DEPARTMENT OF THE ARMY
OFFICE OF THE ASSISTANT SECRETARY OF THE ARMY
INSTALLATIONS AND ENVIRONMENT

# Implementation Guidance Policy For Revised Airborne Exposures Limits For GB, GA, GD, GF, VX, H, HD, and HT

**18 June 2004**

# Implementation Guidance Policy for Revise Airborne Exposures Limits for GB, GA, GD, GF, VX, H, HD, and HT

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Implementation Guidance Policy for Revised Airborne Exposures Limits for GB, GA, GD, GF, VX, H, HD, and HT

1. **Purpose.**

   a. To continue providing a safe and healthful environment, the U.S. Army is adopting the airborne exposure limits criteria for the general population and chemical workers as recommended by the Centers for Disease Control and Prevention (CDC) guidance contained in Federal Register (FR) Volume 68, Number 180, 17 September 2003 for nerve agents GB, GA, and VX; and Federal Register, Vol. 69, No. 85, May 3, 2004 for Mustard Agents H, HD, and HT.
   b. Additionally, the Army has chosen to revise the GD and GF values at this time for consistency.

2. **References.**

   a. Federal Register, Volume 68, Number 196, 9 October 2003, Final Recommendations for Protecting Human Health From Potential Adverse Effects of Exposure to Agents GA (Tabun), GB (Sarin), and VX.
   b. Federal Register, Volume 69, Number 85, May 3, 2004, Interim Recommendations for Airborne Exposure Limits for Chemical Warfare Agents H and HD (Sulfur Mustard).
   c. MEMORANDUM, MCHB-TS-MEM, 19 May 2004, SUBJECT: Nerve Agent Percutaneous Exposure Criteria and Airborne Exposure Levels (AELs) for GD/GF for Use in Interim DA Guidance on Implementation of the New AELS
   d. Related References. See Appendix G.

3. **Applicability.** The revised airborne exposure limits contained in this guidance apply to all chemical agent operations and activities except for tactical military operations and military training (e.g., CDTF), involving military-designed equipment (e.g., NATO-approved, etc.).

4. **Implementation Date.**

   a. The provisions of this guidance policy will be implemented for chemical warfare agents GB, GA, GD, GF, and VX by 1 Jan 2005.
   b. The provisions of this guidance policy will be implemented for chemical warfare agents H, and HD by 1 July 2005.
   c. If an installation cannot meet the above implementation dates for compelling reasons, then the mission commander will develop and submit an Implementation Plan to the Assistant Secretary of the Army (Installations and Environment) (ASA(I&E)) by 1 October 2004. The plan shall address the:
      (1) Specific reasons for not meeting the required implementation dates;
      (2) Specific areas that will not be implemented;

(3) Risk assessment for each specific area not meeting the implementation date;
(4) Compensatory measures to be used until full implementation;
(5) Schedule with milestones, responsibilities and POCs for each action; and
(6) Monthly progress reports will be provided to (ASA(I&E)).

5. **Revised Airborne Exposure Limits Information.** Historical Background for Revised Airborne Exposure Limits. The Centers for Disease Control and Prevention (CDC) reviewed the airborne exposure limits and recommended revised guidelines for GA, GB, VX, H, and HD exposure limits to meet current toxicological risk methodologies.
   a. These revised guidelines do not reflect that unsafe work environments were provided in the past, but rather, as the CDC stated, "there is no indication that the current exposure limits, as implemented by US Army PMCD, have been less than fully protective of human health." Rather, as they continued, "The recommended changes in the AELs do not reflect change in, nor a refined understanding of demonstrated human toxicity of these substances but rather the changes related from updated and minimally modified risk assessment assumptions. Overt adverse health effects have not been noted in association with the previously recommended exposure limits. This may be due to rigorous exposure prevention efforts in recent years as well as the conservative implementation of existing limits."
   b. Therefore, the Army has chosen to adopt CDC's recommendations.
   c. The Army has chosen to revise the exposure limits for GD and GF values at this time for consistency.
   d. The exposure limits for Lewisite have not been revised and therefore the current exposure limits will remain unchanged.
   e. The revised chemical agent airborne exposure limits are contained in Table 1, Revised Airborne Exposure Limits.

**Table1, Revised Airborne Exposure Limits**

| Revised Airborne Exposure Limits for Unprotected Workers and General Populations | | |
|---|---|---|
| **Agent** | **Worker Population Limit ($mg/m^3$) 8-hr Time Weighted Average (TWA)** | |
| **GA, GB** | **$3 \times 10^{-5}$** | **0.00003000** |
| **GD, GF** | **$3 \times 10^{-5}$** | **0.00003000** |
| **VX** | **$1 \times 10^{-6}$** | **0.00000100** |
| **HD, H** | **$4 \times 10^{-4}$** | **0.00040000** |
| | **Short Term Exposure Limit (mg/m3) 15-min TWA** | |
| **GA, GB[1]** | **$1 \times 10^{-4}$** | **0.00010000** |
| **GD, GF[1]** | **$2 \times 10^{-4}$** | **0.00020000** |
| **VX[2]** | **$1 \times 10^{-5}$** | **0.00001000** |
| **HD, H[2]** | **$3 \times 10^{-3}$** | **0.00300000** |
| | **Immediately Dangerous to Life and Health (IDLH) ($mg/m^3$)** | |
| **GA, GB** | **$1 \times 10^{-1}$** | **0.1000** |
| **GD, GF** | **$5 \times 10^{-2}$** | **0.0500** |
| **VX** | **$3 \times 10^{-3}$** | **0.0030** |
| **HD, H** | **$7 \times 10^{-1}$** | **0.7000** |
| | **General Population Limit (mg/m3) 12-hour TWA** | |
| **GA, GB** | **$1 \times 10^{-6}$** | **0.00000100** |
| **GD, GF** | **$1 \times 10^{-6}$** | **0.00000100** |
| **VX** | **$6 \times 10^{-7}$** | **0.00000060** |
| **HD, H, HT** | **$2 \times 10^{-5}$** | **0.00002000** |

Notes:
1. For GB, GA, GD, and GF, a worker may be exposed to this concentration 4 times a day with sixty minutes between successive exposures in this range.
2. For VX, H, HT, and HD exposures, a worker may only have one exposure per day at the STEL.

6. **Chemical Agent Monitoring Requirements.**

a. Workplace Monitoring. Workplaces associated with, near or surrounding activities involving chemical agent will be monitored. A site quality assurance plan for monitoring will be developed that is based on the guidance established in either the Research Development and Engineering Command (RDECOM) Chemical Agent Standard Analytical Reference Material (CASARM) Quality Assurance Plan, May 2004, the Chemical Materials Agency (CMA) Laboratory and Monitoring Quality Assurance Plan (LMQAP), May 2004, or an agency approved site specific quality assurance program.

b. Worker Population Limit (WPL) Monitoring.
   (1) Monitoring will be performed for identified areas of the facility where workers may have an exposure potential to chemical warfare agent.
   (2) The monitoring may be either historical and/or real or near real-time based on the WPL Section of the site Monitoring Plan, described below.

c. Short Term Exposure Limit (STEL) Monitoring.
   (1) Areas involving operations where release of chemical agent into the operating environment at levels exceeding the Short Term Exposure Limit (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 near-real time 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, e.g., MINICAMS for a 15-minute cycle, set at the STEL for a method that measures +/- 25% of the true concentration, 95% of the time.
   (4) Records will be maintained of excursions above STEL. They shall include as a minimum: location, time and date.

d. Immediately Dangerous to Life and Health (IDLH) Monitoring for purposes of decontamination and release of equipment. When chemical agent concentrations exceed the IDLH, the exceedance may be documented and may be preserved for historical purposes (e.g., log-book). Documentation of IDLH exceedances can be valuable for determining whether certain types of equipments are clean or need decontamination, see section 11c(2).

e. Worker Population Limit (WPL) Monitoring Section of the site specific monitoring plan will:
   (1) Address monitoring of areas where workers may be exposed to chemical agent at levels exceeding the WPL.
   (2) Address monitoring levels at specific locations based on potential time of exposure (stay time) and will incorporate the maximum use concentration for a given respirator protection factor. Under these conditions different monitoring levels may be implemented, depending on the level of PPE used and implementation of administration controls to reduce potential exposure times. The frequency of monitoring will be based on Industrial Hygiene (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 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 excursions;
      (k) Type of monitors being used;
      (l) Duration of possible exposures;
      (m) Reliability of engineering and work practices; and
      (n) Reliability of containment controls.

7. **Excursion of WPL.** When monitoring indicates excursions of chemical agent levels above the WPL in areas where excursions are not expected, the following actions will be completed:

   a. The area will be restricted (i.e.; increase level of PPE, limit transients) until the cause is evaluated and corrected. When evaluated and/or corrected, the restrictions may be lifted.

   b. Notice of the Excursion will be posted informing all employees of:
      (1) Location of the excursion;
      (2) Period of time during which excursion occurred;
      (3) Name of chemical agent observed;
      (4) WPL for chemical agent monitored in $mg/m^3$;
      (5) Amount of exceedance in $mg/m^3$;
      (6) Statement of proposed action to limit future excursions;
      (7) Safety POC with phone number;
      (8) Medical POC with phone number; and
      (9) Statement concerning the health significance of the excursion, with concurrence of the competent medical authority.

c. Location and Duration of Posting. The Notice of Excursion will be provided employees as soon as possible after the determination of the excursion in a manner that informs all possibly effected employees of the excursion. The notice may be delivered electronically, posted on a bulletin board near the location of the excursion, or other method that ensures effected employees are notified of the required information.

d. Competent medical authority will be notified of the excursion and provided the following:
   (1) Location of the excursion;
   (2) Period of time during which excursion occurred;
   (3) Name of chemical agent observed;
   (4) WPL for chemical agent monitored in $mg/m^3$;
   (5) Amount of exceedance in $mg/m^3$;
   (6) Statement of proposed action to limit future excursions; and
   (7) Safety POC with phone number.

e. WPL Excursion Response Plan. A separate, locally developed plan will be developed and executed to investigate, identify and control the source of each identified excursion.

8. **M40 Series, Chemical Biological Gas Mask, Application.**

a. For industrial operations and applications, the use of the M40 Mask in an agent environment, will conform to the Occupational Safety & Health Administration's criteria of designating all full-face, air-purifying negative-pressure, respirators with an Assigned Protection Factor (APF) of 50.

b. Using these criteria, the M40 Mask may be used for respiratory protection in chemical agent environments up to a maximum of 50 times the Workers Population Limit (WPL) for GB, GA, GD, VX, H, HD, and HT. See Tables 2 through 9 below for stay time based on using the WPL and M40 Mask.

c. Additionally, the M40 Mask will provide employee respiratory protection for up to a maximum of 50 times the STEL for periods not to exceed 15 minutes.

d. The M40 canister may be used in industrial and military-unique applications for six-hours with no reuse[1].

e. The M40 Mask will not be used for respiratory protection in IDLH environments.

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[1] Based on collaboration with the Individual and Collective Protection Commodity Business Unit, Edgewood Chemical Biological Center (ECBC)

