.

Clean
Free of chemical agent contamination by either never having been exposed to liquid or aerosol chemical agent or to vapor concentrations exceeding the STEL concentration or where air concentrations have been monitored and verified to be below the suitable chemical agent exposure limit for the appropriate population.

Clean (unrestricted)
A condition where an item has been shown to be free of chemical agent at levels that are safe for unrestricted human use applications. This classification can be given to items and facilities not considered to have ever been contaminated, or to previously contaminated items and facilities that have undergone decontamination, monitoring, and risk assessment to ensure chemical agent residue has been removed.

Compatibility group
The compatibility group for ammunition, explosives, and/or other hazardous materials that can be stored and/or transported together without significantly increasing the probability of mishap or, for a given quantity, the magnitude of the effects of such an mishap. The compatibility groups are based on the system recommended for international use by the United Nations Organization and as adopted by NATO and DoD.

Competent medical authority
A physician, physician assistant, or nurse practitioner (military, civilian, or contract) appropriately trained and privileged to provide medical services or clinical evaluations in support of the chemical agent safety and occupational health program. Physician assistants and nurse practitioners must be supervised by licensed physicians.

Concentration
The amount of a chemical agent present in a unit volume of air. Usually expressed in mg per cubic meter (mg/m3).

Contaminated
A general term referring to a condition where an item, facility, or waste is considered or known to have chemical agent at some level of potential health concern on or contained in the matrix.

Contracting officer's representative
An individual designated and authorized in writing by the contracting officer to perform specific technical or administrative functions.

Corrective action
Any action taken to rectify adverse conditions and, where possible, to preclude their recurrence.

Decontaminating material
Any substance used to chemically destroy, physically remove, seal, or otherwise make harmless a chemical agent.

Decontamination
The process of making safe any person, object, or area by absorbing, destroying, neutralizing, making harmless, or removing the chemical agent on that person, object, or area. Physical or chemical means to remove, deactivate, or destroy chemical agents in the surface and in the matrix of protective clothing, object, or equipment.

Detection
The determination of the presence of a chemical agent.

Dilute chemical agent
Schedule 1 chemicals or NTAs that have been reduced in strength (such as less than neat) by admixture (dilution) with a solvent. Limiting quantities and concentrations are considered a means of reducing the potential hazard or threat. However, even at the dilute chemical agent concentrations, acute schedule 1 chemical or NTA properties are still present, thus appropriate health and safety precautions are warranted. The following levels are considered dilute chemical agents:
a. Concentrations of H, HD, or HT not greater than 10 mg/ml and containing not greater than 100 mg of chemical agent.

b. Concentrations of GB not greater than 2 mg/ml and containing a maximum quantity of 20 mg of chemical agent.
c. Concentrations of VX not greater than 1 mg/ml and containing a maximum quantity of 10 mg of chemical agent.
d. Concentrations of L and HL not greater than 5 mg/ml and containing a maximum quantity of 50 mg of chemical agent.

Egress, emergency
As defined in NFPA 101, the unplanned exiting from an operational operating area when a medical necessity occurs (for example, an immediately life-threatening or serious medical condition) to one or more of the workers requiring removal for immediate medical attention.

Egress, nonroutine
As defined in NFPA 101, the unplanned exiting from an operational operating area due to one or more of the following conditions:
a. Damage or malfunction of PPE.
b. The measured level of chemical agent concentration exceeding the design capability of PPE being used.
c. Unplanned removal of PPE due to an unusual occurrence (for example, cannot decontaminate to the appropriate level).
d. An unacceptable risk occurs to the worker, placing the worker in a situation that necessitates immediate exit, but not requiring emergency medical response.

Egress, routine
As defined in NFPA 101, the exiting from an operational operating area after completion of mission, planned activity, task, or end-of-shift (such as exiting where no mask or wearing PPE was required and personnel were not exposed to the chemical agent concentrations at or above the STEL, chemical agent concentration did not exceed PPE capability, and end of stay time).

Engineering controls
Regulation of facility operations through the use of prudent engineering principles, such as facility design, operation sequencing, equipment selection, and process limitations.

Engineering controls, primary
The device, room, or structure immediately surrounding the chemical agent source that provides the primary protection to the workers from the chemical agent hazard and is under negative pressure relative to the location of unprotected workers. (Examples of primary controls are hoods, gloveboxes, or rooms under negative pressure relative to the adjacent vestibule, corridor, or room.) The chemical agent container (such as projectile shell, rocket-casing) is considered as a primary engineering control.