**Table 2, GB and GA Concentrations vs Stay Time (Unprotected Worker)**

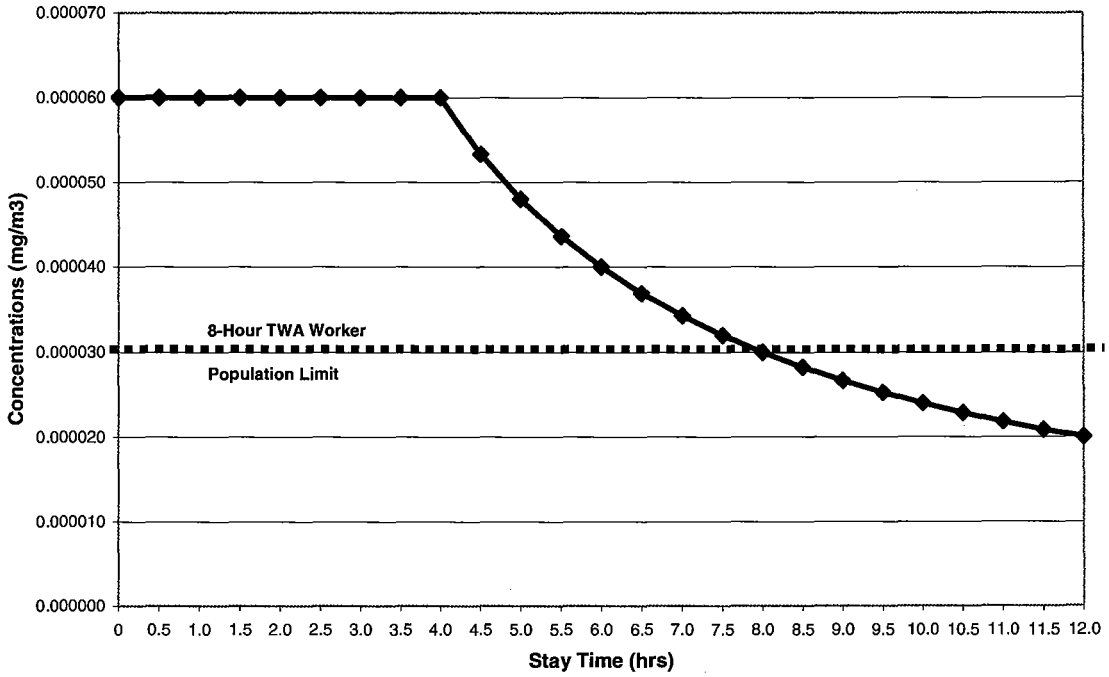



**Table 3, GD and GF Concentrations vs Stay Time (Unprotected Worker)**

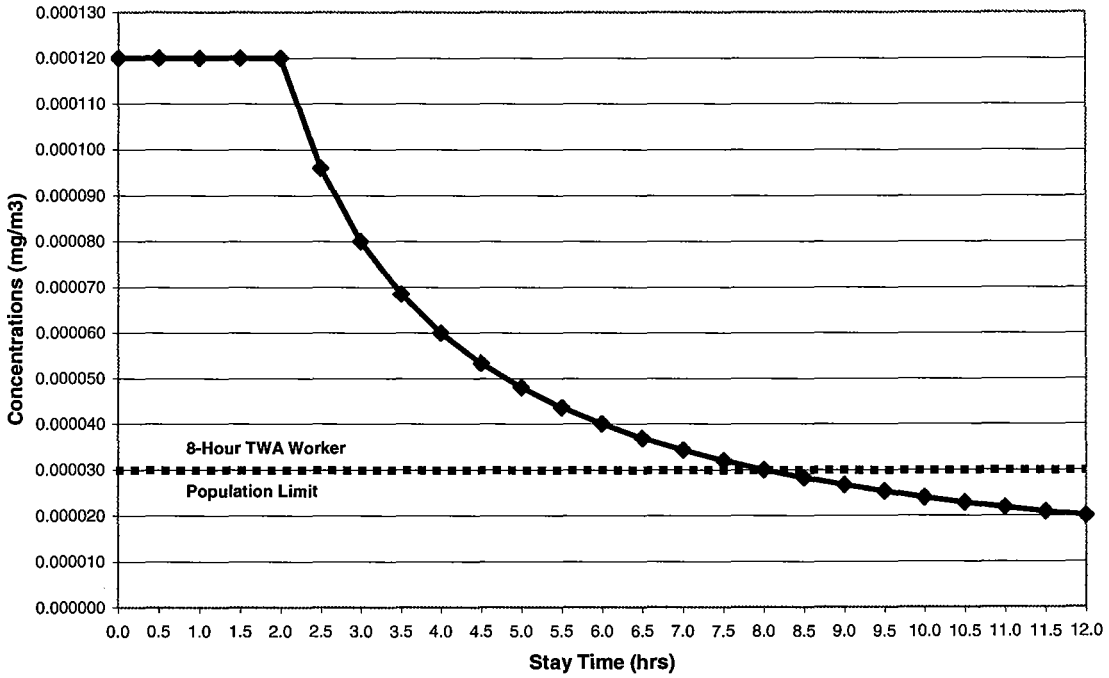


**Table 4, VX Concentrations vs Stay Time (Unprotected Worker)**

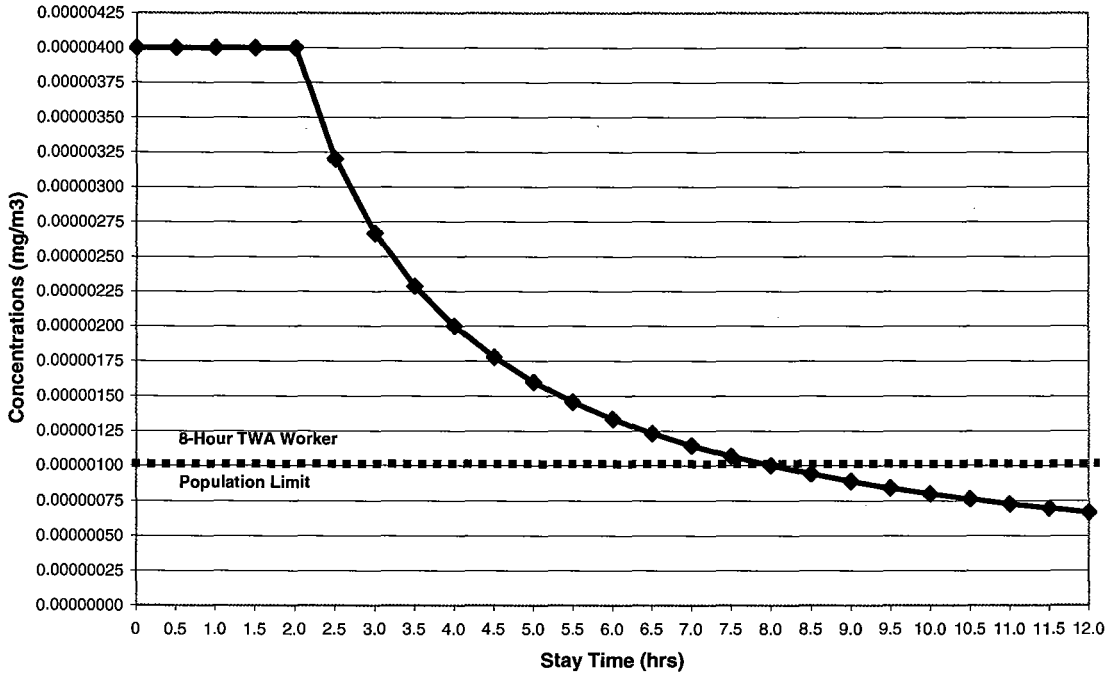



**Table 5, HD and H Concentrations vs Stay Time (Unprotected Worker)**

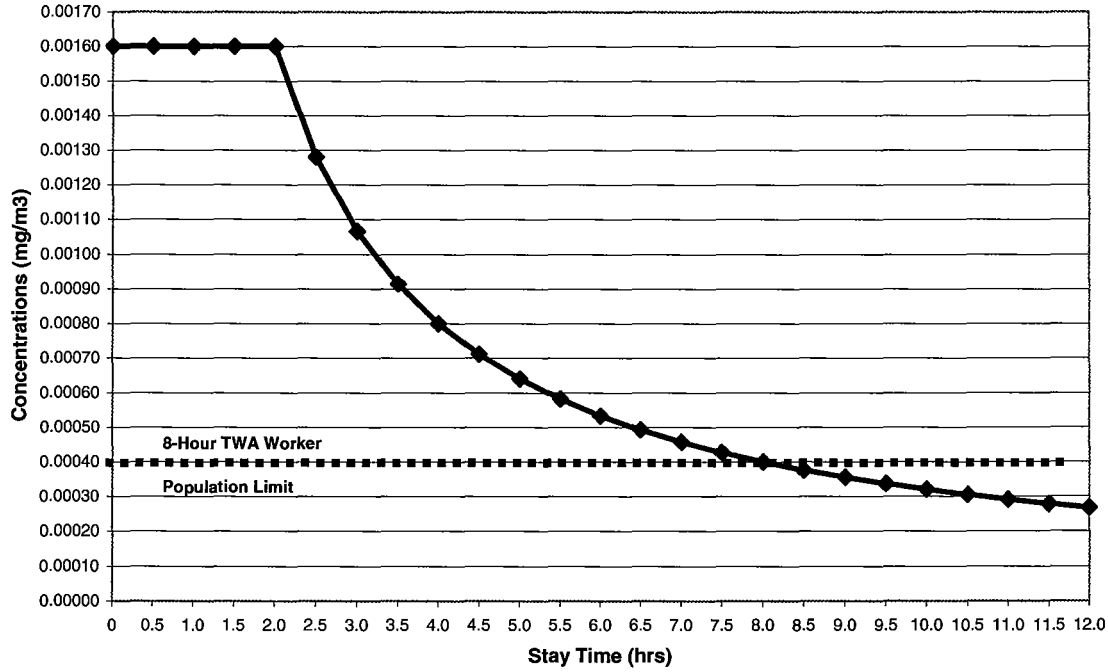


**Table 6, GA and GB Concentrations vs Stay Time (Protected Worker)**

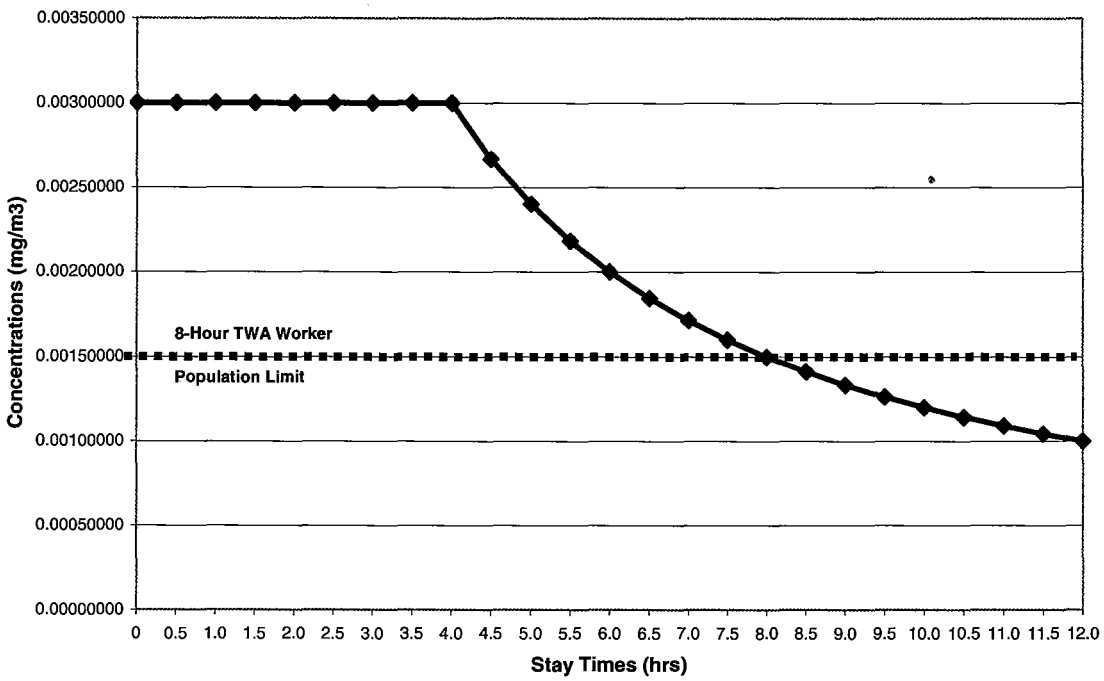



**Table 7, GD, GF Concentrations vs Stay Time (Protected Worker)**

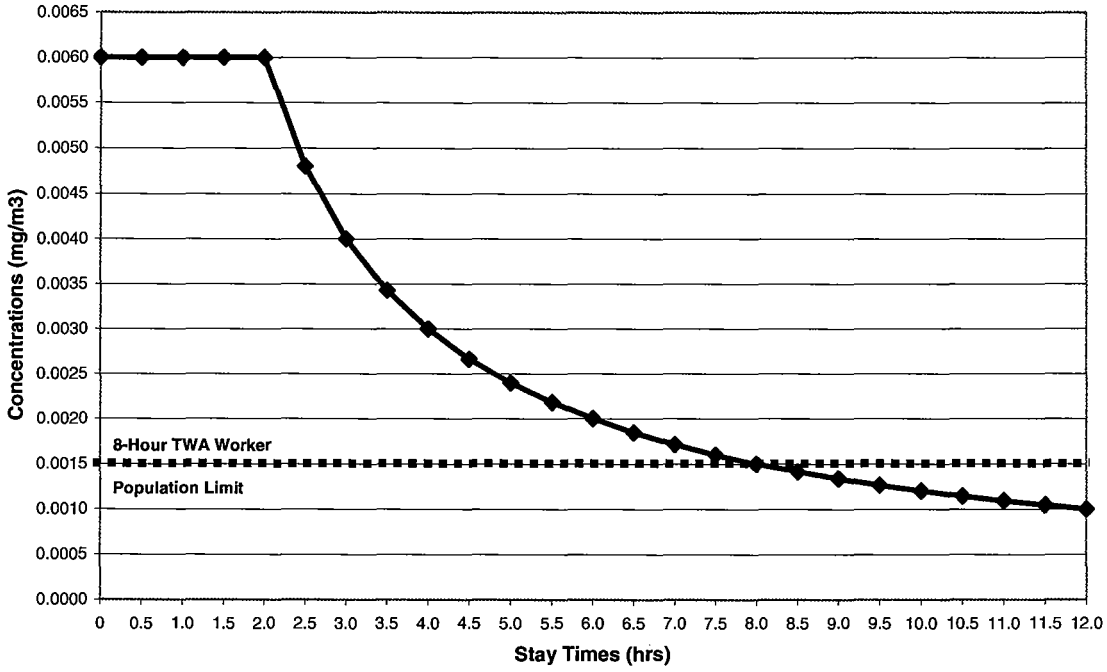
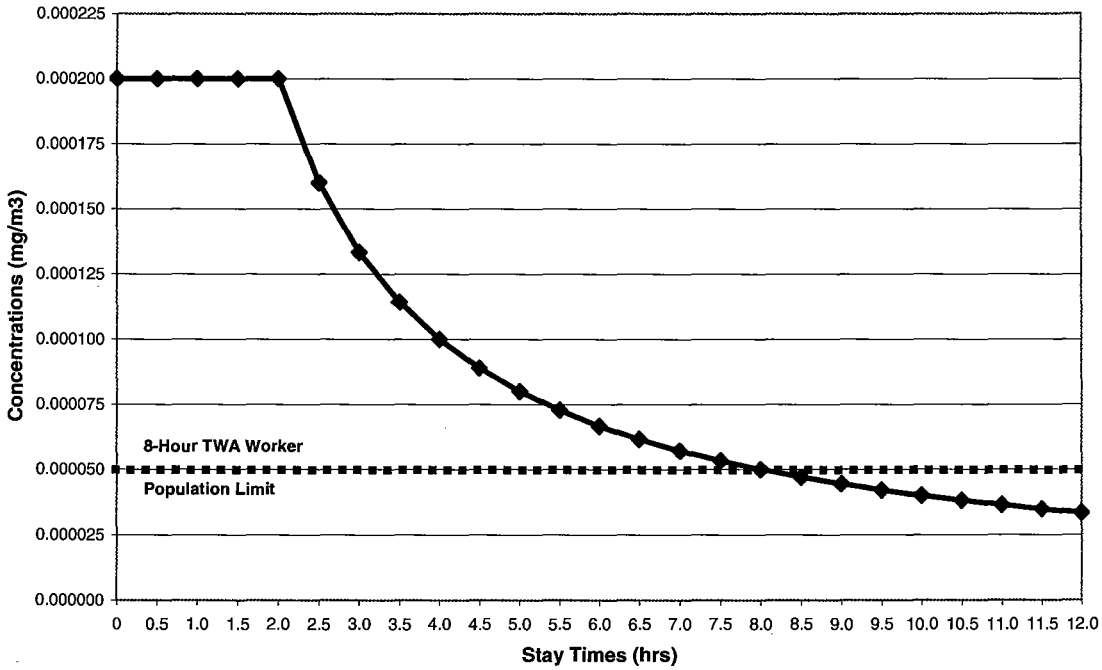


**Table 8, VX Concentrations vs Stay Time (Protected Worker)**




f. Use of M40 Mask with H, HD, and HT. The M40 Mask may be used for escape from environments containing concentrations above the STEL. The M40 Mask may be used for routine entry with real-time monitoring for STEL and historical monitoring for the WPL. The M40 Mask will not be used for routine respiratory protection above the STEL or in the absence of WPL monitoring.

## 9. Chemical Event Categories for Airborne Exposures to Personnel.

a. Confirmed detection of chemical agent exceeding the Short Term Exposure Limits (STEL) cited in this guidance, outside of the primary engineering controls but within secondary engineering controls shall be considered a Category I chemical event and reported IAW with the requirements of Section 11-3 of AR 50-6, Chemical Surety, 26 June 2001.

b. Confirmed detection of agent occurring for greater than 15 minutes outside of engineering controls into the environment, exceeding the STEL for the chemical agent cited in this guidance shall be considered a Category II chemical event and reported IAW with the requirements of Section 11-3 of AR 50-6, Chemical Surety, 26 June 2001. This includes agent operations

conducted in a closed system (e.g., filtered bunkers, filtered igloos, overpack containers, on site containers, demilitarization operating facilities and outdoor glovebox operations) designed to protect unprotected workers or the ambient environment.

c. Any known release of chemical agent above the STEL for the chemical agent greater than 15 minutes cited in this guidance where unprotected personnel were present at the time of release shall be considered a Category II chemical event and reported IAW with the requirements of Section 11-3 of AR 50-6, Chemical Surety, 26 June 2001.

**10. Decontamination of Personnel upon Egress from Agent Operating Areas.**

a. Routine and Non-routine Egress:
   (1) Personnel working in an environment where no liquid or aerosol contact with chemical agent was possible and real-time or near-real time monitoring was conducted during the full duration of the work-period showing chemical agent concentrations never exceeded the STEL, are not contaminated and do not require decontamination.
   (2) Personnel who were exposed to an environment in which liquid or aerosol chemical agent was involved and/or where monitoring indicated chemical agent concentrations above the STEL will be considered as potentially contaminated and require decontamination of personnel protective equipment to below the STEL prior to release from a controlled and identified decontamination area.

b. Emergency Egress.

   (1) If real-time or near-real-time monitoring indicates the worker(s) experiencing the medical necessity was never exposed to chemical agent above the STEL and/or was never exposed to liquid or aerosol chemical agent, no decontamination is required and the worker(s) may be transported as required by the medical response team.
   (2) If real-time or near-real-time monitoring indicates the worker(s), who are experiencing an immediately life-threatening or serious medical condition, were exposed to chemical agent above the STEL and/or were exposed to liquid or aerosol chemical agent, then the worker or workers will be considered contaminated and the following guidelines will be used:
      (a) A gross decontamination of the worker will be conducted;
      (b) The worker will cut out of the protective clothing by the First Responders, employing the best and most practical methods to prevent spread of contamination.

(c) After removal from the suit, the affected worker(s) will be transferred to the Medical Response Team in a manner to limit spread of possible contamination.

(d) The patient can then be transported to the government clinic, government-contracted clinic IAW contract requirements or predetermined healthcare facility serving the government under a Memorandum of Agreement (MOA) IAW the MOA (e.g., Contract or MOA may require patient to be decontaminated to a specific limit.)

(e) If the patient's medical condition requires transfer to another healthcare facility, the patient will not be released for transport until certified as free from residual chemical agent contamination by monitoring at the STEL. In cases where immediate, life-saving care is required, and delays in obtaining near real time monitoring would compromise patient survival, the Medical Response Team Leader may certify the patient free from contamination based upon the verified observation of patient decontamination procedures, without air monitoring results.

c. Post-Emergency Action.

(a) If monitoring of the patient(s) indicates concentration of the chemical agent never exceeded the STEL and no liquid contamination was involved prior to transport, then the transport vehicle and clinic can be considered as never having been contaminated by the patient.

(b) If monitoring of the patient(s) indicates concentration of the chemical agent never exceeded the STEL prior to entering the clinic then the clinic can be considered as never having been contaminated by the patient. The transport vehicle will be considered having the potential of being contaminated and will be handled IAW with requirements for determining contamination contained below.

(c) If the patient was not monitored prior to entering the clinic, the transport vehicle and portions of the clinic where the patient was held, prior to any decontamination will be considered having the potential of being contaminated and will be monitored and decontaminated IAW accepted Industrial Hygiene practices.

11. **Decontamination and Disposal of Tools, Supplies, Equipment, and Facilities.**

a. Adopting the revised exposure limits for chemical agents has resulted in an evaluation of the method of using 0, X, XXX, and XXXXX decontamination terminology. To move the Army into conformance with existing laws and regulations, these "Decontamination Levels" criteria are

no longer applicable to the Army, except as noted below.

(1) Any existing material which was characterized under the old system may continue to be characterized under the old criteria.

(2) Material that has been disposed under previous Army regulations is exempt from these new requirements.

b. Tools, supplies, equipment and facilities used in and around chemical agent operations and activities should not automatically be considered contaminated. Due to their intrinsic value, every effort will be made to reuse them by limiting chemical agent exposure or through implementing accepted IH practices to clean the tools, supplies, equipment and facilities and return them to useable service.

c. Tools, supplies, equipment and facilities, except for used carbon filter material which will be handled as contaminated[2], meeting the following conditions will be considered clean and available for unrestricted use if the item never contacted liquid agent or experienced a chemical agent aerosol environment and meets one of the following conditions:

(1) If in a continuously-controlled environment where the environment is documented to never have had exceeded the Short Term Exposure Limit (STEL) when the item was present;

(2) If in a continuously-controlled environment where the environment is documented to never have had exceeded the Immediately Dangerous to Life and Health (IDLH) when the item was present, the item may be considered clean based on a risk assessment addressing the following factors as a minimum:

(a) Temperature of environment (e.g., condensation of vapors);

(b) Type of process, operation or task;

(c) Concentration of agent and duration of exposure;

(d) Material composition (e.g., porosity, density, organic, inorganic, metallic, crystalline);

(e) Historical documentation for similar operations and items;

(f) Type of equipment (e.g., wrench, rubber mat, process equipment, auxiliary equipment); and

(g) Location of object considering source of vapor and air flow direction.

(3) Tools, supplies, equipment and facilities will require decontamination or disposal if any one of the following conditions is met:

(a) Contacted liquid chemical agent;

(b) In a chemical agent aerosol environment;

[2] This includes the M40 Mask canister if the mask was used in an environment above the STEL for the given chemical warfare agent.

(c) In a continuously controlled environment and exposed above the IDLH for any period of time;
(d) In an uncontrolled environment where monitoring has indicated the environment exceeded the STEL concentration; or
(e) In an uncontrolled environment involving the storage, use or presence of chemical agent and where physical factors (e.g., discoloration, stains, etc.) indicate possible exposure to chemical agent.

d. Decontamination of Tools, Supplies, and Equipment. When the value, utility or uniqueness of the tools, supplies or equipment warrants reuse, and will be used outside of contaminating operation or activity, the item will be cleaned IAW current accepted IH practices or the item will be disposed of as waste, described below.
   (1) For release to chemical agent worker and used in the chemical agent facilities or operations, the item will be cleaned and/or monitored to a vapor screening level equivalent to less than the STEL concentration.
   (2) For release to the general (non-agent) facility/installation employee for unlimited use, with an approved Equipment Decontamination Plan and certified by the mission commander to the selected health-based concentration (e.g., General Population Limit (GPL), Waste Control, see Appendix F) for the reasonably anticipated use environment.
   (3) For release to the general (non-agent) facility/installation employee for maintenance, the item will be cleaned IAW locally approved procedures and monitored with a vapor screening procedure equivalent to less than the Worker Population Limit (WPL), immediately prior to release. The tools and equipment will not leave government control and will not be modified or disassembled. Maintenance or disassembly of such items will be accomplished by personnel knowledgeable in agent symptomatology and agent characteristics, and in facilities equipped with appropriate safeguards to control potential hazards.

e. Facilities. When the value or uniqueness of a facility warrants use for non-chemical-agent and limited to general worker use (e.g.,., office space, storage facilities, etc), the facility will be cleaned IAW accepted IH practices and meet the conditions below or otherwise restricted to similar chemical agent operations, activities and tasks. Chemical agent facilities converted to non-chemical agent use prior to implementation of this guidance are not subject to these requirements.
   (1) The facility will be cleaned and/or monitored to a vapor screening procedure equivalent to less than Worker Population Limit (WPL) - unventilated; and
   (2) A WPL Monitoring Plan will be developed and implemented for the facility.

f. Chemical Agent Associated Surplus Material and Waste.
   (1) Surplus material associated with chemical agent facilities and operations, which meets the definition of clean, may be sent to DRMO or sent to a landfill or treatment facility for disposal IAW existing laws and regulations.
   (2) Waste associated with chemical agent facilities and operations, which does not meet the definition of clean, will be shipped IAW existing laws and regulations to a permitted Treatment, Storage, Disposal Facility (TSDF), whose permit allows receipt of such wastes.

g. Clean for Release to the Public. Surplus tools, supplies, equipment and facilities may be released unconditionally to the public IAW all applicable federal, state, and local regulations if one of the following conditions is met:
   (1) The item is heated to a surface temperature of 538 degrees C (1,000 degrees F) for at least 15 minutes.
   (2) The item is cleaned IAW with an approved Equipment Decontamination Plan and certified by the mission commander to the selected health-based criteria (e.g., General Population Limit (GPL), Waste Control) for the reasonably anticipated use environment of the public owner.

h. Equipment Decontamination Plan. A plan will developed and approved for releasing tools, supplies, equipment and facilities to the public which will address as a minimum:
   (1) Description of the item to be released to include type of construction materials.
   (2) The cleaning process to be used, to include cleaning materials, duration of cleaning process, and cleaning environment;
   (3) Rationale for selecting the health-based criteria being used;
   (4) The analytical method that will be used to determine the item has been cleaned to below the selective health based concentration;
   (5) The quality control process that will be used in conjunction with the analytical method to assure cleanliness; and
   (6) A statement of the reasonably anticipated environment in which the public could be expected to use it, considering: temperature, modification, etc. and how the selective cleaning process and monitoring meets those conditions.

12. **Handling of Personal Protective Equipment (PPE) for Laundering**.
   a. Clean PPE does not have to be monitored and will be labeled and marked "Cleared for Laundry."
   b. If the PPE contacted liquid or aerosol chemical agent it will not be reused and will be disposed of IAW existing laws and regulations unless granted approved by the Office of the Director of Army Safety, based upon review of the decontamination plan and evaluation of supporting test data.

c. PPE, exposed above the STEL, will be decontaminated and/or monitored and marked "Cleared for Laundry." Two options are permissible for exposed PPE being sent to the laundry. The options are either:
   (1) If decontaminating and monitoring to the STEL is used for clearing PPE for the laundry, then the laundry work area must be continuously air-monitored real-time or near real-time for STEL concentrations and periodic monitoring for WPL concentrations IAW WPL Monitoring Section for the Laundry; or
   (2) If decontaminating and monitoring to the WPL is used for clearing PPE for the laundry, then no real-time or near real-time monitoring or WPL Monitoring Section is required for the laundry work area.

13. **Chemical Agent Site Plans and Safety Submissions.** Existing chemical agent site plans and safety submissions shall be considered as valid and do not require any modifications or changes as a result of this guidance.

14. **Shipment of Environmental Samples**. Environmental samples may consist of soils and other solids, liquids, sludge, and vegetation. Prior to packaging, potentially contaminated samples will be screened using either airborne (ensure concentrations are below the Short Term Exposure Limit (STEL) or extraction methods (ensure agent concentrations are below detectable levels). Samples will be preserved and packaged to conform to EPA requirements and DOT shipping requirements IAW all existing laws and regulations.

15. **Training and Health Education.**
   a. Training and training plans will be revised to address the revised chemical agent exposure limits and this guidance. Employees will be trained on the revised chemical agent exposure limits, this guidance and local implementation procedures prior to implementation.
   b. Major Commands (MACOMs) will ensure that information and education packages on the revised chemical agent exposure limits and this guidance are provided to installations and activities, including contractors.

# Appendix A

# Interim Guidance on Occupational Health Practices for the Evaluation and Control of Occupational Exposures to Nerve Agents GA, GB, GD, GF and VX
## Revised 8 June 2004

# Interim Guidance on Occupational Health Practices for the Evaluation and Control of Occupational Exposures to Nerve Agents GA, GB, GD, GF and VX
## Revised 8 June 2004

**Summary of Change**
This document provides guidance to supercede the provisions of specific, limited sections within DA Pamphlet (PAM) 40-8, DA PAM 50-6, AR 50-6 and DA PAM 385-61 dealing with the occupational safety and health aspects of nerve agents, until the updated versions of these Department of Army policy and informational documents are published. Existing policies in these four regulations and pamphlets remain in force, if specific paragraphs of DA PAM 40-8, DA PAM 50-6, AR 50-6, or DA PAM 385-61 are not listed as "superceded" within this interim guidance. This revised guidance supplants the interim guidance issued through Office of the Deputy Assistant Secretary of the Army (Environment, Safety and Occupational Health ) OASA(I&E), 10 June 2003, and becomes effective on 1 January 2005.

**Applicability**
This document applies to all Department of Army commands, agencies, organizations, and contractors (unless otherwise specified within contract clauses) that have nerve agent related responsibilities (both surety and non-surety). Specifically, this document applies to personnel, organizations and contractors that may provide medical services to soldiers, employees, or contractors working or training with nerve agents, or who may respond to accidents or incidents involving nerve agent materials in peacetime environments. It also applies to laboratory operations involving research, development, test and evaluation of dilute solutions, and chemical warfare materiel recovery or remediation. This document applies to Active Army, Army National Guard, and/or Army Reserve units supporting these activities. It is not applicable to agencies outside the Department of the Army, or contractors who are not under contract to Army organizations. This document does not apply to battlefield, low intensity conflict, or terrorism response activities.

**Proponent and Exception Authority**
The Deputy Assistant Secretary of the Army (Environment, Safety and Occupational Health ) is the proponent for this guidance document and has the authority to approve exceptions to this guidance document that are consistent with controlling law and policy. Users are invited to send comments and suggested changes on DA Forms 2028 directly to OASA(I&E), ATTN: Assistant for Safety. This policy guidance contained herein has also been coordinated with the Office of The Surgeon General, the Deputy Chief of Staff, G-3, and the Director of Army Safety.

## Section 2 – Information and Reporting Requirements (see Chapter 3, DA PAM 40-8)

### 1-1. Information and reporting requirements (supercedes DA PAM 40-8, paragraph 3-2)

a. The garrison commander, activity commander, director, site project manager, or contracting officer's representative (hereinafter known as the "responsible official"), in coordination with other appropriate personnel, provides the following information to the installation medical authority (IMA) and/or contract medical director (CMD) (see definitions in glossary):

(1) A copy of this document.

(2) A written job description or SF 78, which details the affected individual's duties as they relate to the nerve agent exposure potential (see definition in glossary) in routine and emergency operations.

(3) The air-monitoring results for a potentially exposed worker (see definition in glossary), measured or estimated, under the circumstances defined in Section 5.

(4) A description of any personal protective equipment (PPE) used or to be used.

b. If an exposed worker (see definition in glossary) is removed from work because of signs and symptoms commonly associated with exposure to nerve agents or if the competent medical authority (CMA-see definition in glossary) believes that a potential exposure evaluation provides clinical or biochemical evidence of a nerve agent exposure effect, the CMA should—

(1) Immediately report the occurrence to the responsible official (see definition in glossary), or his or her designated representative.

(2) Report the occurrence as potentially disqualifying information to the certifying official, if the employee is enrolled in the chemical personnel reliability program (PRP) (see AR 50-6).

(3) Document the potential exposure evaluation (see definition in glossary) in the patient's medical record.

(4) Report the incident through the Reportable Medical Events System as soon as possible after the diagnosis has been made or within 48 hours (applicable to government-operated U.S. Army Medical Department clinics and hospitals only). For information on reporting requirements and procedures, see http://amsa.army.mil

**1-2. Record keeping (supercedes DA PAM 40-8, paragraph 3-1)**

a. General. The occupational health and medical surveillance programs (as described in AR 40-5) are composed of both general medical and workplace surveillance and job-specific surveillance. The job-specific surveillance is based on the functional requirements and exposure risks of specific jobs. The nerve agent medical surveillance program is a job-specific surveillance program and is a part of the overall occupational and environmental health program. The IMA/CMD shall maintain the medical records of personnel enrolled in the nerve agent medical surveillance program in accordance with the requirements of AR 40-66, AR 40-5, and 29 CFR 1910.1020 (for contractors, Army regulations specified in the medical portions of the contract apply). The medical record should include the results of post-offer, pre-placement (or change-of-position); periodic job-related; and termination examinations (see Sections 2 and 3 and the Appendix D), as well as respirator screenings/clearances and the results of any nerve agent exposure or potential exposure evaluations. Civilian medical records and x-rays must be maintained for 40 years or the duration of the individual's employment plus 30 years, whichever is longer. (See AR 40-66, paragraph 7-10a and 29 CFR 1910.1020 (d) (1) (i)).

b. Air-monitoring records. Documentation of a worker's exposure potential to nerve agents is important in assessing the present and past exposure history and in documenting compliance with the established airborne exposure limits (AELs).

(1) The responsible official will designate qualified personnel to maintain, interpret, correlate, and transmit air-monitoring records. (See DA Pam 385-61, paragraph 3-7a through c.)

(2) The CMA incorporates air-monitoring data on exposed workers or potentially exposed workers into the medical record on Standard Form (SF) 600 (Medical Record – Chronological Record of Medical Care), DA Form 4700 (Medical Record - Supplemental Medical Data), or other appropriate forms. (See Section 5 for the criteria for potential exposure evaluations, and

Section II of the Appendix D for potential exposure evaluation forms.) Any medical record entry of exposure or potential exposure meeting the criteria defined in paragraph 5-3 shall include—

(a) The date, location, time, duration and results of each air sample taken, and whether confirmation of the results was obtained through a second analytical method of detection.

(b) The physical state of the nerve agent, potential route of exposure, time of occurrence, estimated duration of exposure or potential exposure, and type of PPE worn. An example of a medical data sheet that can be used to collect such information is provided in the Appendix D, Section II.

c. Employee access. The IMA/CMD—

(1) Provides the affected individuals, former employees, or their designated representatives access to the air-monitoring records associated with exposure or potential exposure evaluations. (See DA Pam 385-61, paragraphs 3-7c and d.) In instances where the CMA does not maintain the air-monitoring records, he or she will coordinate with the designated records custodian.

(2) Makes available the medical records containing the examination content described in paragraph 1-1a for inspection and copying per AR 40-66, AR 50-6, and 29 CFR 1910.1020.

**1-3. Employee health education (supercedes DA PAM 40-8, paragraph 3-3)**

a. Employee health training. The IMA/CMD for the supported chemical activity or operation reviews and concurs/non-concurs with any employee-training materials, local plans, policies or procedures dealing with: the health effects or treatment aspects of nerve agent exposure; patient or skin decontamination procedures; use of respiratory, ocular or dermal protective equipment to protect against nerve agent exposure; or buddy-aid, self-aid, and essential first aid practices for nerve agent casualties. The IMA/CMD shall conduct and document this review and concurrence/non-concurrence on an annual basis.

b. Access to health education materials. The supervisor ensures that a copy of health education materials used in the employee training programs (see DA PAM 385-61, paragraph 7-2) is readily available to all individuals with an exposure potential to nerve agents.

c. Hazard communication information. Methods of instruction may include formal classes, work area meetings, audiovisual and computer-based presentations as appropriate. The responsible official shall assure that health-related training, as described below, is repeated annually by all workers having an exposure potential to nerve agents.

(1) The following nerve agent specific items will be included in the employee hazard communication training—

(a) An explanation of the types of operations in the individual's workplace that have a nerve agent exposure potential.

(b) Methods used to recognize and evaluate work areas with a nerve agent exposure potential.

(c) An explanation of the potential acute and chronic health effects associated with nerve agent exposure and the purpose and description of the nerve agent medical surveillance program (see Sections 2 and 3 and the Appendix D).

(d) Protective measures including administrative and engineering controls, PPE, safe work practices, and emergency procedures to include self-aid, buddy-aid, first aid, and decontamination.

(e) An explanation of the nerve agent material safety data sheets (MSDSs) and applicable standing operating procedures to assure that nerve agent materials are handled and stored per standing operating procedures and DA regulations.

(f) Emergency evacuation and notification procedures.

(2) The IMA/CMD for the supported chemical activity or operation shall provide technical assistance, monitor selected training sessions, and review and approve (in writing) the content of the self/buddy-aid and CPR programs, and the personnel who conduct the training (see DA PAM 385-61, paragraph 7-2d).

**1-4. Material safety data sheets (supercedes DA PAM 40-8, paragraph 3-4)**

a. The employee must have direct access to the nerve agent MSDS content and location. The MSDSs are products of the materiel developer. To obtain copies of the current MSDSs, contact the U.S. Army Research, Development and Engineering Command, Edgewood Chemical and Biological Center, Building E-3330, Risk Reduction Office, Aberdeen Proving Ground, MD 21010-5423.

b. Since the MSDSs content may change with time, the MSDSs may not always represent the medical guidance provided by the Office of The Surgeon General. Questions concerning medical guidance provided in the MSDS may be addressed to HQDA (DASG-PPM-NC), 5109 Leesburg Pike, Falls Church, VA 22041-3258 or telephone (703) 681-0650.

c. The MSDSs must be available in an organized manner where the needed information can be retrieved by employees in an emergency situation.

**Section 2 - Nerve Agent Medical Surveillance Program (see DA PAM 40-8, Chapter 4)**

**2-1. Introduction**

a. **(New paragraph, not previously contained in DA PAM 40-8)** The nerve agent medical surveillance program is part of a comprehensive occupational and environmental health program that preserves health and prevents work-related disease. Medical surveillance may be defined as the ongoing, systematic, evaluation of employees at risk of exposure to achieve early recognition and prevention of clinical disease. The nerve agent medical surveillance program is part of a larger hazard-specific or job-related medical surveillance program, which includes other chemical, physical, and biological hazards that have been included by the industrial hygienist on a current inventory of OH hazards. When conducting a nerve agent medical surveillance examination, the CMA should also consult the health hazard inventory or industrial hygienist to determine what (if any) other exposures have occurred (or are likely to occur) at or above the action levels established for other industrial chemical or physical hazards. Based on this information, the CMA determines the appropriate medical surveillance questions or content for those exposure hazards.

b. **(Supercedes DA PAM 40-8, paragraph 4-1a.)** The IMA/CMD for the supported chemical activity or operation establishes the nerve agent medical surveillance program for all personnel with a significant exposure potential to nerve agents (see Section 3). The IMA/CMD will assure that these individuals are assigned to one of two medical surveillance categories (I or II) and have been enrolled in the nerve agent medical surveillance program. Personnel with a highest risk of nerve agent exposure (that is, Category I) will receive the most extensive examinations.

c. **(Supercedes DA PAM 40-8, paragraph 4-1b.)** Table 2-1 presents the nerve agent category-specific medical surveillance requirements.

d. **(Supercedes DA PAM 40-8, paragraph 4-1c.)** Section 4 provides the latest information on the diagnosis and treatment of nerve agent intoxication (NOTE: This information is intended for health providers only, and, except for the information provided on the handling of spent MARK I

kits and methods for skin decontamination, section 4 is NOT intended for first responders, nor to replace the information provided in DA PAM 385-61, Chapter 7, paragraph 7-8, for self/buddy-aid procedures.)

## 2-2. Nerve agent medical surveillance categories [Supercedes DA PAM 40-8, paragraph 4-2, first sentence; and AR 50-6, paragraph 2-5d(6)]

a. The surety officer [or Site Safety and Health Officer, at Non-Stockpile Chemical Materiel (NSCM) activities] will, on a regular, periodic basis (e.g., once a month), provide to the safety officer, IMA/CMD for the supported chemical activity or operation, and industrial hygiene program manager, a list of all persons who have access to the chemical limited area (see definition in glossary), and who may have an exposure potential to nerve agents. The IMA/CMD for the supported chemical activity or operation, with the assistance of safety and industrial hygiene, will separate these individuals by specific job title and/or activity, and conduct a risk assessment on the individuals' activities to evaluate their exposure potential to nerve agents. As part of this risk assessment process, the IMA/CMD will assign each individual to medical surveillance category I or II, or state that the individual has no significant exposure potential. The IMA/CMDs will then enroll these individuals with a significant exposure potential to nerve agents (e.g., who meet the criteria of Category I or II below) into the appropriate nerve agent medical surveillance program. Written documentation of the safety and industrial hygiene concurrences will be maintained by the IMA/CMD (or Site Safety and Health Officer, if a NSCM operation). The IMA/CMD will also maintain a comprehensive medical surveillance roster or database, which identifies all employees with a significant nerve agent exposure potential (i.e., Category I or II) for whom the IMA/CMD provides occupational health services. This roster will be reviewed monthly and updated so that it contains the latest medical surveillance category designations, based upon the chemical limited area access information received from the surety officer (or Site Safety and Health Officer, at NSCM sites). A medical surveillance category designation is NO LONGER required on the chemical duty position roster (CDPR--see AR 50-6, Chapter 2, paragraph 2-5) for employees who are enrolled in the PRP.

b. The IMA/CMD for the supported chemical activity or operation should give careful attention to the exposure potential of one time or repetitive visitors to the chemical limited area, such as contract vendors, maintenance personnel, grass mowers, etc., and determine the need for enrolling them in a nerve agent medical surveillance program. After conducting a risk assessment, the IMA/CMD will provide the responsible official or their designee with recommendations as to which individuals should be enrolled in the medical surveillance program, and what medical surveillance category assignments would be appropriate these personnel. If medical surveillance is deemed to be required for individuals with sporadic or intermittent entries into the chemical limited area, the responsible official or their designee will assure that the employers of these workers provide the appropriate medical surveillance, in consultation with the IMA/CMD for the supported chemical activity or operation. Some contract employees may be eligible for occupational health services from government health clinics, on a reimbursable basis, under the provisions of AR 40-400, paragraph 3-45(d).

c. **(Supercedes DA PAM 40-8, paragraph 4-2a and b)** The two nerve agent medical surveillance categories include Category I (old A and B) and Category II (old C and D) personnel. Category I personnel are individuals—

(1) Who may be routinely required (that is, on the average, at least once a week or at least four times per month) to make entries or to work for more than one hour at a time in areas with concentrations of nerve agent greater than the short term exposure limit (STEL); OR

(2) Whose work activities in nerve agent operations, or whose contingency responses to actual nerve agent accidents or simulated exercises, require the workers to wear air-purifying respirators, self-contained breathing apparatuses, or supplied air respirators for more than one hour at a time, with entry into the chemical limited area; OR

(3) Whose work may entail any entry or work in areas with unknown or uncharacterized nerve agent concentrations, or entry into known IDLH environments; OR

(4) Who are designated to conduct leaker containerization, nerve agent materiel or munition recovery, hotline, hazardous material response, personnel decontamination station, or patient decontamination activities in OSHA level C PPE or above; OR

(5) Who serve as air-monitoring technicians or are engaged in monitoring operations; OR

(6) Who conduct chemical maintenance or ammunition surveillance operations within the chemical limited area or nerve agent storage or disposal facilities; OR

(7) Who conduct demilitarization protective ensemble (DPE) stand-by activities; OR

(8) Who are designated to serve on an Initial Response Force, enter the chemical limited area or contamination reduction zone, and wear dermal or respiratory PPE for purposes other than emergency egress (this includes hazardous material responders, security guards, and healthcare providers on the MRT), in the event of a chemical accident/incident response and assistance (CAIRA) event; OR

(9) Who are cadre at live agent training facilities, responsible for handling or disseminating nerve agents in a controlled training environment, or overseeing the activities of students while wearing PPE in a live nerve agent training environment.

d. **(Supercedes DA PAM 40-8, paragraph 4-2c and d)** Category II personnel are individuals—

(1) With minimal probability of exposure to nerve agents except under accident conditions, but whose activities within nerve agent operating areas of the chemical limited area create an exposure potential as defined in the IMA/CMD's risk assessment; OR

(2) Who are assigned to the Chemical Security Defense Force (CSDF) at chemical stockpile locations, do not enter the chemical limited area, and do not wear respiratory protection for other than emergency egress purposes; OR

(3) Who are laboratory or test and evaluation personnel working with neat or dilute nerve agents under engineering controls; OR

(4) Who are assigned to the unescorted access program (UAP) for nerve agent facilities; OR

(5) Who are assigned to a live nerve agent training facility, but who are not responsible for handling or disseminating nerve agent, or overseeing the activities of students while wearing PPE in a live nerve agent training environment.

NOTE: At the discretion of the IMA/CMD, individuals who do not fit the specific exposure criteria listed above may be enrolled in the Category I or II nerve agent medical surveillance

program, if deemed appropriate. The IMA/CMD may also make adjustments in category assignments on an individual, case-by-case basis (e.g., needs to be assigned to category I, rather than category II), if he or she believes this is merited, based upon the individual's job duties and exposure potential. Students at a live nerve agent training facility shall not be assigned a nerve agent category designation, or included on the medical surveillance roster referred to in paragraph 2-2a above.