Engineering controls, secondary
The area containing or adjacent to the primary engineering control that will prevent the further release or migration of chemical agent (to adjacent areas or the environment) if released from primary control. Examples of secondary controls are the lab room in which a hood or glovebox is located, or a corridor or observation vestibule adjacent to a chemical agent storage or operations room. This includes closed systems (such as filtered bunkers, filtered magazines, overpack containers, on site containers, demilitarization operating facilities and outdoor glovebox operations) designed to protect unprotected workers or the ambient environment.

Exceedance
The measured amount of chemical agent concentration above a given agent concentration reference point, such as the measured concentration of 5 x 10–5 (0.00005) goes above the WPL's 8-hour TWA concentration of GB of 3 x 10–5 (0.00003) mg/m3 by 2 x 10–5 (0.00002) mg/m3. Therefore, the exceedance is 2 x 10–5 (0.00002) mg/m3.

Explosive ordnance disposal
The detection, identification, field evaluation, rendering safe, recovery, and destruction of munitions and explosives of concern. It may also include the rendering safe and/or disposal of explosive ordnance that have become hazardous by damage or deterioration when the disposal of such is beyond the capabilities of personnel normally assigned the responsibility for the routine disposal.

Explosive ordnance disposal personnel
Military personnel who have graduated from the Naval School, EOD; are assigned to a military unit with a Service defined EOD mission; and meet Service and assigned unit requirements to perform EOD duties. EOD personnel have received specialized training to address explosive and certain chemical agent hazards during both peacetime and wartime. EOD personnel are trained and equipped to perform render safe procedures on nuclear, biological, chemical, and conventional munitions, and on improvised explosive devices.

Explosive ordnance disposal procedures
Those particular courses or modes of action for access to, recovery, rendering safe and final disposal of explosive ordnance, or any hazardous material associated with an EOD incident.

Exposed worker
An exposed worker is defined as an individual (with a chemical agent or NTA exposure potential) who exhibits clinical signs or symptoms of chemical agent or NTA intoxication. Alternatively, a worker is presumed to have been exposed to nerve agents (even if asymptomatic) if all of the following is true—(1) The worker has a confirmed acute depression in red blood cell cholinesterase activity (greater than 10 percent) from baseline following work activities in a nerve agent chemical limited area. (2) The worker has had no immediate history of contact with other cholinesterase-inhibiting substances, such as carbamates or organophosphate pesticides. (3) The worker has nerve agent urinary metabolites on gas chromatography-mass spectrometry analysis, or other validated nerve agent-specific biomarkers. Alternatively, a worker is presumed to have been exposed to mustard agents if there is skin redness and/or blistering, followed by one of the following: (1) The presence of laboratory-significant quantities of sulfonylbismethylthioethane (SBMTE), which would be 1, 1'-sulfonylbis [2-(methylthio) ethane] SBMTE, and related metabolites in the urine. (2) The presence of mustard-protein adducts in the blood or blister fluid.

Exposure
The amount of radiation or pollutant present in a given environment that represents a potential health threat to living organisms.

Exposure potential
Refers to workplace conditions in which chemical agents or NTAs may be present in a liquid or vapor form, in varying quantities and concentrations, due to the nature of storage, disposal, training, testing, recovery, remediation, or laboratory operations.

Field operations
Operations conducted outdoors or outside of fabricated enclosures or structures that contain built-in alarms or engineered chemical agent controls. Short-term operations in storage structures are also considered field operations.

GA (tabun)
The chemical ethyl-N, N-dimethylphosphoramidocyanidate, Chemical Abstracts Service number 77–81–6, in pure form and in the various impure forms that may be found in storage as well as industrial, depot, or laboratory operations. GA is a lethal anticholinesterase agent similar in action to GB. GA vapor does not penetrate the skin, but GA liquid penetrates rapidly. The toxic hazard is high for inhalation, ingestion, and skin and eye exposure.

GB (sarin)
The chemical isopropyl methylphosphonofluoridate, Chemical Abstracts Services number 107448, in pure form and in the various impure forms that may be found in storage as well as in industrial, depot, or laboratory operations. GB is a lethal anticholinesterase agent. Its toxic hazard is high for inhalation, ingestion, and eye and skin exposure. Due to its high volatility, it is mainly an inhalation threat.