**2-3. Medical surveillance examinations (New paragraph, not previously contained in DA PAM 40-8)**

Four types of examinations may be conducted as part of the nerve agent medical surveillance program. These include post-offer, pre-placement (including change of position); periodic job-related; termination; and potential exposure evaluations. The IMA/CMD is responsible for conducting the medical surveillance examinations, and identifying those individuals who are due or delinquent for the required medical surveillance examination, based upon the medical surveillance roster and tracking system maintained by the IMA/CMD (see paragraph 2-2a above). The responsible official or their designee is responsible for ensuring that individuals identified by the IMA/CMD as requiring nerve agent medical surveillance examinations report for medical examinations (to include termination examinations), and for ensuring that the required medical surveillance has been conducted before allowing the employee to participate in chemical operations that have a nerve agent exposure potential.

**2-4. Post-offer, pre-placement (including change-of-position) examinations (Supercedes DA PAM 40-8, paragraph 4-3)**

a. All personnel assigned to work in areas with a nerve agent exposure potential shall receive a post-offer, pre-placement medical surveillance (or change-of -position) examination to—

(1) Document that the employee—

(a) Does not exhibit physical, mental, or emotional impairments that may result in a higher vulnerability to nerve agent exposure.

(b) Is physically and mentally able to wear and use the required PPE.

(2) Establish the employee's baseline health status, particularly for organ systems that may be affected by exposure to nerve agents.

(3) Assess the employee's functional capacity to perform specific work-related tasks.

(4) Identify any medical conditions for which recommended work restrictions, limitations, or reasonable accommodations are appropriate under the provisions of 29 CFR Part 1630.

(5) If required by job position, assess suitability for enrollment into the CPRP, to include a face to face interview with the CMA.

b. This examination should be performed by or under the supervision of the CMA and at no cost to the employee. See Table 2-1 for the examination requirements by medical surveillance category.

c. An acceptable post offer, pre-placement examination is any medical examination that is--

(1) Conducted within 90 days prior to work assignment to an area involving the potential exposure to nerve agents. If the employee is being enrolled in the PRP, the preplacement or change-of- position examination must be completed within 90 days prior to the date of the certifying official's completion of part VI of the DA Form 3180. If the examination occurred more than 90 days prior to work assignment or prior to certifying official completion of the DA

Form 3180, the CMA shall update the medical history and work history to ensure that no interval changes have occurred, and annotate the SF 600 (or equivalent progress note form) to this effect.

(2) Consistent with the requirements outlined in paragraphs 3-1 through 3-2. If the examination does not include all of the requirements, the CMA should perform the procedures that were not completed. If this examination was not conducted specifically as a post offer, pre-placement or change-of-position examination, the CMA should review the examination results and render a written opinion in the medical record as to its acceptability as a post offer, pre-placement examination for nerve agents.

**2-5. Periodic job-related examinations (Supercedes DA PAM 40-8, paragraph 4-4)**

a. The CMA performs the appropriate category-specific, periodic examination (see paragraphs 3-4 through 3-5) and informs the responsible official or their designee of those individuals who do not have current periodic examinations (see paragraph 2-3).

b. Periodic job-related examinations are—

(1) Usually performed on an annual basis.

(2) Conducted to document any change in the employee's health status, particularly with respect to specific exposure hazards encountered in the workplace over the intervening year.

(3) Designed to screen for nerve agent exposure effects and to assess the employee's physical capacity to perform essential job functions. Using the data gathered from these examinations, the CMA may discover correlations between workplace exposures to nerve agents and specific health endpoints by comparing the employee to—

(a) Himself or herself over time.

(b) Groups of workers with greater or lesser degrees of exposure (i.e., is there a dose-response relationship.)

**2-6. Termination examinations (Supercedes DA PAM 40-8, paragraph 4-5)**

a. The CMA performs a termination examination on individuals within 30 days before or after removal from the nerve agent medical surveillance program. The examination documents the employee's health status at the time of termination, particularly for organ systems that may have been affected by nerve agent exposure. Paragraphs 3-7 through 3-8 detail the termination examination requirements by medical surveillance category.

b. Termination examinations do not have to be conducted on individuals who have been enrolled in the nerve agent medical surveillance program for three months or less, unless—

(1) There is documented evidence of exposure to nerve agents (that is, clinical signs or symptoms or laboratory results consistent with a nerve agent exposure effect)

(2) A potential exposure evaluation has been conducted within the three-month time period.

c. The responsible official or their designee ensures that a termination examination (to include RBC-ChE determination) has been administered or offered to workers who—

(1) Have been enrolled in the nerve agent medical surveillance program for more than three months.

(2) Have been permanently disqualified or administratively terminated from the chemical personnel reliability program (PRP), or, if not enrolled in the PRP, who no longer have nerve agent exposure potential.

d. The termination examination content should reflect the highest category of nerve agent medical surveillance for which the employee was enrolled during employment.

**2-7. Post exposure and potential exposure evaluations (Supercedes DA PAM 40-8, paragraph 4-7)**

This document requires medical evaluations to be performed in the event of accidental exposure or potential exposure to nerve agents.

a. An exposed worker is defined as an individual (with a nerve agent exposure potential) who exhibits clinical signs or symptoms of nerve agent intoxication. In addition, a worker is presumed to have been exposed to nerve agents (even if asymptomatic) if he or she--

(1) has a confirmed acute depression in RBC-ChE activity (greater than 10%) from baseline following work activities in a nerve agent chemical limited area; AND

(2) has had no immediate history of contact with other cholinesterase-inhibiting substances, such as carbamates or organophosphate pesticides; AND

(3) has nerve agent urinary metabolites, as identified by the U.S. Army Medical Research Institute of Chemical Defense (USAMRICD) on GC/MS analysis (see TB MED 296), or other validated nerve agent-specific biomarkers.

b. A potentially exposed worker is defined as an individual (with a nerve agent exposure potential) who is present within a chemical limited area or exclusion area where levels of nerve agent—

(1) exceed the respiratory or dermal protective capability of intact PPE as defined in paragraphs 5-3a,b,c,d, and e, OR

(2) are detectable at the established dermal threshold concentrations for specific nerve agents (see paragraphs 5-3a(2), b(2), c(2), d(2), e(2), and f(2) of this document) and there is a breach in PPE; OR

(3) exceed the STEL and there is a failure in engineering controls involving unprotected personnel.

c. If an individual has been potentially exposed, the CMA should conduct a potential exposure evaluation to—

(1) Obtain information concerning the circumstances of the exposure or potential exposure and provide the appropriate medical examinations (for example, RBC-ChE monitoring) and emergency treatment as needed.

(2) Document in the medical record the circumstances of exposure, the results of the examination, and an opinion as to whether a nerve agent exposure has occurred (see forms provided for this purpose in Section II to the Appendix D.)

(3) Record any air-monitoring measurements in the medical record (see paragraph 1-2b(2)). See Section II of the Appendix D, which contains a place for recording air monitoring results on the "Data Sheet for Collecting Information on Chemical Agent Exposed or Potentially Exposed Workers".

d. Section 5 provides additional potential exposure evaluation criteria for GA, GB, GD, GF, and VX operations.

**2-8. Documentation of medical opinion (Supercedes DA PAM 40-8, paragraph 4-6)**

The CMA records a written opinion in the medical record for each medical examination. This opinion includes—

a. The results of the medical examination and testing.

b. A statement about any detected medical condition that would place the individual's health at an increased risk of impairment if exposed to nerve agents (e.g., asthma, chronic obstructive pulmonary disease, epilepsy, glaucoma, etc.)

c. Any recommended limitations on the potential exposure to nerve agents or on the use of PPE.

d. A statement that the employee has been informed of the above.

**2-9. Red blood cell-cholinesterase activity determinations (Supercedes DA PAM 40-8, paragraph 4-8)**

a. Quality assurance.

(1) The U.S. Army Center for Health Promotion and Preventive Medicine (USACHPPM) Cholinesterase Reference Laboratory manages the external quality assurance and quality control program for RBC-ChE activity determinations in support of the nerve agent medical surveillance program.

(2) All clinics or laboratories performing RBC-ChE activity determinations in support of the nerve agent medical surveillance program must comply fully with the provisions of TB MED 590, related USACHPPM procedures, and Armed Forces Institute of Pathology Pamphlet 40-24 (i.e., personnel requirements for overseeing high complexity laboratories, such as those conducting RBC-ChE testing). Participation in the USACHPPM external quality assurance/quality control program is mandatory.

b. Monitoring RBC-ChE for DOD contractors.

(1) Department of Defense contractors performing work with a nerve agent exposure potential will be enrolled in a nerve agent medical surveillance program and will undergo periodic RBC-ChE monitoring. Under special provisions established by the Secretary of the Army, any participating U.S. Army laboratory may analyze DOD contractors' RBC-ChE assays on a cost reimbursable basis. Alternatively, the contractor may send the blood specimens to the USACHPPM Cholinesterase Reference Laboratory for primary analysis on a cost reimbursable basis. See TB MED 590.

(2) The Cholinesterase Reference Laboratory or site laboratory director will forward the RBC-ChE results to the CMA (or designated representative) for incorporation as part of the nerve agent medical surveillance examination and for placement in the patient's medical record.

(3) The CMA will investigate any ChE depression greater than 10 percent from the baseline (see Section 3), document the results of that investigation in the employee's medical record, and maintain the RBC-ChE results. Specific requirements for RBC-ChE monitoring in support of the nerve agent medical surveillance program are provided in paragraphs 3-9 through 3-11 of this document.

**2-10. Special notification requirements (New Section, not previously addressed in DA PAM 40-8)**

Situations may arise in which historical air monitoring results indicate that individuals within a chemical limited area may have sustained unprotected exposures to concentrations of nerve agent greater than the allowable time-weighted average workplace exposure limits, but less than established short term exposure limits. When this occurs, the affected area will be posted to notify occupants and transients of the air monitoring results, their potential health significance, and a point of contact for individuals to obtain more information. The CMA will concur (or non-concur) in writing with the statement of potential health significance. This notice shall remain posted for at least two weeks after follow-up air monitoring results demonstrate the return of concentrations below the allowable time-weighted average workplace exposure limit.

**Table 2-1 (Supercedes DA PAM 40-8, Table 4-1)**
**Category specific medical surveillance[1]**

| Category | Post-offer, pre-placement | Periodic[2] | Termination |
|---|---|---|---|
| I | Occupational history (OH) | Interval OH | Interval OH |
| | Medical history (MH) | Interval MH | Interval MH |
| | Physical examination (PE) | PE | PE |
| | Electrocardiogram (EKG) | EKG (every 2 years) | RBC-ChE |
| | Spirometry baseline | | |
| | PPE eval (heat) | PPE evaluation (heat) | |
| | Respirator clearance[4] | Respirator Clearance[4] | |
| | Audiometric examination | Audiometric examination | |
| | Visual acuity (VA) | VA | |
| | Pupil size and reactivity | Pupil size and reactivity | |
| | Baseline RBC-ChE | RBC-ChE[3] | |
| | CBC with diff | | |
| II | OH | Interval OH | Interval OH |
| | MH | Interval MH | Interval MH |
| | Baseline RBC-ChE | RBC-ChE[3] | RBC-ChE |
| | Respirator Clearance[4] | Respirator clearance[4] | |

[1]See Section 3 for detailed guidance.
[2]Denotes annual requirement, unless otherwise mentioned.
[3]Re-established baseline by a two-sample blood draw at least every three years.
[4]Category I or II employees with a nerve agent exposure potential will be issued respiratory protective devices or emergency escape devices. Under provisions of 29 CFR 1910.134 all individuals issued respiratory protection must be medically evaluated to ensure that they are physiologically and psychologically able to wear the respirators for the intended tasks. Respirator clearance evaluations should be added to the scope of the nerve agent medical surveillance examination under these circumstances. See Section I of the Appendix D for the Occupational Safety and Health Administration (OSHA) Respirator Questionnaire and Medical Clearance Form.

**Section 3 - Medical Surveillance Program for Personnel with a Significant Exposure Potential to Nerve Agents (see DA PAM 40-8, Appendix B)**

**3-1. Post-Offer, Pre-Placement Examinations for Category I (Supercedes DA PAM 40-8, paragraph B-1)**

The CMA—

a. Obtains a comprehensive—

(1) Occupational history (OH), with specific emphasis on prior potential exposures to cholinesterase-inhibiting substances (for example, organophosphorous chemicals) and chemicals associated with cardiovascular, pulmonary, neurological, or psychiatric disease.

(2) The medical history (MH) and review of systems, to include the OHSA Respirator Questionnaire or equivalent (see Appendix D), focusing on the skin, eyes, nose/throat, pulmonary, cardiovascular, neurologic and reproductive systems. For individuals enrolled in the PRP, the medical history should also explicitly address: a list of current medications; past or present history of illicit drug use, substance abuse or dependency; past or present history of hypnosis; or past suicide attempts.

b. Administers a general physical examination—

(1) With emphasis on the identification of any work-limiting conditions requiring reasonable accommodations or work restrictions, particularly with regard to having the ability to wear PPE.

(2) To detect any significant abnormalities in visual acuity or hearing, which may impair the individual's ability to egress during an emergency. The physical examination should also include any abnormalities of the skin (i.e., cracking, fissures, or scaling), cardiovascular, pulmonary or neurologic systems, which might make the individual more susceptible to the effects of nerve agents.

c. Performs specific evaluations to include a (an)—

(1) Electrocardiogram at rest. At the discretion of the CMA, an individual may obtain an exercise tolerance test (that is, stress EKG) if the individual is to perform strenuous activities in encapsulating PPE, and the individual's symptomatology or cardiovascular risk profile indicates that he or she is at high risk of coronary heart disease, using the Framingham Heart Study or other appropriate risk factors.

(2) Evaluation of the individual's physical ability to perform work involving potential exposure to nerve agents using the required dermal and respiratory protective ensembles (PPE). This evaluation includes, as a minimum, completion of an OSHA respirator questionnaire (or equivalent), which is specific to the types of respiratory protection to be worn by the individual. It should also consider reliable evidence, such as the past or current history of wearing PPE without sustaining adverse health effects, or direct observation (for example, a use test) to show the individual can safely and effectively use the required PPE and that no physiological or psychological conditions impair the individual's ability to use this equipment. For this evaluation, document the completion of the OSHA respirator questionnaire (or equivalent), the issuance of a respirator clearance, and any evidence of the individual's ability to use such equipment in the individual's medical record.

(a) In addition to reviewing the worker's responses to the OSHA Respirator Questionnaire (or equivalent), the CMA must document a baseline spirometry examination including, as a minimum, three tracings with the forced vital capacity (FVC) and the forced expiratory volume at one second ($FEV_1$), the best two of which demonstrate FVCs within 5% of one another. (See TB MED 509.) Subsequent evaluations of physiologic capabilities to wear a respirator do not

require repeated documentation of pulmonary function studies unless specifically required by the CMA. Abnormal pulmonary function tests alone are not grounds for disqualification. If there are abnormal pulmonary function tests, consider the following before disqualifying an individual from respiratory PPE use: The individual's MH and age; the nature of the work to be performed while wearing respiratory PPE; the type of respiratory PPE employed; the results of the tests of cardiovascular status; the results of the OSHA respirator questionnaire (or equivalent); and if necessary, a use test.

(b) The CMA must inform management, the supervisor, or the certifying official (if the employee is enrolled in the PRP) in a confidential manner, about any individual who appears to be physically or psychologically unable to wear dermal or respiratory protective ensembles. If work practices require activities to be performed in full protective clothing (that is, air-purifying or atmosphere-supplying respirators with an encapsulating protective ensemble), document the individual's ability to withstand heat stress in the medical record and enroll the individual in a heat stress prevention program with the elements described in DA PAM 385-61, paragraph 4-3.

(3) Audiometric examination to determine the individual's auditory acuity per DA PAM 40-501. The purpose of the audiogram is to assess the individual's ability to communicate, particularly for those who may be wearing encapsulating PPE, and who may need to communicate over a radio, while in areas with varying levels of background noise. The CMA should consider performing an audiologic use test in individuals with poor auditory acuity (see AR 40-501, paragraph 2-7), if these employees are required to communicate with others who are wearing respirators, and speaking over a radio, while in a nerve agent environment.

(4) Determination of the near and distant visual acuity and pupillary reactivity.

(a) The CMA will record the corrected and uncorrected, near and distant visual acuity in the medical record, along with the reactivity of each pupil, assessed in a dark room. (NOTE: This identifies the pre-existence (if any) of unequal pupil size and confirms the presence of maximally dilated pupils.) Distant visual acuity should be at least 20/40 or better in at least one eye. If optical inserts are required to provide this acuity while wearing a respirator, the CMA will obtain a copy of the worker's optical prescription and file it in the medical record (see DA PAM 40-506, paragraph 2-5f). Obtaining the optical prescription is the employee's responsibility (see DA PAM 40-506, paragraph 3-6c). The responsible official should assure that the optical inserts are in the worker's possession before the individual is allowed to work in a nerve agent environment while wearing a respirator. (NOTE: If the worker is enrolled in the PRP, the CMA should notify the certifying official that the individual has poor visual acuity requiring the use of inserts, and should recommend medical restriction from PRP duties if the employee does not possess the optical inserts. See exceptions in DA PAM 385-61, paragraph 4-4, with regard to the wearing of contact lenses.)

(b) Instruct individuals on the importance of wearing eyewear and the proper use of these items (whether protective or merely corrective, including optical inserts for the protective mask [if required]).

(5) Other clinical tests include a determination of the individual's baseline RBC-ChE activity as required by paragraph 3-9, and a CBC with differential count.

### 3-2. Post-Offer, Pre-Placement Examinations for Category II (Supercedes DA PAM 40-8, paragraphs B-2 and B-3)

a. The post-offer, pre-placement medical surveillance evaluation for Category II is limited to a comprehensive occupational history, with specific emphasis on prior potential exposures to ChE-inhibiting substances.

b. The CMA should also obtain a MH and a review of systems, focusing on the skin and eyes, cardiovascular, pulmonary, neurologic and psychiatric systems. For individuals enrolled in the PRP, the medical history should also explicitly address: a list of current medications; past or present history of illicit drug use, substance abuse or dependency; past or present history of hypnosis; or past suicide attempts.

c. If the individual may be issued a respirator or emergency escape device for emergency egress, the individual will complete the OSHA Respirator Questionnaire (or equivalent) provided in section I of the Appendix D, and the CMA should render and document a medical opinion as to the individual's ability to safely wear a respirator for emergency egress purposes.

d. The CMA will also obtain a determination of the individual's baseline RBC-ChE activity per paragraph 3-9.

**3-3. Abnormal findings (Supercedes DA PAM 40-8, paragraph B-4)**

In the event of abnormal findings on the post-offer, pre-placement examination, the CMA—

a. Determines what (if any) functional activity or PPE limitations are necessary to protect the health of the worker.

b. Discusses these with the worker in a face-to-face interview after reviewing the worker's job description.

c. Informs the worker's supervisor or management officials (in a confidential manner) of any work restrictions or reasonable accommodations that might be necessary to protect the health of the worker or to allow him or her to accomplish the essential functions of their job.

d. Informs the certifying official in a confidential manner of any potentially disqualifying information (if the worker is in the PRP), along with the appropriate recommendation for restriction or disqualification. (See AR 50-6, paragraph 2-15a(4).)

**3-4. Periodic Job-Related Examinations for Category I (Supercedes DA PAM 40-8, paragraph B-5)**

a. The CMA will conduct an annual medical surveillance examination on all workers in Category I to review their occupational exposure during the preceding year, update their medical history, and determine their continued fitness to meet the functional requirements of their jobs. The components listed in Table 2-1 for a Category I periodic exam (as amplified by the descriptions contained in paragraph 3-1) should supplement other hazard-specific medical surveillance tests indicated by worker exposures (if any) to substances other than nerve agent that are listed on the health hazard inventory. (See AR 40-5, paragraph 5-9a.)

b. The CMA will also update the Category I worker's RBC-ChE baseline every three years, and obtain a new EKG every two (2) years.

**3-5. Periodic Job-Related Examinations for Category II (Supercedes DA PAM 40-8, paragraphs B-6 and B-7)**

The CMA will conduct an annual medical surveillance examination on all Category II workers, which will include an interval OH, MH and review of systems, focusing on any symptoms, or adverse effects that may be connected to exposure to nerve agents or other ChE-inhibiting substances. No physical examination is required. The CMA will update the OSHA Respirator

Questionnaire (or equivalent) and the individual's medical clearance to wear a respirator on an annual basis. The CMA should also update the Category II worker's RBC-ChE baseline every three years. The Category II nerve agent medical surveillance examination's content should supplement other hazard-specific medical surveillance tests indicated by worker exposures (if any) to substances that are listed on the health hazard inventory (see AR 40-5, paragraph 5-9a).

**3-6. Periodic Job-Related Examinations - Abnormal findings (Supercedes DA PAM 40-8, paragraphs B-8)**

In the event of abnormal findings on the periodic job-related examination, the CMA—

a. Determines what (if any) functional activity or PPE limitations are necessary to protect the health of the worker.

b. Discusses the limitations with the worker in a face-to-face interview after reviewing the worker's job description.

c. Informs the worker's supervisor of any work limitations or reasonable accommodations that will be needed to protect the health of the worker or to allow him or her to accomplish the essential functions of the job.

d. If the worker is in the PRP, informs the certifying official in a confidential manner of any potentially disqualifying information, along with the appropriate recommendation for restriction or disqualification.

**3-7. Termination Examinations – Category I (Supercedes DA PAM 40-8, paragraph B-9)**

The CMA will conduct a medical surveillance examination with the components listed in Table 2-1 for a Category I termination examination (as amplified by the descriptions contained in paragraph 3-1). This examination should be supplemented by any other hazard-specific medical surveillance tests indicated by worker exposures to substances other than nerve agent that are listed on the health hazard inventory. A termination RBC-ChE will also be obtained. If the individual declines the termination examination, the CMA shall document this declination in the medical record.

**3-8. Termination Examinations - Category II (Supercedes DA PAM 40-8, paragraphs B-10 and B-11)**

The CMA will conduct a medical surveillance examination with the components listed in Table 2-1 for a Category II termination examination (as amplified by the descriptions contained in paragraph 3-1). This examination should be supplemented by any other hazard-specific medical surveillance tests indicated by worker exposures to substances other than nerve agents that are listed on the health hazard inventory. A termination RBC-ChE will also be obtained. If the individual declines the termination examination, the CMA shall document this declination in the medical record.

**3-9. RBC-ChE Monitoring - RBC-ChE Baseline (Supercedes DA PAM 40-8, paragraphs B-12 and B-13)**

a. A determination of the individual's baseline RBC-ChE activity is required due to the variability between individuals. A baseline RBC-ChE is defined as the average of two separate measurements obtained at least 24 hours and no more than 14 days apart. The CMA should verify that the individual being tested has avoided any known exposures to cholinesterase-inhibiting substances for at least 30 days prior to establishing the initial (i.e., preplacement)

RBC-ChE baseline. During the time between the two RBC-ChE measurements, the individual should not be allowed to enter agent-operating areas and should be warned to avoid exposure to any ChE-inhibiting substances. If these two measurements vary by more than 0.05 delta pH units, a third measurement should be obtained. In this case, the baseline RBC-ChE activity will then become the average value of all three measurements. The RBC-ChE baselines may fluctuate in some workers monitored over a period of time. This fluctuation reflects the natural physiological enzyme variance in humans.

b. The individual's RBC-ChE baseline shall be updated every three years, by taking two separate blood draws at least twenty-four hours, but no more than 14 days, apart. The CMA should verify that the employee has not been evaluated for potential exposure to nerve agents, or had exposure to other cholinesterase-inhibiting substances, for at least 30 days prior to blood draws for the triennial RBC-ChE baseline update. Elevation or depression of the updated RBC-ChE baseline activity of greater than 10 percent, compared to the previous baseline, is grounds for careful investigation of etiology, including possible organophosphate exposures.

c. The initial RBC-ChE baseline, and any triennial updates or adjustments in RBC-ChE baselines, must be approved (that is, initialed off on the SF 512, Clinical Record Plotting Chart, or equivalent) by the CMA. Any adjustments to the RBC-ChE baseline, necessitated by persistent elevations or depressions of greater than 10%, must also be accompanied by a medical record entry by the CMA as to the reasons for the adjustment and the outcome of the clinical investigation. The triennial updated RBC-ChE baseline, or adjusted RBC-ChE baseline, will be recorded on a separate, new SF 512 and annotated using the words "Updated baseline", with the date of the update, and the initials of the CMA. (NOTE: Locally approved, computer-generated forms may be used in lieu of SF 512s, as long as all requirements are complied with; CMA approval may be annotated with electronic signatures.)

**3-10. RBC-ChE Monitoring - Recording RBC-ChE monitoring determinations (Supercedes DA PAM 40-8, paragraphs B-14)**

a. The RBC-ChE determinations should be plotted on an SF 512 or a locally approved, computer-generated form. This plotting should show the actual RBC-ChE values or the percentage of RBC-ChE value expressed in percent of baseline versus time. If percentage values are plotted, note the absolute RBC-ChE determinations above the respective data points. File the SF 557, Miscellaneous Laboratory Slip, (or equivalent) with the RBC-ChE determinations from the laboratory in the patient's medical record.

b. Incorporate the SF 512 in the medical record per AR 40-66, paragraphs 5-15 and 7-12, figure 7-1. In the event that the SF 512 is maintained separately from the medical record (that is, in laboratory notebooks), insert an Optional Form (OF) 23, Charge-out Record, or other approved forms, into the medical record identifying the responsible custodian.

c. Upon the employee's removal from the nerve agent medical surveillance program (which only occurs with a transfer to work activities not having a nerve agent exposure potential, retirement, or a permanent change in duty station), place the SF 512 in the medical record per AR 40-66, paragraph 5-15.

**3-11. RBC-ChE Monitoring - Action levels (Supercedes DA PAM 40-8, paragraph B-15)**

a. The RBC-ChE activity should be determined when signs and symptoms of systemic uptake of nerve agents are apparent. In addition, local (minor) signs, such as miosis or localized sweating, or a potential exposure to nerve agents, will necessitate an immediate RBC-ChE

determination and immediate removal of the employee from further duties in nerve agent operating areas, until the RBC-ChE results are known.

b. In the event RBC-ChE activity drops below 75 percent of the baseline value (that is, 25 percent depression in RBC-ChE activity), remove the affected individual(s) from further actual or potential nerve agent exposure. Perform RBC-ChE determinations weekly until the affected individual(s) return to work. Do not permit an individual to return to work in a nerve agent operating area until the—

(1) RBC-ChE has reached a value of at least 90 percent of the individual's most recent baseline value and,

(2) The individual has been asymptomatic for at least 1 week. The CMA should annotate and initial the SF 512 indicating the period of removal from work referred to in paragraph 3-11b

c. Variations in RBC-ChE determinations greater than 10 percent from the baseline value (both low or high) shall be referred to the CMA for review. The CMA should document the resolutions of any variations in the medical record. The medical record entry should include the—

(1) Results of any relevant laboratory investigations.

(2) Occupational history.

(3) Air-monitoring results; if these are not applicable (e.g., the individual has not been in an agent operations area), a statement to that effect should be in the chart.

(4) Workplace investigations.

(5) Physical examinations.

(6) A physician's written opinion as to whether or not the ChE anomalies were related to the exposure to ChE-inhibiting substances.

d. As part of any potential exposure evaluation for nerve agents, the CMA must determine the worker's RBC-ChE activity and assess whether a depression from the RBC-ChE baseline has occurred before returning the individual to duties within a nerve agent operating area. If inhalation is the presumed route of exposure, the ChE activity depression may continue for up to one to two hours following exposure. Following liquid percutaneous nerve agent exposures, the ChE activity depression may continue for up to 12 to 16 hours following exposure. The CMA should consider these facts when confirming the absence of an RBC-ChE depression from baseline activity. If an RBC-ChE depression of greater than 10 percent is detected as part of a potential exposure evaluation, the CMA should attempt to—

(1) Correlate with any clinical signs or symptoms of nerve agent exposure.

(2) Determine concentration of nerve agent (in $mg/m^3$) in the worker's immediate vicinity.

(3) Determine the duration of exposure sustained by the employee.

(4) Formulate a written opinion as to any nerve agent exposure effect.

e. For ChE depressions of greater than 10 percent that are associated with potential exposures to GA, GB, GD, GF, or VX, the CMA should consider obtaining nerve agent urinary metabolites, as identified by the U.S. Army Medical Research Institute of Chemical Defense (USAMRICD) on GC/MS analysis (see TB MED 296), or other validated nerve agent-specific biomarkers. (NOTE: These specimens MUST be collected within 48 hours of the potential exposure to nerve agents, since the alkyl methylphosphonates are eliminated rapidly from the body.) The following procedures should be followed when collecting urine samples. Specimen collection should be done under close supervision by a health care provider to preclude the possibility of sample tampering.

(1) Provide clean urine cups for the collection.

(2) Immediately transfer 30 milliliters of urine to a plastic sample tube or container.

(3) Leave enough air space in the container to allow for the expansion of liquid contents in the frozen state. Sample containers made of non-breakable plastic, which can withstand cryogenic temperatures, need to be used during shipping.

(4) Collect urine immediately following suspected exposure. If possible, two additional urine specimens, with 30-milliliter aliquots, need to be obtained one (1) day and seven (7) days after exposure. The clinic should also provide a 30-milliliter urine sample obtained from at least one known unexposed individual to serve as a control.

(5) Place a tamper proof strip with the patient's name, social security number, and date on it across each tube or container with the patient's initials.

(6) Include a memorandum with the specimens, providing information on the time of suspected exposure, onset time of symptoms/signs (if any), baseline and post-exposure RBC-ChE activity results, possible nerve agents involved, patient's age and gender, as well as the CMA's name, address, and phone number.

(7) Ship all sealed containers in dry ice by overnight delivery to the U.S. Army Medical Research Institute of Chemical Defense, ATTN: MCMR-UV-PA, Applied Pharmacology Branch, 3100 Ricketts Point Road, APG, MD 21010-5400. If immediate shipping is not possible, urine samples need to be kept frozen. Call USAMRICD at (410) 436-3276 to advise them that a shipment is being sent to the Applied Pharmacology Branch. (NOTE: Use of the USAMRICD Applied Pharmacology Laboratory will continue for up to 24 months from the effective date of this interim guidance, during which time processes will be established for obtaining Clinical Laboratory Improvement Act (CLIA) certified assays.)

## Section 4 - Diagnosis and Treatment of Nerve Agent Intoxication (see DA PAM 40-8, Appendix D)

### 4-1. General (Supercedes DA PAM 40-8, paragraph D-1)

This appendix—

a. Provides general information to medical personnel treating—

(1) Nerve-agent intoxication.

(2) The clinical effects of acetylcholinesterase inhibition, from nerve agents above or below the surety threshold as defined in AR 50-6, Table 6-2, and from research, development, test, and evaluation dilute solutions as defined in AR 50-6, Table 6-1. Although research, development, test, and evaluation solutions may be significantly less hazardous than pure undiluted nerve agents, research, development, test, and evaluation solutions may represent a significant exposure potential to nerve agents.

b. The information provided in section 4 is intended for health providers only. Except for the information provided on the handling of spent MARK I kits and methods for SKIN decontamination, section 4 is NOT intended for first responders, nor intended to replace war fighting doctrine for SKIN decontamination training at the live agent training facility. This guidance is not intended to replace the direction provided in DA PAM 385-61, Chapter 7, paragraph 7-8, for decontamination of protective masks, hoods, butyl rubber gloves, or other personal protective equipment. However, the practice of applying 5% sodium or calcium hypochlorite (bleach) or 10% sodium carbonate directly to skin for the purposes of decontamination shall be discontinued immediately, and the guidance provided in paragraph 4-5 of this document shall be used in its place.

**4-2. Routes of entry (Supercedes DA PAM 40-8, paragraph D-2)**
The routes of entry for nerve agents are inhalation and ingestion, as well as eye and skin contact.

**4-3. Toxicology (Supercedes DA PAM 40-8, paragraph D-3)**
a. Nerve agents GA, GB, GD, and VX are readily absorbed and are hazardous through all routes of exposure, in both liquid and vapor forms. The most prominent physiological effects result from inhibition of the ChE enzymes distributed throughout the nervous system. The resultant excess acetylcholine at the site of the parasympathetic nerve endings produces—

(1) Characteristic muscarine-like effects including miosis, rhinorrhea, bronchoconstriction, and increased gastrointestinal motility.

(2) Nicotine-like effects including muscle fasciculations, weakness, or flaccid paralysis. The accumulation of excessive acetylcholine in the brain and spinal cord results in characteristic central nervous system effects such as difficulty in concentrating, anxiety, insomnia, restlessness, depression of the respiratory center, convulsions, or death.

b. A few controlled studies were conducted in an attempt to scientifically document potential long-term neuropsychological effects such as memory loss, decreased alertness, decreased problem-solving abilities, language problems, and decreased eye-hand coordination. No long-term effects from repeated low level exposure to nerve agents have been identified, except slowed electroencephalogram wave changes without clinical correlation.

c. Although certain organophosphate pesticides were shown to be teratogenic in animals, these effects were not documented in carefully controlled toxicological evaluations for nerve agents. Nerve agents are not thought to be developmentally toxic in doses that are not maternally toxic.

**4-4. Signs and symptoms (Supercedes DA PAM 40-8, paragraph D-4)**
a. The onset of the signs and symptoms following exposure to nerve agents may occur within seconds, minutes, or hours, depending upon the concentration, dosage, and route of entry, as well as the type and physical state of the nerve agent.

b. Nerve agents GA, GB, GD, and GF pose primarily a vapor hazard to the unprotected worker. Exposure to low concentrations of GB vapor, for instance, will usually affect the eyes, nose, and/or lungs. These effects may occur within seconds of exposure and may reach their peak within several minutes after exposure ceases.

(1) Early, mild signs and symptoms of vapor exposure might include--

(a) Miosis, conjunctival injection, pain behind the eyes, dimness of vision, and/or blurred vision, with some reflex nausea and/or vomiting.

(b) Rhinorrhea or excessive salivation.

(c) Chest tightness, with minimal bronchorrhea with higher levels of vapor exposure. Clinical manifestations may develop in organ systems, which were not in direct contact with the nerve agent vapor.

(2) Moderate nerve agent intoxication may include signs and symptoms of mild exposure, plus—

(a) An increase in shortness of breath, with coughing, wheezing, or voluminous bronchorrhea.

(b) Nausea, vomiting, or diarrhea.

(3) Severe signs and symptoms are those in which the central nervous system and multiple organ systems are involved. Severe nerve agent intoxication may include the signs and

symptoms of moderate exposure, plus generalized weakness or fasciculations/twitching, loss of consciousness (within seconds), convulsions (within minutes), severe respiratory distress, flaccid paralysis, and apnea. These signs and symptoms have occurred within humans after one breath, within seconds to minutes following exposure to a high concentration of nerve agent GB. Peak effects will occur within minutes following a vapor exposure.

c. Effects from liquid percutaneous exposures to nerve agents, such as VX, are slower to develop and slower to reach their peak, compared to vapor exposures of the eyes or respiratory tract. This is because nerve agent uptake across the skin is slower than via inhalation, and continued absorption of agent through the various skin layers can occur, even hours after the skin surface has been decontaminated. Signs and symptoms following large liquid percutaneous exposures may occur within 15 to 30 minutes after exposure; however, with small amounts of liquid on the skin, the latent period between exposure and clinical signs may be as long as 18 hours.

(1) Mild signs of liquid nerve-agent skin exposure may include localized sweating at the site of exposure, along with fine muscle fasciculations. (NOTE: Pinpoint pupils (miosis) are not an early sign of liquid skin exposure and may not be present at all in a mild or moderate exposure scenario. Miosis generally results from direct eye exposure to nerve agent vapor. Pinpoint pupils may or may not occur much later in a casualty who has sustained a large skin exposure to liquid nerve agent.)

(2) Moderate signs or symptoms of liquid nerve agent exposure may include those of mild vapor exposure, plus nausea, vomiting and/or diarrhea; headache; and a feeling of generalized weakness, but no respiratory signs or symptoms.

(3) Severe signs and symptoms may include miosis (from systemic uptake of nerve agents), generalized fasciculations and twitching, respiratory secretions, unconsciousness, convulsions, flaccid muscle paralysis, and apnea. The apnea is probably caused by central respiratory depression, although other factors, such as flaccid paralysis of the muscles of respiration or bronchoconstriction, may contribute to respiratory failure.

**4-5. Treatment (Supercedes DA PAM 40-8, paragraph D-5)**

a. The concepts of diagnosing and treating nerve agent casualties may be divided into five basic areas: self-protection, removal from exposure, maintenance of airway patency and ventilation, antidote administration, and supportive care. These concepts are applicable to each level of care provided to nerve agent casualties, whether the healthcare provider is located at the accident site, hotline, patient collection points, health clinics, or definitive-care facilities.

b. Self-protection. Although casualties contaminated with liquid nerve agent are unlikely to present directly to health care providers before decontamination in the field, medical personnel performing triage or supervising the initial treatment of nerve agent casualties should assume the presence of liquid-agent contamination, unless a "vapor only" exposure history is confirmed, or low-level air monitoring has documented the absence of residual nerve agent contamination. When handling potentially contaminated casualties, health care providers should wear air-purifying or atmosphere-supplying respirators, with a dermal protective ensemble covering exposed skin. Whenever possible, areas of known liquid contamination should be decontaminated prior to patient handling to minimize exposure risks; however, if the nerve agent casualty exhibits symptoms requiring two or more 2-mg doses of atropine or has significant injuries, properly protected medical personnel should respond to the contaminated site or the contamination reduction zone of the hotline to treat the patient. In industrial operations, such as

demilitarization plants, the proximity of medical support allows medical personnel to arrive at the injury site early in the decontamination process. In this case medical personnel should don proper PPE and evaluate the exposed workers. This will allow for early diagnosis and treatment if required and will facilitate psychological support to the worker.

c. Removal from exposure. The old adage to "remove the patient from the puddle and the puddle from the patient" is the next appropriate step, after protecting yourself. If the hazard is from vapor alone, evacuation of the patient upwind from the exposure source and removal of clothing may be sufficient. For unmasked casualties who are unconscious or otherwise incapacitated, mask the casualty before evacuating. This is unnecessary after the casualty has been decontaminated in the field and is in a clean environment.