GD (soman)
The chemical methyl-1,2,2,-trimethylpropylphosphonofluoridate, CAS number 96–64–0, in pure form and in the various impure forms that may be found in storage as well as in industrial, depot, or laboratory operations. GD is a lethal anticholinesterase agent. Its toxic hazard is high for inhalation, ingestion, and eye and skin exposure, although it is primarily a vapor hazard.

General population limit
A TWA that represents the maximum concentration to which the general population may be exposed 24 hours per day, 7 days a week, for a 70-year lifetime. Applies to the entire general population, including all ages and medical conditions.

General public
Persons not associated with a DoD installation's mission or operations such as visitors, to include guests of personnel assigned to the garrison or installation, or persons not employed or contracted by DoD or the garrison or installation.

GF
The chemical methylphosphonofluoridic acid, cyclohexyl ester, also known as cyclosarin, CAS number 329–99–7, in pure form and in the various impure forms that may be found in storage as well as in industrial, depot, or laboratory operations.

Government control
Refers to items which are under direct Government control (such as property book item), used by an operator under a Government contract operating on a Government facility (such as Government furnished equipment), under control of a transportation agent hired by the Government (such as contract carrier), or control of a service provider contractor (such as off-installation specialty repair shop).

Gross-level alarm
A device (used in conjunction with a gross-level monitor or detector) that produces an audible sound when the appropriate level of detection above the STEL concentration is detected.

Gross-level detectors
Those detection devices that can provide a response within 3 minutes for high chemical agent concentrations (above STEL/AEL concentrations).

H
The chemical called Levinstein mustard, consisting of a mixture of 70 percent bis (2–chloroethyl) sulfide and 30 percent sulfur impurities produced by the Levinstein process.

Half source emission limit
The agent concentration limit used by the CDTF to monitor the exhaust stack and all filter banks. The CDTF HSEL concentration is 0.00015mg/m3 for both VX and GB.

Hazardous waste
A solid waste, or combination of solid waste, which because of its quantity, concentration, or physical, chemical, or infectious characteristics may (a) cause, or significantly contribute to an increase in mortality or an increase in serious irreversible, or incapacitating reversible, illness; or (b) pose a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported, or disposed of, or otherwise managed. Chemical agents and munitions become hazardous wastes if (a) they become a solid waste under 40 CFR, and (b) they are listed as a hazardous waste or exhibit a hazardous waste characteristic; chemical agents and munitions that are hazardous wastes must be managed in accordance with all applicable requirements of RCRA.

HD
Distilled mustard or bis (2-chloroethyl) sulfide, CAS number 505–60–2. HD is H that has been purified by washing and vacuum distillation to reduce sulfur impurities. It is a vesicant (blister agent) and alkylating agent, producing cytotoxic action on the hematopoietic (blood-forming) tissues. The rate of detoxification of HD in the body is very slow, and repeated exposures produce a cumulative effect. Its toxic hazard is high for inhalation, ingestion, and skin and eye absorption, but the most common acute hazard is from liquid contact with eyes or skin.

HL (mustard-Lewisite mixture)
A mixture of 37 percent HD and 63 percent L; the mixture forms a lethal vesicant and alkylating agent producing cytotoxic action on the hematopoietic (blood-forming) tissues, which are especially sensitive.

HT
A lethal vesicant composed of approximately 60 percent HD [bis(2–chloroethyl) sulfide] and 40 percent agent T {bis[2–(2–chloroethylthio)ethyl]ether}. Both HD and T are alkylating agents. HT is monitored as HD. It is expected that the effects of HT would encompass those of both HD and T.

Immediately dangerous to life or health
An atmosphere that poses an immediate threat to life, would cause irreversible adverse health effects, or would impair an individual's ability to escape from a dangerous atmosphere, regardless of PPE use. For planning purposes, the respirator wearer will be unaffected by the environment for up to 30 minutes without any respirator being worn but should make every effort to leave the environment as quickly as possible. IDLH also includes atmospheres where oxygen content by volume is less than 19.5 percent.

Impervious
Providing protection by precluding penetration of nerve agents and mustard (as demonstrated by methods prescribed in MIL–STD 282) for the useful life of the item concerned.