(1) **(Supercedes DA PAM 50-6, paragraph 6-5b(2)(e)"note")** Vapor-exposed nerve agent casualties should be decontaminated by removing all clothing in a clean air environment and shampooing or rinsing the hair to prevent vapor off-gassing.

(2) [**Supercedes DA PAM 50-6, paragraphs 6-5b(3)(a) and 6-5b(3)(b); and DA PAM 385-61, skin decon provisions of paragraphs 7-8b and c.**] Liquid-exposed nerve agent casualties (particularly their skin and hair) should be decontaminated by—

(a) Washing the skin surface and hair in warm or hot water at least three times. The rapid physical removal of a chemical agent is essential. Scrubbing of exposed skin with a stiff brush or bristles is discouraged, because skin damage may occur and may increase absorption of agent. Use liquid soap (dispose of container after use and replace), copious amounts of water, and mild to moderate friction with a single-use sponge or washcloth in the first and second washes. The third wash should be a rinse with copious amounts of warm or hot water. Shampoo can be used to wash the hair. If warm or hot water is not available, but cold water is, use cold water. Do not delay decontamination to obtain warm water. Two permissible alternative skin decontaminants include the M291 Skin Decontaminating Kit (SDK) and a 0.5% sodium hypochlorite solution. (NOTE: The use of the M291 SDK and/or 0.5% sodium hypochlorite on skin is appropriate in situations where soap and water may not be as efficacious in physically removing particular types of nerve agents, such as those used in certain research and development laboratories. Neither soap and water, 0.5% sodium hypochlorite, or the M291 SDK have been shown to be more efficacious than the other for physically removing every type of nerve agent from the skin.) If used, the 0.5% sodium hypochlorite should be applied with mild to moderate friction, with a single-use sponge or washcloth in the first and second washes. The third wash should be a rinse to remove any residual sodium hypochlorite with copious amounts of warm or hot water.

(b) Rinsing the eyes, mucous membranes, or open wounds with sterile saline or water. Flush the eyes immediately with sterile saline or water by tilting the head to the side, pulling the eyelids apart with gloved fingers and pouring slowly into the eyes. A Morgan lens may also be used for continuous eye irrigation.

(3) **(Supercedes DA PAM 50-6, paragraph 6-5d.)** The healthcare provider should—

(a) Check the casualty after the three washes to verify adequate decontamination (i.e., less than or equal to the numeric value of the applicable nerve agent short-term exposure limit or STEL [see glossary]) BEFORE allowing patient entry to the treatment area within the military or contractor-operated medical treatment facility. This is normally accomplished by monitoring the patient at the medical treatment facility with a near real time, low level air monitoring device to detect any evidence of nerve agent vapor off-gassing. (NOTE: In cases where immediate, life-saving care is required, and delays in obtaining near real time monitoring would compromise patient survival, the Medical Response Team Leader may certify the patient free from

contamination based upon the verified observation of patient decontamination procedures, without air monitoring results.) If initial decontamination efforts prove inadequate (i.e., residual nerve agent concentrations coming off of the victim exceed the STEL), repeat the entire process, giving special attention to the hair, intertriginous areas, open wounds or foreign bodies, and consider the alternative skin decontaminants mentioned above. Patients should be prominently tagged as decontaminated before being transported to definitive care facilities off-post.

(b) Be prepared to administer antidote and or to stabilize conventional injuries during the decontamination process.

(c) Protect the airway while conducting decontamination and assure appropriate placement of the respirator over the uncontaminated face. The initial assessment of the casualty can best be performed in an agent-free environment where the health care provider is able to "look, listen, and feel" unencumbered by protective clothing. However, careful decontamination can be a time consuming process. Healthcare providers at fixed medical treatment facilities shall be prepared to enter the contamination reduction zone of the decontamination area in the appropriate level of PPE to evaluate and treat the casualty during this process. This will also provide some measure of psychological support and reassurance to exposed victim.

d. Maintenance of airway patency and ventilation. Initial treatment of the nerve agent-intoxicated casualty should begin with the primary survey of airway, breathing, and circulation. Some degree of respiratory tract involvement is seen in most cases of nerve agent vapor intoxication. In conscious patients who have received relatively minor exposures, administration of atropine will reverse bronchoconstriction, reduce secretions, improve airflow, and reduce the work of breathing. However, severely intoxicated casualties with fulminant secretions, significant stridor or wheezing, agonal respirations, and an altered level of consciousness require the early establishment of a definitive airway. Here, the order of treatment and assessment may be best summarized as "AABC", that is antidote, airway, breathing and circulation. Airway resistance may be initially high (50 to 70 centimeters of water) due to bronchoconstriction and copious secretions. Adequate atropinization will reverse these muscarinic effects of nerve agent intoxication and will allow easier ventilation. Endotracheal intubation is the airway of choice. Assisted ventilation with high partial pressures of oxygen may be required for up to several hours following exposure for individuals with flaccid paralysis or central respiratory depression. Periodic suctioning of secretions will also improve ventilation and enhance air exchange.

e. Antidote administration. Three medications are used to treat the signs and symptoms of nerve-agent intoxication: atropine, pralidoxime chloride, and diazepam. The general indications for use of these antidotes are discussed first, followed by a discussion of their use in the treatment of mild, moderate, or severe nerve-agent intoxication. The CMA shall ensure adequate stockage of these drugs to treat the number and severity of nerve agent casualties associated with the most probable event for their supported facility.

(1) Atropine is an anticholinergic compound, which antagonizes the muscarinic effects of acetylcholine. It may be administered intramuscularly (IM), intravenously (IV), or through the endotracheal tube. Parenteral atropine will reverse muscarinic effects such as rhinorrhea, salivation, sweating, bronchoconstriction, bronchorrhea, nausea, vomiting, and diarrhea. Miosis and ciliary body spasms are not reversed by parenteral atropine; relief of intractable pain in or around the eye requires the instillation of 1 percent homatropine or atropine, repeated as needed at intervals of several hours for 1 to 3 days. Severe symptoms may require the local instillation of 1 percent atropine sulfate ointment. Although the intravenous (IV) route of administration is preferred when treating systemic effects, atropine should be administered IV very cautiously in

hypoxemic patients, since studies have documented the occurrence of ventricular fibrillation following IV atropine administration in hypoxemic animals. The initial parenteral dose is 2 to 6 mg, with subsequent doses titrated to the severity of nerve-agent signs and symptoms. Side effects in non-exposed individuals may include tachycardia, dry mouth, blurred vision, mydriasis, a very transient atrio-ventricular dissociation, mild sedation, and delirium in doses greater than 10 mg. The greatest potential problem from the administration of atropine in a non-nerve-agent-intoxicated person is inhibition of sweating; this, when combined with physical exertion, can cause heat injury in warm weather.

(2) Pralidoxime chloride (2-PAMCL) is an oxime, which displaces the nerve agent from the esteratic site of ChE when administered before aging of the affected enzyme takes place. (NOTE: 2-PAMCL is particularly effective in reactivating ChE enzymes following exposures to GA, GB, GF and VX; it is ineffective in reactivating ChE systems poisoned by GD due to the rapid aging phenomenon seen with this nerve agent). Pralidoxime chloride reverses some of the nicotinic effects of acetylcholine, principally skeletal muscle fasciculations, twitching, and fatigue. The initial dose is 600 mg IM; 2-PAMCL may also be administered by intravenous infusion (1 gram in 250 cubic centimeters of Normal Saline), given over a 20 to 30 minute time period. The principal side effects from 2-PAMCL in a non-poisoned person are hypertension, dizziness, blurred vision, double vision, dysgeusia, and nausea/vomiting. Hypertension may be seen at high doses (greater than 15 milligrams per kilogram body weight) but may be treated with intravenous phentolamine (5 mg intravenous push). The CMA must ensure that antihypertensives are on hand to reverse 2-PAMCL-induced hypertension.

(3) In the military medical supply system, atropine and 2-PAMCL are packaged together as auto-injectors in the MARK I kit for the field expedient administration of these antidotes. (NOTE: MARK I kit 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. Also, the injectors, when not issued for use in the mask carrier, must not be stored in sub-freezing temperatures, because the injector may not function properly while frozen.) Each MARK I kit contains 2 mg of atropine sulfate in one injector and 600 mg of pralidoxime chloride in a second injector. Each chemical agent worker is issued three MARK I kits inside the protective mask carrier for personal use. Individuals handling MARK I kits that have been discharged (either accidentally or as part of patient treatment) should not attempt to cap or bend the needles, or to place the spent kits in the mask carrier. Instead, the MARK I kits should be disposed of in large sharps containers that have been pre-positioned in all work areas in which it can be reasonably anticipated that MARK I kits might be used. If no sharps containers are available, alternative local procedures should be developed and implemented to ensure compliance with the OSHA Bloodborne Pathogens Standard.

(4) **(Supercedes DA PAM 50-6, paragraph 6-5c(2)"note")** Diazepam is an anticonvulsant drug used to decrease seizure activity and to reduce brain injury caused by prolonged seizures. Animal studies have clearly indicated a correlation between prolonged seizure activity and the occurrence of brain injuries following nerve agent GD exposure. The CMA provider should consider the use of diazepam in unconscious, severely intoxicated nerve agent casualties, after administering atropine and pralidoxime chloride. The initial dose of diazepam is 2 to 5 mg IV or 10 mg IM, with additional doses as required. Intravenous doses of greater than 30 mg of diazepam may be required to ablate active nerve agent-induced convulsions. Anticonvulsants that are routinely used for the treatment of status epilepticus, such as dilantin, phenobarbital, or

valproic acid, are NOT effective in the treatment of nerve agent-induced seizures. Diazepam resistant seizures are best treated with midazolam (another benzodiazepine).

(5) Mild nerve-agent intoxication may occur following vapor or liquid exposures and has a varied clinical presentation. The occurrence of miosis and rhinorrhea alone following vapor exposures generally requires observation only. If accompanied by chest tightness or upper respiratory tract secretions, which do not subside, an initial dose of 2 mg IV or IM atropine should be given, with repeat doses given at 5 to 10 minute intervals as required. (A patient has been adequately atropinized when secretions are diminishing and ventilation is accomplished with ease; the need for more atropine should never be assessed by pulse rate or the presence of miosis.) Treatment of mild liquid exposures is more problematic, due to the slower uptake and onset of clinical effects. The onset of sweating or muscle fasciculations at a known site of liquid exposure within 1 to 2 hours suggests the imminent development of more serious, systemic effects and should be treated with 2 mg of atropine IM or IV and 600 mg of 2-PAMCL IM or 1 gram of 2-PAMCl very slowly (20 to 30 minutes) IV.

(6) Moderate symptoms of nerve-agent intoxication following a vapor exposure should be treated more aggressively if significant respiratory distress is present, along with muscular weakness, fasciculations, or gastrointestinal effects. The initial dose of atropine should be 4 mg IM or IV, accompanied by 1,200 mg of pralidoxime chloride IM (2 injectors) or 1 gram IV as previously described. If exposure was to vapor alone, this should be adequate therapy, although repeat doses may be given at 5 to 10-minute intervals. If moderate intoxication has occurred within several hours following liquid percutaneous exposure, repeated doses of atropine and 2-PAMCL may be required. The onset of gastrointestinal symptoms delayed more than 6 hours after liquid exposures may be treated adequately with as little as 2 mg of atropine, accompanied by 600 mg of pralidoxime chloride.

(7) Severe nerve-agent intoxication requires the immediate establishment of a definitive airway, along with an assessment of ventilation and perfusion. Respiratory failure also requires aggressive antidote administration to relieve bronchospasm, minimize secretions, reduce the work of breathing, and improve respiratory muscle function. For these patients, the initial dose of atropine should be 6 mg. Additional atropine by the IV route, once hypoxemia has been reversed, should be given at 3 to 5-minute intervals as required to support airway management. Severely intoxicated casualties may require up to 15 to 30 mg atropine over the first 3 hours of treatment. An IV infusion of 2-PAMCL should be given as previously described, with 1-gram infusions repeated at hourly intervals as required, for up to three doses. Diazepam should be used in patients who are seizing and should be considered for use in patients who have signs of severe intoxication whether or not they are seizing.

f. Supportive care. In the peacetime environment, moderate to severe nerve agent exposures are unlikely to occur except in the setting of laboratory accidents, storage disposal, remediation sites or after terrorist attacks. Under these conditions, other conventional injuries may be superimposed upon the nerve agent exposure. The priorities for emergency medical treatment of mixed conventional-nerve agent casualties should be based upon traditional priorities established for advanced cardiac life support and advanced trauma life support. Primacy should always be given to maintaining airway, breathing and circulation. Other injuries or illnesses uncovered during the secondary survey should be treated with available resources after resuscitative care has been rendered. Fluid and electrolyte requirements are usually minimal, unless superimposed burns or blood loss cause a decrease in cardiac output. Head trauma may be difficult to assess when seen in association with the altered levels of consciousness and pupillary changes of a

severe nerve agent vapor exposure and may require early neurosurgical consultation. *Torsades de pointes*, a rapid, multifocal ventricular arrhythmia, has been reported in humans following organophosphorus-pesticide intoxication and may require immediate treatment following the latest advanced cardiac life support guidelines.

**Section 5 - Potential Exposure Evaluation Criteria for GB and VX Nerve Agents. (New Section , not previously addressed in DA PAM 40-8).**

**5-1. Introduction**

Certain medical evaluations must be performed in the event of an accidental exposure or potential exposure to nerve agents. This section provides the criteria to be used for deciding when to conduct potential exposure evaluations during GA, GB, GD and VX operations.

a. An exposed worker is defined as an individual (with a nerve agent exposure potential) who exhibits clinical signs or symptoms of nerve agent intoxication. In addition, a worker is presumed to have been exposed to nerve agents (even if asymptomatic) if he or she--

(1) has a confirmed acute depression in RBC-ChE activity (greater than 10%) from baseline following presence in a nerve agent chemical limited area; AND

(2) has had no immediate history of contact with other cholinesterase-inhibiting substances, such as carbamates or organophosphate pesticides; AND

(3) has nerve agent urinary metabolites as identified by USAMRICD on GC/MS analysis (see TB MED 296), or other validated nerve agent-specific biomarkers..

b. A potentially exposed worker is defined as an individual (with a nerve agent exposure potential) who is present within a chemical limited area or exclusion area where levels of nerve agent—

(1) exceed the respiratory or dermal protective capability of intact PPE as defined in paragraphs 5-3a,b,c,d, and e, OR

(2) are detectable at the established dermal threshold concentrations for specific nerve agents (see paragraphs 5-3a(2), b(2), c(2), d(2), e(2), and f(2) of this document) and there is a breach in PPE; OR

(3) exceed the STEL and/or there is a failure in engineering controls involving unprotected personnel. .

**5-2. Policies**

a. These potential exposure guidelines apply to potential exposure scenarios to nerve agents in military training, and in storage, disposal, non-stockpile, testing and laboratory operations. (The only exception made is for live agent training at Ft. Leonard Wood: a potential exposure evaluation is not required for training conducted in air purifying respirators in concentrations that are less than IDLH or in known liquid contaminated environments. Signs or symptoms of nerve agent exposure or fulfillment of the other listed criteria shall trigger a potential exposure evaluation under live agent training circumstances.) See paragraph 5-3 for specific potential exposure criteria.

b. All operational events meeting the potential exposure criteria shall be reported immediately to the responsible official or their designee. Any exposed or potentially exposed worker shall be sent immediately to the supporting medical facility for a medical evaluation (see paragraph 2-7 and Section II of the Appendix D).

c. In the event that the potential exposure evaluation reveals that RBC-ChE activity drops below 75 percent of the baseline value (that is, 25 percent depression in RBC-ChE activity), the CMA shall ensure the removal of the affected individual(s) from further actual or potential nerve agent exposure. Exposed or potentially exposed individuals shall not be returned to work in an agent operating area until the CMA has medically cleared them (i.e., no cholinesterase depression greater than 10% from baseline, and no clinical evidence or signs and symptoms of nerve agent exposure for at least one week). The agent operating area is any portion of a chemical limited area where workers are actively conducting nerve agent operations, and there is a nerve agent vapor or liquid exposure hazard, requiring engineering controls or the wearing of respiratory or dermal PPE.

**5-3. Criteria**

a. GA operations. Individuals shall be considered potentially exposed when any one of the following criteria are met.

(1) GA concentrations exceed the authorized level for the PPE being worn during entry. The authorized levels are—

(a) up to the maximum use concentration for the M40 respirators (see Table 1of this guidance) and other air purifying respirators approved by the Office of the Director of Army Safety for chemical agent operations (see DA PAM 385-61, paragraph 4-8.)

(b) up to the maximum use concentration for a self-contained breathing apparatus, supplied air respirator, or combination airline respirator (with an auxiliary self-contained breathing apparatus) worn with anything other than OSHA Level A (vapor tight) ensembles.

(2) A breach or tear occurs during activities in OSHA Level A and GA agent vapor is detectable at or above 11 $mg/m^3$ or liquid contamination is known to exist. (The routes of exposure that are of principal concern are dermal vapor or liquid skin contact; the specified concentration was derived by taking the OTSG approved percutaneous vapor minimal effects concentration-time profile for GA, and dividing by a 30 minute exposure duration for egress.)

(3) Loss of engineering controls, upset conditions, or mishaps which result in a nerve agent concentration that exceeds the short term exposure limit concentrations, in areas where the individual is unprotected (that is, no respiratory protection for nerve agents is being worn).

(4) An individual develops signs or symptoms consistent with a nerve agent exposure effect during or following any entry into a GA chemical limited or exclusion area.

(5) An OSHA Level A or B cut out in an airlock occurs in which the GA concentration is greater than the maximum use concentration for the M40 respirators (see Table 1of this guidance), and the worker is switched from an SCBA backpack to an M40 respirator.

(6) DPE life support systems' air sampling indicates agent concentrations 50 times the GA workplace airborne exposure limit (taken as an 8-hour time-weighted average.) (This is based upon test data on the efficacy of the DPE in-line charcoal filter.)

b. GB operations. Individuals shall be considered potentially exposed when any one of the following criteria are met.

(1) GB concentrations exceed the authorized level for the PPE being worn during entry. The authorized levels are—

(a) up to the maximum use concentration for the M40 respirators (see Table 1of this guidance) and other air purifying respirators approved by the Office of the Director of Army Safety for chemical agent operations (see DA PAM 385-61, paragraph 4-8.)

(b) up to the maximum use concentration for a self-contained breathing apparatus, supplied air respirator, or combination airline respirator (with an auxiliary self-contained breathing apparatus) worn with anything other than OSHA Level A (vapor tight) ensembles.

(2) A breach or tear occurs during activities in OSHA Level A and GB agent vapor is detectable at or above 6 $mg/m^3$ or liquid contamination is known to exist. (The routes of exposure that are of principal concern are dermal vapor or liquid skin contact; the specified concentration was derived by taking the OTSG approved percutaneous vapor minimal effects concentration-time profile for GB, and dividing by a 30 minute exposure duration for egress.)

(3) Loss of engineering controls, upset conditions, or mishaps which result in a nerve agent concentration that exceeds the short term exposure limit concentrations in areas where the individual is unprotected (that is, no respiratory protection for nerve agents is being worn).

(4) An individual develops signs or symptoms consistent with nerve agent exposure effect during or following any entry into a GB chemical limited or exclusion area.

(5) An OSHA Level A or B cut out in an airlock occurs in which the GB concentration is greater than the maximum use concentration for the M40 respirators (see Table 1of this guidance), and the worker is switched from an SCBA backpack to an M40 respirator.

(6) DPE life support systems' air sampling indicates agent concentrations 50 times the GB workplace airborne exposure limit (taken as an 8-hour time-weighted average.) (This is based upon test data on the efficacy of the DPE in-line charcoal filter.)

c. GD operations. Individuals shall be considered potentially exposed when any one of the following criteria are met.

(1) GD concentrations exceed the authorized level for the PPE being worn during entry. The authorized levels are—

(a) up to the maximum use concentration for the M40 respirators (see Table 1of this guidance) and other air purifying respirators approved by the Office of the Director of Army Safety for chemical agent operations (see DA PAM 385-61, paragraph 4-8.)

(b) up to the maximum use concentration for a self-contained breathing apparatus, supplied air respirator, or combination airline respirator (with an auxiliary self-contained breathing apparatus) worn with anything other than OSHA Level A (vapor tight) ensembles.

(2) A breach or tear occurs during activities in OSHA Level A and GD agent vapor is detectable at or above 1.5 $mg/m^3$ or liquid contamination is known to exist. (The routes of exposure that are of principal concern are dermal vapor or liquid skin contact; the specified concentration was derived by taking the OTSG approved percutaneous vapor minimal effects concentration-time profile for GD, and dividing by a 30 minute exposure duration for egress.)

(3) Loss of engineering controls, upset conditions, or mishaps which result in a nerve agent concentration that exceeds the short term exposure limit concentrations in areas where the individual is unprotected (that is, no respiratory protection for nerve agents is being worn).

(4) An individual develops signs or symptoms consistent with nerve agent exposure effect during or following any entry into a GD chemical limited or exclusion area.

(5) An OSHA Level A or B cut out in an airlock occurs in which the GD concentration is greater than the maximum use concentration for the M40 respirators (see Table 1of this guidance), and the worker is switched from an SCBA backpack to an M40 respirator.

(6) DPE life support systems' air sampling indicates agent concentrations 50 times the GD workplace airborne exposure limit (taken as an 8-hour time-weighted average.) (This is based upon test data on the efficacy of the DPE in-line charcoal filter.).

d. GF operations. Individuals shall be considered potentially exposed when any one of the following criteria are met.

(1) GF concentrations exceed the authorized level for the PPE being worn during entry. The authorized levels are—

(a) up to the maximum use concentration for the M40 respirators (see Table 1of this guidance) and other air purifying respirators approved by the Office of the Director of Army Safety for chemical agent operations (see DA PAM 385-61, paragraph 4-8.)

(b) up to the maximum use concentration for a self-contained breathing apparatus, supplied air respirator, or combination airline respirator (with an auxiliary self-contained breathing apparatus) worn with anything other than OSHA Level A (vapor tight) ensembles.

(2) A breach or tear occurs during activities in OSHA Level A and GF agent vapor is detectable at or above 1.5 $mg/m^3$ or liquid contamination is known to exist. (The routes of exposure that are of principal concern are dermal vapor or liquid skin contact; the specified concentration was derived by taking the OTSG approved percutaneous vapor minimal effects concentration-time profile for GF, and dividing by a 30 minute exposure duration for egress.)

(3) Loss of engineering controls, upset conditions, or mishaps which result in a nerve agent concentration that exceeds the short term exposure limit concentrations in areas where the individual is unprotected (that is, no respiratory protection for nerve agents is being worn).

(4) An individual develops signs or symptoms consistent with nerve agent exposure effect during or following any entry into a GF chemical limited or exclusion area.

(5) An OSHA Level A or B cut out in an airlock occurs in which the GF concentration is greater than the maximum use concentration for the M40 respirators (see Table 1of this guidance), and the worker is switched from an SCBA backpack to an M40 respirator.

(6) DPE life support systems' air sampling indicates agent concentrations 50 times the GF workplace airborne exposure limit (taken as an 8-hour time-weighted average.) (This is based upon test data on the efficacy of the DPE in-line charcoal filter.).

e. VX operations. Individuals shall be considered potentially exposed when any one of the following criteria are met.

(1) VX concentrations exceed the authorized level for the PPE being worn during entry. The authorized levels are—

(a) up to the maximum use concentration for the M40 respirators (see Table 1of this guidance) and other air purifying respirators approved by the Office of the Director of Army Safety for chemical agent operations (see DA PAM 385-61, paragraph 4-8.)

(b) up to the maximum use concentration for a self-contained breathing apparatus, supplied air respirator, or combination airline respirator (with an auxiliary self-contained breathing apparatus) worn with anything other than OSHA Level A (vapor tight) ensembles..

(2) A breach or tear occurs during activities in OSHA Level A and VX agent vapor is detectable at or above 0.13 $mg/m^3$ or liquid contamination is known to exist. (The routes of exposure that are of principal concern are dermal vapor or liquid skin contact; the specified concentration was derived by taking the OTSG approved percutaneous vapor minimal effects concentration-time profile for VX, and dividing by a 30 minute exposure duration for egress.)

(3) Loss of engineering controls, upset conditions, or mishaps which result in a nerve agent concentration that exceeds the short term exposure limit concentrations in areas where the individual is unprotected (that is, no respiratory protection for nerve agents is being worn).

(4) An individual develops signs or symptoms consistent with nerve agent exposure effect during or following any entry into a VX chemical limited or exclusion area.

(5) An OSHA Level A or B cut out in an airlock occurs in which the VX concentration is greater than the maximum use concentration for the M40 respirators (see Table 1of this guidance), and the worker is switched from an SCBA backpack to an M40 respirator.

(6) DPE life support systems' air sampling indicates agent concentrations 50 times the VX workplace airborne exposure limit (taken as an 8-hour time-weighted average.) (This is based upon test data on the efficacy of the DPE in-line charcoal filter.).

# Interim Guidance on Occupational Health Practices for the Evaluation and Control of Occupational Exposures to Mustard Agents H, HD, and HT
## Revised 8 June 2004

# Interim Guidance on Occupational Health Practices for the Evaluation and Control of Occupational Exposures to Mustard Agents H, HD, and HT
## Revised 8 June 2004

**Summary of Change:**
This document provides guidance to supercede the provisions of specific, limited sections within DA Pamphlet (PAM) 40-173, DA PAM 50-6, AR 50-6 and DA PAM 385-61 dealing with the occupational safety and health aspects of mustard agents, until the updated versions of these Department of Army policy and informational documents are published. Existing policies in these four regulations and pamphlets remain in force, if specific paragraphs of DA PAM 40-173, DA PAM 50-6, AR 50-6, or DA PAM 385-61 are not listed as "superceded" within this interim guidance. This revised guidance supplants the interim guidance issued through Office of the Deputy Assistant Secretary of the Army (Environment, Safety and Occupational Health ) OASA(I&E), 10 June 2003, and becomes effective on 1 July 2005.

**Applicability:**
This document applies to all Department of Army commands, agencies, organizations, and contractors (unless otherwise specified within contract clauses) that have mustard agent related responsibilities (both surety and non-surety). Specifically, this document applies to personnel, organizations and contractors that may provide medical services to soldiers, employees, or contractors working or training with mustard agents, or who may respond to accidents or incidents involving mustard agent materials in peacetime environments. It also applies to laboratory operations involving research, development, test and evaluation of dilute solutions, and chemical warfare materiel recovery or remediation. This document applies to Active Army, Army National Guard, and/or Army Reserve units supporting these activities. It is not applicable to agencies outside the Department of the Army, or contractors who are not under contract to Army organizations. This document does not apply to battlefield, low intensity conflict, or terrorism response activities.

**Proponent and Exception Authority**:
The Deputy Assistant Secretary of the Army (Environment, Safety and Occupational Health ) is the proponent for this guidance document and has the authority to approve exceptions to this guidance document that are consistent with controlling law and policy. Users are invited to send comments and suggested changes on DA Forms 2028 directly to OASA(I&E), ATTN: Assistant for Safety. This policy guidance contained herein has also been coordinated with the Office of The Surgeon General, the Deputy Chief of Staff, G-3, and the Director of Army Safety.

## Section 1 – Information and Reporting Requirements (see Chapter 3, DA PAM 40-173)

### 1-1. Information and reporting requirements (supercedes DA PAM 40-173, paragraph 3-2)

a. The installation commander, activity commander, director, site project manager, or contracting officer's representative (hereinafter known as the "responsible official"), in coordination with other appropriate personnel, provides the following information to the installation medical authority (IMA) and/or contract medical director (CMD) (see definitions in glossary):

(1) A copy of this document.

(2) A written job description or SF 78, which details the affected individual's duties as they relate to the mustard agent exposure potential (see definition in glossary) in routine and emergency operations.

(3) The air-monitoring results for a potentially exposed worker (see definition in glossary), measured or estimated, under the circumstances defined in Section 5.

(4) A description of any personal protective equipment (PPE) used or to be used.

b. If an exposed worker (see definition in glossary) is removed from work because of signs and symptoms commonly associated with exposure to mustard agents or if the competent medical authority (CMA) believes that a potential exposure evaluation provides clinical or biochemical evidence of a mustard agent exposure, the CMA should—

(1) Immediately report the occurrence to the responsible official (see definition in glossary), or his or her designated representative.

(2) Report the occurrence as potentially disqualifying information to the certifying official, if the employee is enrolled in the chemical personnel reliability program (PRP) (see AR 50-6).

(3) Document the potential exposure evaluation (see definition in glossary) in the patient's medical record.

(4) Report the incident through the Reportable Medical Events System as soon as possible after the diagnosis has been made or within 48 hours (applicable to government-operated U.S. Army Medical Department clinics and hospitals only). For information on reporting requirements and procedures, see http://www.amsa.army.mil.

**1-2. Record keeping (supercedes DA PAM 40-173, paragraph 3-1)**

a. General. The occupational health and medical surveillance programs (as described in AR 40-5) are composed of both general medical and workplace surveillance and job-specific surveillance. The job-specific surveillance is based on the functional requirements and exposure risks of specific jobs. The mustard agent medical surveillance program is a job-specific surveillance program and is a part of the overall occupational and environmental health program. The IMA/CMD shall maintain the medical records of personnel enrolled in the mustard agent medical surveillance program in accordance with the requirements of AR 40-66, AR 40-5, and 29 CFR 1910.1020 (for contractors, Army regulations specified in the medical portions of the contract apply). The medical record should include the results of post-offer, pre-placement (or change-of-position); periodic job-related; and termination examinations (see Sections 2 and 3 and the Appendix D), as well as respirator screenings/clearances and the results of any mustard agent exposure or potential exposure evaluations. Civilian medical records and x-rays must be maintained for 40 years or the duration of the individual's employment plus 30 years, whichever is longer. (See AR 40-66, paragraph 7-10a and 29 CFR 1910.1020 (d) (1) (i)).

b. Air-monitoring records. Documentation of a worker's exposure potential to mustard agents is important in assessing the present and past exposure history and in documenting compliance with the established airborne exposure limits (AELs).

(1) The responsible official will designate qualified personnel to maintain, interpret, correlate, and transmit air-monitoring records. (See DA Pam 385-61, paragraph 3-7a through c.)

(2) The IMA/CMD incorporates air-monitoring data on exposed workers or potentially exposed workers into the medical record on Standard Form (SF) 600 (Medical Record – Chronological Record of Medical Care), DA Form 4700 (Medical Record - Supplemental Medical Data), or other appropriate forms. (See Section 5 for the criteria for potential exposure

evaluations, and Section II of the Appendix D for potential exposure evaluation forms.) Any medical record entry of exposure or potential exposure meeting the criteria defined in paragraph 5-3 shall include—

(a) The date, location, time, duration and results of each air sample taken, and whether confirmation of the results was obtained through a second analytical method of detection.

(b) The physical state of the mustard agent, potential route of exposure, time of occurrence, estimated duration of exposure or potential exposure, and type of PPE worn. An example of a medical data sheet that can be used to collect such information is provided in the Appendix D, Section II.

c. Employee access. The IMA/CMD—

(1) Provides the affected individuals, former employees, or their designated representatives access to the air-monitoring records associated with exposure or potential exposure evaluations. (See DA Pam 385-61, paragraphs 3-7c and d.) In instances where the IMA/CMD does not maintain the air-monitoring records, he or she will coordinate with the designated records custodian.

(2) Makes available the medical records containing the examination content described in paragraph 1-1a for inspection and copying per AR 40-66, AR 50-6, and 29 CFR 1910.1020.

**1-3. Employee health education (supercedes DA PAM 40-173, paragraph 3-3)**

a. Employee health training. The IMA/CMD for the supported chemical activity or operation reviews and concurs/non-concurs with any employee-training materials, local plans, policies or procedures dealing with: the health effects or treatment aspects of mustard agent exposure; patient or skin decontamination procedures; use of respiratory, ocular or dermal protective equipment to protect against mustard agent exposure; or buddy-aid, self-aid, and essential first aid practices for mustard agent casualties. The IMA/CMD shall conduct and document this review and concurrence/non-concurrence on an annual basis.

b. Access to health education materials. The supervisor ensures that a copy of health education materials used in the employee training programs (see DA PAM 385-61, paragraph 7-2) is readily available to all individuals with an exposure potential to mustard agents.

c. Hazard communication information. Methods of instruction may include formal classes, work area meetings, audiovisual and computer-based presentations as appropriate. The responsible official shall assure that health-related training, as described below, is repeated annually by all workers having an exposure potential to mustard agents.

(1) The following mustard agent specific items will be included in the employee hazard communication training—

(a) An explanation of the types of operations in the individual's workplace that have a mustard agent exposure potential.

(b) Methods used to recognize and evaluate work areas with a mustard agent exposure potential.

(c) An explanation of the potential acute and chronic health effects associated with mustard agent exposure and the purpose and description of the mustard agent medical surveillance program (see Sections 2 and 3 and the Appendix D).

(d) Protective measures including administrative and engineering controls, PPE, safe work practices, and emergency procedures to include self-aid, buddy-aid, first aid, and decontamination.

(e) An explanation of the mustard agent material safety data sheets (MSDSs) and applicable standing operating procedures to assure that mustard agent materials are handled and stored per standing operating procedures and DA regulations.

(f) Emergency evacuation and notification procedures.

(2) The IMA/CMD for the supported chemical activity or operation shall provide technical assistance, monitor selected training sessions, and review and approve (in writing) the content of the self/buddy-aid and CPR programs, and the personnel who conduct the training (see DA PAM 385-61, paragraph 7-2d).

**1-4. Material safety data sheets (supercedes DA PAM 40-173, paragraph 3-4)**

a. The employee must have direct access to the mustard agent MSDS content and location. The MSDSs are products of the materiel developer. To obtain copies of the current MSDSs, contact the U.S. Army Research, Development and Engineering Command, Edgewood Chemical Biological Center, Building E-3330, Risk Reduction Office, Aberdeen Proving Ground, MD 21010-5423.

b. Since the MSDSs content may change with time, the MSDSs may not always represent the medical guidance provided by the Office of The Surgeon General. Questions concerning medical guidance provided in the MSDS may be addressed to HQDA (DASG-PPM-NC), 5109 Leesburg Pike, Falls Church, VA 22041-3258 or telephone (703) 681-0650.

c. The MSDSs must be available in an organized manner where the needed information can be retrieved by employees in an emergency situation.

## Section 2 - Mustard Agent Medical Surveillance Program (See DA PAM 40-173, Chapter 4)

**2-1. Introduction**

a. **(New paragraph, not previously contained in DA PAM 40-173)** The mustard agent medical surveillance program is part of a comprehensive occupational and environmental health program that preserves health and prevents work-related disease. Medical surveillance may be defined as the ongoing, systematic, evaluation of employees at risk of exposure to achieve early recognition and prevention of clinical disease. The mustard agent medical surveillance program is part of a larger hazard-specific or job-related medical surveillance program, which includes other chemical, physical, and biological hazards that have been included by the industrial hygienist on a current inventory of OH hazards. When conducting a mustard agent medical surveillance examination, the CMA should also consult the health hazard inventory or industrial hygienist to determine what (if any) other exposures have occurred (or are likely to occur) at or above the action levels established for other industrial chemical or physical hazards. Based on this information, the CMA determines the appropriate medical surveillance questions or content for those exposure hazards.

b. **(Supercedes DA PAM 40-173, paragraph 4-1a.)** The IMA/CMD for the supported chemical activity or operation establishes the mustard agent medical surveillance program for all personnel with a significant exposure potential to mustard agents (see Section 3). The IMA/CMD will assure that these individuals are assigned to one of two medical surveillance categories (I or II) and have been enrolled in the mustard agent medical surveillance program. Personnel with a highest risk of mustard agent exposure (that is, Category I) will receive the most extensive examinations.

c. **(Supercedes DA PAM 40-173, paragraph 4-1b.)** Table 2-1 presents the mustard agent category-specific medical surveillance requirements.

d. **(Supercedes DA PAM 40-173, paragraph 4-1c.)** Section 4 provides the latest information on the diagnosis and treatment of mustard agent intoxication (NOTE: This information is intended for health providers only, and, except for the information provided on the handling of spent MARK I kits and methods for skin decontamination, section 4 is NOT intended for first responders, nor to replace the information provided in DA PAM 385-61, Chapter 7, paragraph 7-8, for self/buddy-aid procedures.)