Industrial chemical
Chemicals developed or manufactured for use in industrial operations or research, by industry, Government, or academia. These chemicals are not primarily manufactured for the specific purpose of producing human casualties or rendering equipment, facilities, or areas dangerous for use by man.

Industrial hygiene best practices
The science and practice of anticipating, recognizing, evaluating, and controlling workplace conditions that may cause workers' injury or illness. This is accomplished through surveys and evaluations of worksites to assess both chemical and physical occupational hazards, risk assessment and worker awareness training, and consultation on matters regarding occupational health and safety regulations and requirements. Best practices incorporate environmental monitoring and analytical methods to detect the extent of worker exposure and employ engineering controls, work practice controls, and other methods to control potential health hazards. Examples of these practices are described in the Fundamentals of Industrial Hygiene Online Course published by the National Safety Council, or in other literature recommended by the American Board of Industrial Hygiene.

L (Lewisite)
The chemical dichloro-(2–chlorovinyl)-arsine, CAS number 541–25–3, in pure form and in the various impure forms that may be found in storage as well as in industrial, depot, or laboratory operations. L is a lethal vesicant (blister agent). The toxic hazard of L is high for inhalation, ingestion, and skin and eye exposure, although the most severe effects occur from liquid contact with eyes or skin.

Laboratory
A location or facility where engineering controls may include a glovebox or laboratory-type ventilation hood, and the quantities of chemical agents in use at one time are small, normally not exceeding 1 liter. Laboratory operations may include research and development, production or acceptance testing, sample analysis and evaluation, limited detoxification, animal testing, or other small-scale chemical agent operations.

Laboratory or monitoring group
Person or person(s) responsible for performing environmental, analytical, and safety laboratory or monitoring activities at a site. This group has the responsibility to collect, analyze, and document samples, preserve samples, prepare samples for offsite transportation, calibrate and challenge monitoring instruments, review sample analysis results, and report sample analysis results from laboratory or monitoring instruments.

Laboratory sample container
The LSC is a performance-oriented packaging developed in accordance with 49 CFR for these shipments. It consists of a steel cylinder constructed in the following fashion: on one end, the flat bottom is welded; on the other, a flange is welded. O-rings are placed in the two grooves in the flange; the inner o-ring is Teflon, and the outer O-ring is butyl rubber. Six bolts secure the domed lid to the cylinder. Each bolt is tightened to a specified torque. Each LSC is overpacked in a wooden box for shipment.

Laboratory-type hood
An enclosed ventilation device that does not require the insertion of any portion of an individual's body other than the hands and arms, and that is designed, constructed, and maintained as described in appropriate portions of this pamphlet.

Low-level alarm
A device (used in conjunction with a low-level monitor or detector) that produces an audible sound when a predetermined level of detection below the STEL concentration is obtained. The MINICAMS® and RTAP are examples.

Low-level detectors
Those detection devices that can provide detection capability and/or alarm for concentrations of 0.003 mg/m3 for mustard, 0.0001 mg/m3 for GA/GB, and 0.00001 mg/m3 for VX. Examples include the MINICAMS®, and DAAMS for nerve and mustard agents and real-time monitors for nerve agents only.

Material documented as safe
For the purpose of this pamphlet, MDAS is MPPCAH that has been assessed and documented as not presenting an explosive or chemical agent hazard and for which the chain of custody has been established and maintained.

Material documented as to its chemical agent hazard
MPPCAH that cannot be documented as MDAS, that has been assessed and documented as to the maximum chemical agent hazard the material is known or suspected to present, and for which the chain of custody has been established and maintained. This material is no longer considered to be MPPCAH.

Material potentially presenting a chemical agent hazard
MPPCAH is material owned or controlled by DoD that, before determination of its chemical agent safety status, potentially contains chemical agent; potentially contains chemical munitions or chemical agent (such as containers; munitions debris remaining after use, demilitarization, or disposal); or potentially contains a high enough concentration of chemical agent such that the material presents a chemical agent hazard (such as equipment, drainage systems, holding tanks, piping, or ventilation ducts that were associated with munitions production, demilitarization, or disposal operations). Excluded from MPPCAH are chemical munitions remaining in the U.S. chemical munitions stockpile and managed as part of the chemical agent demilitarization program.

Matrix
The component or substrate that contains the analyte of interest.

Maximum credible event
The most disastrous maximum credible loss identified for a given system or operation. In ammunition, explosives, and chemical agent hazards evaluation, the MCE 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 ammunition and explosives. 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 MCE evaluated on this basis may then be used as a basis for effects calculations and casualty predictions.

Maximum use concentration
The maximum atmospheric concentration of a hazardous substance from which an employee can expect to be protected when wearing a respirator. Determined by the APF of the respirator or class of respirators and the exposure limit of hazardous substance. The MUC can usually be determined mathematically by multiplying the APF specified for a respirator by the permissible exposure limit, STEL, ceiling limit, peak limit, or any other exposure limit used for the hazardous substance.

Method
A set of procedures and techniques for systematically performing an activity (such as sampling, chemical analysis, quantification). A method will encompass certain parameters that, when changed significantly, may result in a new method. Methods will be placed under configuration control and critical parameters will identify tolerances that, when exceeded, will result in a new method.

Method detection limit
Refers to waste methods only. The minimum concentration of a substance that can be measured and reported with 99 percent confidence that the analyzed concentration is greater than zero and is determined from analysis of a sample in a given waste matrix containing the analyte. The method detection limit is the lowest level at which an analyte may be reported using that method (see 40 CFR 136).

Mishap
An unplanned event or series of events resulting in death, injury, or illness to personnel, or damage to or loss of equipment or property. Within the context of this pamphlet, mishap is synonymous with accident. (See also definition of chemical agent mishap.)

Mission oriented protective posture
A flexible system that provides maximum nuclear, biological, and chemical protection for the individual with the lowest risk possible while maintaining mission accomplishment.

Monitor, historical
An environmental sample of the work place, which may possibly contain chemical agents, collected at a fixed point in that work place. Determination of the presence or concentrations of chemical agents requires processing of the sample away from the collection point (such as DAAMS). Therefore, the results are derived later, possibly hours or even days later. Consequently, they cannot be used at the work place to make decisions on the workers' environment or safety.

Monitoring
The continued or periodic act of determining whether a chemical agent is present.

Monitoring level
The level to which monitoring is performed. Responses at or above the monitoring level indicate the monitoring level has been met or exceeded, and corrective actions are required. For waste screening purposes, the monitoring level is the negotiated treatment value for a specific analyte within a specific matrix.

Monitoring plan
A detailed, site-specific plan that covers all laboratory and monitoring objectives and strategies for a given site. The plan describes methods and equipment used, locations, number and type of samples, safety requirements, transportation and shipping instructions, scheduling, and any other site-related monitoring requirements.

Munitions and explosives of concern
This term, which distinguishes specific categories of military munitions that may pose unique explosives safety risks, means: (1) Unexploded ordnance; (2) Discarded military munitions; or (3) Munitions Constituents (such as 2,4,6-trinitrotoluene) present in high enough concentrations to pose an explosive hazard.

Mustard
The chemical bis(2–chloroethyl)sulfide, CAS number 505–60–2, in pure form and in the various impure forms that may be found in munitions as well as field, industrial, or laboratory operations. These include H, HD, and closely related preparations.

Near real-time monitor
A nonportable, continuous air-sampling device normally used in operational facilities for the detection of chemical agents. The NRT will provide a direct read, an audible alarm, and sampling results in less than or equal to 15 minutes.

Neat Schedule 1 chemical/NTA
An undiluted, full-strength (as manufactured) Schedule 1 chemical or NTA. A Schedule 1 chemical or NTA manufactured by the binary synthesis route is also considered neat agent regardless of purity.

Nerve agent
A lethal agent that causes casualties by interfering with the ability of muscles to relax after stimulation by associated nerves.

Neutralization
The act of altering the chemical, physical, and toxicological properties to render the chemical agent ineffective for use as intended.

Nonstandard glove
Any other glove not covered by a military specification. These gloves must be tested in accordance with an AQL plan and be approved by the ACOM, ASCC, or DRU.

Nontraditional agent
Chemical agents as defined by DoDI 5210.65.

Oxygen deficient atmosphere or oxygen deficiency
An atmosphere containing less than 19.5 percent oxygen by volume at sea level.

Permissible exposure limit
A legal limit in the United State for exposure of an employee to a chemical substance or physical agent such as high level noise. The exposure, inhalation, or dermal permissible exposure limit specified in 29 CFR 1910, subparts G and Z.

Persistency
An expression of the duration of effectiveness of a chemical agent. This is dependent on physical and chemical properties of the agent, weather, methods of dissemination, and conditions of the terrain. The terms persistent and nonpersistent should not be used to denote classes of chemical agents.

Potential exposure evaluation
A medical evaluation conducted by a CMA, which documents workplace exposure activities, concentrations of chemical agent or NTAs, levels of protective equipment worn, medical review of systems, and relevant physical examination results on a potentially exposed worker.

Potentially exposed worker
A potentially exposed worker is defined as an individual (with a chemical agent or NTA exposure potential) who is present within an area where levels of chemical agent or NTAs—(1) exceed the respiratory or dermal protective capability of intact PPE; or (2) are detectable at the established dermal threshold concentrations for specific chemical agents and there is a breach in PPE; or (3) exceed the STEL and there are either unprotected personnel in the immediate area, or there is a failure in engineering controls involving unprotected personnel.

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).

Protected worker
A worker in the appropriate level and ensemble of PPE based upon an analysis of the hazards involved with the task being performed.

Provisioning agreement
An agreement under which a DoD organization may provide DoD chemical agents to other DoD organizations, other Federal agencies, DoD contractors, or other nonfederal entities for purposes authorized by law and regulation such as research, medical, pharmaceutical, training, or development of protective material. It includes the purpose of the provisioning, statutory, and regulatory authority for the provisioning, responsibilities of the parties, procedures, funding, and terms and conditions for the certification of the recipient organization, the transfer of the DoD chemical agents to the recipient organization, the use of the agents by the recipient organization, and the return of any residual DoD chemical agent upon completion of the authorized use. A provisioning agreement may be a separate document or its substance may be incorporated in another document such as an inter-agency agreement, a memorandum of agreement, or a contract clause.

Public access exclusion distance
The greater of the IBD (based on the fragment hazard distance or the net explosive weight of the munitions) or the one percent lethality distance

Receptor
Exposed human or ecological individual relative to the exposure pathway considered.

Recovered chemical warfare material
CWM used for its intended purpose or previously disposed of as waste, which has been discovered during a CWM response or by chance (such as accidental discovery by a member of the public), that DoD

has either secured in place or placed under DoD control, normally in a DDESB-approved storage location or interim holding facility, pending final disposition.

Release
Any spilling, leaking, pumping, pouring, emitting, emptying, discharging, injecting, escaping, leaching, dumping, or disposing into the environment (including the abandonment or discarding of barrels, containers, and other closed receptacles containing any hazardous substance or pollutant or contaminant).

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.

Resource Conservation and Recovery Act
The Federal statute that governs the management of all hazardous waste from cradle to grave. RCRA covers requirements regarding identification, management, and cleanup of waste, including (1) identification of when a waste is solid or hazardous; (2) management of waste C transportation, storage, treatment, and disposal; and (3) corrective action, including investigation and cleanup, of old solid waste management units.

Risk
The expected damage or consequences expressed as the product of the consequence's probability and severity.

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 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 mishap-producing hazards associated with a mission; the design of a system, facility, equipment, or processes; and their operation.

Safety data sheet
For the purposes of this pamphlet, a SDS refers to a document used to relay safety and health information that meets the requirements of 29 CFR 1910.1200, Hazard Communication, or 29 CFR 1910.1450 Occupational Exposure to Hazardous Chemicals in Laboratories, whichever standard applies. It may include the known properties of the chemical; the physical, health, and environmental health hazards; protective measures; first-aid measures; and safety precautions for handling, storing, and transporting the chemical. In cases where the chemical in question is a substance developed in a laboratory, an SDS may not be available and other locally generated documents may be used to record like information.

Sample
Physical evidence collected for environmental measuring and monitoring.

Sampling
The physical collection of a representative portion of the population, universe, or environment.

Sampling plan
A detailed, site-specific plan that covers all sampling objectives and strategies for a given site. The plan describes methods and equipment used, locations, number and type of samples, safety requirements, transportation and shipping instructions, scheduling, and any other site-related sampling requirements.

Self-or buddy-aid
Administration of a chemical agent antidote to one's self or to a co-worker upon experiencing early symptoms of chemical agent poisoning.

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).

Short-term exposure limit
The maximum concentration to which unprotected chemical workers may be exposed to for up to 15 minutes continuously.

Solid waste
Any garbage, refuse, sludge from a waste treatment plant, water supply treatment plant, or air pollution control facility and other discarded material, including solid, liquid, semisolid, or contained gaseous material resulting from industrial, commercial, mining, and agricultural operations, and from community activities, but not including solid or dissolved material in domestic sewage, or solid or dissolved materials in irrigation return flows or industrial discharges which are point sources subject to permits under section 402 of the Federal Water Pollution Control Act as amended, or source, special nuclear, or byproduct material as defined by the Atomic Energy Act of 1954, as amended. When a military munition is identified as a solid waste as defined in 40 CFR.

Source emission limit
A nonregulatory ceiling value that serves as an engineering guide and not as a health standard. The SEL is used for monitoring the furnace's ducts and common stack. The SEL replaces the previously used allowable stack concentration. SELs are identified in table 9–1.

Standard
A known concentration of a known chemical that is used to perform quantitative analysis.

Standard glove
All gloves covered by a military specification (such as TAP and glove set glove).

Standing operating procedure
A written document that details the method for an operation, analysis, or action with thoroughly prescribed techniques and steps, and that is officially approved as the method for performing certain routine or repetitive tasks.

T
A vesicant, CAS number 63918–89–8, with an estimated human lethal dose for inhalation that is much less than that for HD. The biological effects observed after animal exposure to HT are similar to those induced by HD, although induction following HT exposure is more rapid and/or severe. This greater activity is a result of the presence of stable agent T in the mixture; the more volatile HD dissipates and leaves a reactive blend containing a higher concentration of T.

Time-weighted average
A maximum level or concentration of a chemical agent, averaged over a specified length of time, to which employees may be exposed (such as STEL is a 15–minute TWA).

Toxicity
The property possessed by a material that enables it to injure the physiological mechanism of an organism by chemical means, with the maximum effect being incapacitation or death.

Unrelated personnel
All personnel who are not directly involved with a chemical agent operation.

Vapor screening level
The level to which an item is monitored to determine the level of cleanliness. Typically done by containing the item in an enclosed space to limit incoming dilution.

Vapor screening procedure
A defined process for isolating and then monitoring for chemical agent vapor concentrations in the air around the isolated object, equipment, or portions of a facility based on the type of object, equipment, or facility, considering such factors as ambient temperature, material composition, type of monitoring equipment, and selected health-based criteria.

Vesicant agent
Agent that acts on the eyes and lungs and blisters the skin.

VX
The chemical O-ethyl S-(2–diisopropylaminoethyl) methylphosphonothioate, CAS number 50782–69–9, in pure form and in the various impure forms that may be found in storage as well as in industrial, depot, or laboratory operations. VX is a lethal anticholinesterase chemical materiel. Its toxic hazard is high for inhalation, ingestion, and eye and skin exposure, but due to its low volatility, the primary route of exposure is through ingestion or skin contact.

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.

Worker population limit
Maximum allowable 8-hour TWA concentration that an unmasked worker could be exposed to, for an 8-hour workday and 40-hour week for 30 years without adverse effect.

SUMMARY of CHANGE

DA PAM 385–61
Chemical Agent Safety Standards

This major revision, dated 24 July 2023—

- Changes the title (cover).
- Incorporates minimum safety criteria, guidance, and procedures for use in training, processing, handling, storage, transportation, disposal, and decontamination of nontraditional agents (throughout).
- Adds guidance on acute exposure guideline levels (para 2–3*b*).
- Updates chemical agent detection methods and equipment (para 3–5).
- Adds approved personal protective equipment (para 4–13).
- Incorporates new chemical contamination terminology and requirements from DoDI 4140.62 (chap 5).
- Adds requirements for patient decontamination and quadrant monitoring (para 5–8).
- Updates standing operation requirements (para 6–3).
- Updates pre-operational survey requirements (para 6–4).
- Updates requirements for emergency response equipment (para 7–3).
- Updates mishap notification, investigation, and reporting (para 7–5).
- Updates dilute chemical agent terminology and requirements (para 8–2).
- Clarifies neat chemical agent monitoring requirements (para 8–4).
- Consolidates design criteria (chap 9).
- Adds design, construction, and testing of chemical agent ductwork (para 9–7).
- Updates procedures for meteorological support to chemical incident, or mishap, response-and-assistance operations (chap 12).