## 2-2. Mustard agent medical surveillance categories [Supercedes DA PAM 40-173, paragraph 4-2, first sentence; and AR 50-6, paragraph 2-5d(6)]

a. The surety officer [or Site Safety and Health Officer, at Non-Stockpile Chemical Materiel (NSCM) sites] will, on a regular, periodic basis (i.e., once a month), provide to the safety officer, IMA/CMD for the supported chemical activity or operation, and industrial hygiene program manager, a list of all persons who have access to the chemical limited area (see definition in glossary), and who may have an exposure potential to mustard agents. The IMA/CMD for the supported chemical activity or operation, with the assistance of safety and industrial hygiene, will separate these individuals by specific job title and/or activity, and conduct a risk assessment on the individuals' activities to evaluate their exposure potential to mustard agents. As part of this risk assessment process, the IMA/CMD will assign each individual to medical surveillance category I or II, or state that the individual has no significant exposure potential. The IMA/CMDs will then enroll these individuals with a significant exposure potential to mustard agents (e.g., who meet the criteria of Category I or II below) into the appropriate mustard agent medical surveillance program. Written documentation of the safety and industrial hygiene concurrences will be maintained by the IMA/CMD (or Site Safety and Health Officer, if a NSCM operation). The IMA/CMD will also maintain a comprehensive medical surveillance roster or database, which identifies all employees with a significant mustard agent exposure potential (i.e., Category I or II) for whom the IMA/CMD provides occupational health services. This roster will be reviewed monthly and updated so that it contains the latest medical surveillance category designations, based upon the chemical limited area access information received from the surety officer (or Site Safety and Health Officer, at NSCM sites). A medical surveillance category designation is NO LONGER required on the chemical duty position roster (CDPR--see AR 50-6, Chapter 2, paragraph 2-5) for employees who are enrolled in the PRP.

b. The IMA/CMD for the supported chemical activity or operation should give careful attention to the exposure potential of one time or repetitive visitors to the chemical limited area, such as contract vendors, maintenance personnel, grass mowers, etc., and determine the need for enrolling them in a mustard agent medical surveillance program. After conducting a risk assessment, the IMA/CMD will provide the responsible official or their designee with recommendations for the appropriate medical surveillance category for these personnel. If medical surveillance is deemed to be required for individuals with sporadic or intermittent entries into the chemical limited area, the responsible official or their designee will assure that the employers of these workers provide the appropriate medical surveillance, in consultation with the IMA/CMD for the supported chemical activity or operation. Some contract employees

may be eligible for occupational health services from government health clinics, on a reimbursable basis, under the provisions of AR 40-400, paragraph 3-45(d)a.

c. **(Supercedes DA PAM 40-173, paragraph 4-2a and b)** The two mustard agent medical surveillance categories include Category I (old A and B) and Category II (old C and D) personnel. Category I personnel are individuals—

(1) Who may be routinely required (that is, on the average, at least once a week or at least four times per month) to make entries or to work for more than one hour at a time in areas with concentrations of mustard agent greater than the short term exposure limit (STEL); OR

(2) Whose work activities in mustard agent operations, or whose contingency responses to actual mustard agent accidents or simulated exercises, require the workers to wear air-purifying respirators, self-contained breathing apparatuses, or supplied air respirators for more than one hour at a time, with entry into the chemical limited area; OR

(3) Whose work may entail any entry or work in areas with unknown or uncharacterized mustard agent concentrations, or entry into known IDLH environments; OR

(4) Who are designated to conduct leaker containerization, mustard agent materiel or munitions recovery, hotline, hazardous material response, personnel decontamination station, or patient decontamination activities in OSHA level C PPE or above; OR

(5) Who serve as air-monitoring technicians or are engaged in monitoring operations; OR

(6) Who conduct chemical maintenance or ammunition surveillance operations within the chemical limited area or mustard agent storage or disposal facilities; OR

(7) Who conduct demilitarization protective ensemble (DPE) stand-by activities; OR

(8) Who are designated to serve on an Initial Response Force, enter the chemical limited area or contamination reduction zone, and wear dermal or respiratory PPE for purposes other than emergency egress (this includes hazardous material responders, security guards, and healthcare providers on the MRT), in the event of a chemical accident/incident response and assistance (CAIRA) event.

d. **(Supercedes DA PAM 40-173, paragraph 4-2c and d)** Category II personnel are individuals—

(1) With minimal probability of exposure to mustard agents except under accident conditions, but whose activities within the chemical limited area create an exposure potential, as defined in the IMA/CMD's risk assessment (see glossary); OR

(2) Who are assigned to the Chemical Security Defense Force (CSDF) at chemical stockpile locations, do not enter the chemical limited area, and do not wear respiratory protection for other than emergency egress purposes; OR

(3) Who are laboratory or test and evaluation personnel working with neat or dilute mustard agents under engineering controls; OR

(4) Who are assigned to the unescorted access program (UAP) for mustard agent facilities.

NOTE: At the discretion of the IMA/CMD, individuals who do not fit the specific exposure criteria listed above may be enrolled in the Category I or II mustard agent medical surveillance program, if deemed appropriate. The IMA/CMD may also make adjustments in category assignments on an individual, case-by-case basis (e.g., needs to be assigned to category I, rather than category II), if he or she believes this is merited, based upon the individual's job duties and exposure potential.

**2-3. Medical surveillance examinations (New paragraph, not previously contained in DA PAM 40-173)**

Four types of examinations may be conducted as part of the mustard agent medical surveillance program. These include post-offer, pre-placement (including change of position); periodic job-related; termination; and potential exposure evaluations. The IMA/CMD is responsible for conducting the medical surveillance examinations, and identifying those individuals who are due or delinquent for the required medical surveillance examination, based upon the medical surveillance roster and tracking system maintained by the IMA/CMD (see paragraph 2-2a above). The responsible official or their designee is responsible for ensuring that individuals identified by the IMA/CMD as requiring mustard agent medical surveillance examinations report for medical examinations (to include termination examinations), and for ensuring that the required medical surveillance has been conducted before allowing the employee to participate in chemical operations that have a mustard agent exposure potential.

**2-4. Post-offer, pre-placement (including change-of-position) examinations (Supercedes DA PAM 40-173, paragraph 4-3)**

a. All personnel assigned to work in areas with a mustard agent exposure potential shall receive a post-offer, pre-placement medical surveillance (or change-of -position) examination to—

(1) Document that the employee—

(a) Does not exhibit physical, mental, or emotional impairments that may result in a higher vulnerability to mustard agent exposure.

(b) Is physically and mentally able to wear and use the required PPE.

(2) Establish the employee's baseline health status, particularly for organ systems that may be affected by exposure to mustard agents.

(3) Assess the employee's functional capacity to perform specific work-related tasks.

(4) Identify any medical conditions for which recommended work restrictions, limitations, or reasonable accommodations are appropriate under the provisions of 29 CFR Part 1630.

(5) If required by job position, assess suitability for enrollment into the CPRP, to include a face-to-face interview with the CMA.

b. This examination should be performed by or under the supervision of the CMA and at no cost to the employee. See Table 2-1 for the examination requirements by medical surveillance category.

c. An acceptable post offer, pre-placement examination is any medical examination that is--

(1) Conducted within 90 days prior to work assignment to an area involving the potential exposure to mustard agents. If the employee is being enrolled in the PRP, the preplacement or change-of-position examination must be completed within 90 days prior to the date of the certifying official's completion of part VI of the DA Form 3180. If the examination occurred more than 90 days prior to work assignment or prior to certifying official completion of the DA Form 3180, the CMA shall update the medical history and work history to ensure that no interval changes have occurred, and annotate the SF 600 (or equivalent progress note form) to this effect.

(2) Consistent with the requirements outlined in paragraphs 3-1 through 3-2. If the examination does not include all of the requirements, the CMA should perform the procedures that were not completed. If this examination was not conducted specifically as a post offer, pre-placement or change-of-position examination, the CMA should review the examination results

and render a written opinion in the medical record as to its acceptability as a post offer, pre-placement examination for mustard agents.

**2-5. Periodic job-related examinations (Supercedes DA PAM 40-173, paragraph 4-4)**

a. The CMA performs the appropriate category-specific, periodic examination (see paragraphs 3-4 through 3-5) and informs the responsible official or their designee of those individuals who do not have current periodic examinations (see paragraph 2-3).

b. Periodic job-related examinations are—

(1) Usually performed on an annual basis.

(2) Conducted to document any change in the employee's health status, particularly with respect to specific exposure hazards encountered in the workplace over the intervening year.

(3) Designed to screen for mustard agent exposure effects and to assess the employee's physical capacity to perform essential job functions. Using the data gathered from these examinations, the CMA may discover correlations between workplace exposures to mustard agents and specific health endpoints by comparing the employee to—

(a) Himself or herself over time.

(b) Groups of workers with greater or lesser degrees of exposure (i.e., is there a dose-response relationship.)

**2-6. Termination examinations (Supercedes DA PAM 40-173, paragraph 4-5)**

a. The CMA performs a termination examination on individuals within 30 days before or after removal from the mustard agent medical surveillance program. The examination documents the employee's health status at the time of termination, particularly for organ systems that may have been affected by mustard agent exposure. Paragraphs 3-7 through 3-8 detail the termination examination requirements by medical surveillance category.

b. Termination examinations do not have to be conducted on individuals who have been enrolled in the mustard agent medical surveillance program for three months or less, unless—

(1) There is documented evidence of exposure to mustard agents (that is, clinical signs or symptoms, laboratory results or histopathology consistent with a mustard agent exposure effect)

(2) A potential exposure evaluation has been conducted within the three-month time period.

c. The responsible official or their designee ensures that a termination examination has been administered or offered to workers who—

(1) Have been enrolled in the mustard agent medical surveillance program for more than three months.

(2) Have been permanently disqualified or administratively terminated from the chemical personnel reliability program (PRP), or, if not enrolled in the PRP, who no longer have mustard agent exposure potential.

d. The termination examination content should reflect the highest category of mustard medical surveillance for which the employee was enrolled during employment.

**2-7. Post exposure and potential exposure evaluations (Supercedes DA PAM 40-173, paragraph 4-7)**

This document requires medical evaluations to be performed in the event of accidental exposure or potential exposure to mustard agents.

a. An exposed worker is defined as an individual (with a mustard agent exposure potential) who exhibits clinical signs or symptoms consistent with a vesicant exposure effect (e.g., skin

erythema, or erythema followed by blistering, after a latent period). This diagnosis should be confirmed by the presence of laboratory-significant quantities of thiodiglycol and related metabolites in the urine, OR the presence of mustard-protein/mustard-DNA adducts in the urine, blood, or blister fluid. The characteristic "mustard" histopathology of a blister on skin biopsy (i.e., dermal – epidermal separation with pyknotic nuclei in the germinal epithelium) should also be considered as strongly supportive of the diagnosis of mustard vesication.

b. A potentially exposed worker is defined as an individual (with a mustard agent exposure potential) who is present within a chemical limited area or exclusion area where levels of mustard agent—

(1) exceed the respiratory or dermal protective capability of intact PPE as defined in paragraphs 5-3a OR

(2) are detectable at the established dermal threshold concentrations for mustard agents (see paragraph 5-3a(2)) of this document) and there is a breach in PPE; OR

(3) exceed the STEL and there is a failure in engineering controls involving unprotected personnel.

c. If an individual has been potentially exposed, the CMA should conduct a potential exposure evaluation to—

(1) Obtain information concerning the circumstances of the exposure or potential exposure and provide the appropriate medical examinations (for example, urine, blood or blister fluid thiodiglycol [histopathology is optional], if skin erythema and blisters are present) and emergency treatment as needed.

(2) Document in the medical record the circumstances of exposure, the results of the examination, and an opinion as to whether a mustard agent exposure has occurred (see forms provided for this purpose in Section II to the Appendix D.)

(3) Record any air-monitoring measurements in the medical record (see paragraph 1-2b(2)). See Section II of the Appendix D, which contains a place for recording air monitoring results on the "Data Sheet for Collecting Information on Chemical Agent Exposed or Potentially Exposed Workers".

d. Section 5 provides additional potential exposure evaluation criteria for H, HT and HD operations.

**2-8. Documentation of medical opinion (Supercedes DA PAM 40-173, paragraph 4-6)**

The CMA records a written opinion in the medical record for each medical examination. This opinion includes—

a. The results of the medical examination and testing.

b. A statement about any detected medical conditions that would place the individual's health at an increased risk of impairment if exposed to mustard agents (e.g., cancer, lymphoma, bone marrow disorders, history of recent chemotherapy, atopic dermatitis, etc.)

c. Any recommended limitations on the potential exposure to mustard agents or on the use of PPE.

d. A statement that the employee has been informed of the above.

**2-9. Special notification requirements (New Section, not previously addressed in DA PAM 40-173.**

Situations may arise in the future in which historical air monitoring results indicate that individuals within a chemical limited area may have sustained unprotected exposures to concentrations of mustard agent greater than the allowable time-weighted average workplace exposure limits, but less than established short-term ceiling limits. When this occurs, the affected area will be posted to notify occupants and transients of the air monitoring results, their potential health significance, and a point of contact for individuals to obtain more information. The CMA will concur (or non-concur) in writing with the statement of potential health significance. This notice shall remain posted for at least two weeks after follow-up air monitoring results demonstrate the return of concentrations below the allowable time-weighted average workplace exposure limit.

**Table 2-1 (Supercedes DA PAM 40-173, Table 4-1)**
**Category specific medical surveillance[1]**

| Category | Post-offer, pre-placement | Periodic[2] | Termination |
|---|---|---|---|
| I | Occupational history (OH) | Interval OH | Interval OH |
| | Medical history (MH) | Interval MH | Interval MH |
| | Physical examination (PE) | PE | PE |
| | Electrocardiogram (EKG) | EKG [3] | Spirometry |
| | Spirometry baseline | Spirometry [3] | Chest x-ray |
| | PPE eval (work in heat) | PPE evaluation (heat) | CBC with diff |
| | Respirator clearance[4] | Respirator clearance[4] | |
| | Audiometric exam | Audiometric exam | |
| | Visual acuity (VA) | VA | |
| | Pupil size and reactivity | Pupil size and reactivity | |
| | Chest x-ray | CBC with diff [3] | |
| | CBC with diff | | |
| II | OH | Interval OH | Interval OH |
| | MH | Interval MH | Interval MH |
| | Respirator Clearance[4] | Respirator clearance[4] | |

[1]See Section 3 for detailed guidance.
[2]Denotes annual requirement, unless otherwise mentioned.
[3]Repeated at least every 2 years.
[4]Category I or II employees with a mustard agent exposure potential will be issued respiratory protective devices or emergency escape devices. Under provisions of 29 CFR 1910.134 all individuals issued respiratory protection must be medically evaluated to ensure that they are physiologically and psychologically able to wear the respirators for the intended tasks. Respirator clearance evaluations should be added to the scope of the mustard agent medical surveillance examination under these circumstances. See Section I of the Appendix D for the Occupational Safety and Health Administration (OSHA) Respirator Questionnaire and Medical Clearance Form.

**Section 3 - Medical Surveillance Program for Personnel with a Significant Exposure Potential to Mustard Agents (See DA PAM 40-173, Appendix B)**

**3-1. Post-Offer, Pre-Placement Examinations for Category I (Supercedes DA PAM 40-173, paragraph B-1)**

The CMA—

a. Obtains a comprehensive—

(1) Occupational history, with specific emphasis on prior potential exposures to skin contact irritants (for example, petroleum distillates, coal tar solvents, chlorinated hydrocarbons, alcohols, glycols, ketones or acetates) or contact allergens (such as, nickel, chromate, epoxy resins, phenolic resins, rubber antioxidants or accelerators, biocides, organic dyes or amines). Inquire as to any past exposures to—

(a) Alkylating agents.

(b) Eye, nose or sinus irritants.

(c) Pulmonary intoxicants.

(d) Developmental toxins.

(e) Chemicals associated with peripheral or central nervous system (CNS) effects.

(2) Medical history and review of systems, to include the OSHA Respirator Questionnaire or equivalent (see Appendix D), focusing on the skin, eyes, nose/throat, pulmonary, cardiovascular, neurologic and reproductive systems. For individuals enrolled in the PRP, the medical history should also explicitly address: a list of current medications; past or present history of illicit drug use, substance abuse or dependency; past or present history of hypnosis; or past suicide attempts.

b. Administers a general physical examination—

(1) With emphasis on the identification of any work-limiting conditions requiring reasonable accommodations or work restrictions, particularly with regard to having the ability to wear PPE.

(2) To detect any significant abnormalities in visual acuity or hearing, which may impair the individual's ability to egress during an emergency. The physical examination should also include any abnormalities of the skin (i.e., cracking, fissures, or scaling), cardiovascular, pulmonary or neurologic systems, which might make the individual more susceptible to the effects of mustard agents.

c. Performs specific evaluations to include a (an)—

(1) Electrocardiogram at rest. At the discretion of the CMA, an individual may obtain an exercise tolerance test (that is, stress EKG) if the individual is to perform strenuous activities in encapsulating PPE, and the individual's symptomatology or cardiovascular risk profile indicates that he or she is at high risk of coronary heart disease, using the Framingham Heart Study or other appropriate risk factors.

(2) Evaluation of the individual's physical ability to perform work involving potential exposure to mustard agents using the required dermal and respiratory protective ensembles (PPE). This evaluation includes, as a minimum, completion of an OSHA respirator questionnaire (or equivalent), which is specific to the types of respiratory protection to be worn by the individual. It should also consider reliable evidence, such as the past or current history of wearing PPE without sustaining adverse health effects, or direct observation (for example, a use test) to show the individual can safely and effectively use the required PPE and that no physiological or psychological conditions impair the individual's ability to use this equipment. For this evaluation, document the completion of the OSHA respirator questionnaire (or

equivalent), the issuance of a respirator clearance, and any evidence of the individual's ability to use such equipment in the individual's medical record.

(a) In addition to reviewing the worker's responses to the OSHA Respirator Questionnaire (or equivalent), the CMA must document a baseline spirometry examination including, as a minimum, three tracings with the forced vital capacity (FVC) and the forced expiratory volume at one second ($FEV_1$), the best two of which demonstrate FVCs within 5% of one another. (See TB MED 509.) Subsequent evaluations of physiologic capabilities to wear a respirator do not require repeated documentation of pulmonary function studies unless specifically required by the CMA. Abnormal pulmonary function tests alone are not grounds for disqualification. If there are abnormal pulmonary function tests, consider the following before disqualifying an individual from respiratory PPE use: The individual's MH and age; the nature of the work to be performed while wearing respiratory PPE; the type of respiratory PPE employed; the results of the tests of cardiovascular status; the results of the OSHA respirator questionnaire (or equivalent); and if necessary, a use test.

(b) The CMA must inform management, the supervisor, or the certifying official (if the employee is enrolled in the PRP) in a confidential manner, about any individual who appears to be physically or psychologically unable to wear dermal or respiratory protective ensembles. If work practices require activities to be performed in full protective clothing (that is, air-purifying or atmosphere-supplying respirators with an encapsulating protective ensemble), document the individual's ability to withstand heat stress in the medical record and enroll the individual in a heat stress prevention program with the elements described in DA PAM 385-61, paragraph 4-3.

(3) Audiometric examination to determine the individual's auditory acuity per DA PAM 40-501. The purpose of the audiogram is to assess the individual's ability to communicate, particularly for those who may be wearing encapsulating PPE, and who may need to communicate over a radio, while in areas with varying levels of background noise. The CMA should consider performing an audiologic use test in individuals with poor auditory acuity (see AR 40-501, paragraph 2-7), if these employees are required to communicate with others who are wearing respirators, and speaking over a radio, while in a mustard agent environment.

(4) Determination of the near and distant visual acuity and pupillary reactivity.

(a) The CMA will record the corrected and uncorrected, near and distant visual acuity in the medical record, along with the reactivity of each pupil, assessed in a dark room. (NOTE: This identifies the pre-existence (if any) of unequal pupil size and confirms the presence of maximally dilated pupils.) Distant visual acuity should be at least 20/40 or better in at least one eye. If optical inserts are required to provide this acuity while wearing a respirator, the CMA will obtain a copy of the worker's optical prescription and file it in the medical record (see DA PAM 40-506, paragraph 2-5f). Obtaining the optical prescription is the employee's responsibility (see DA PAM 40-506, paragraph 3-6c). The responsible official should assure that the optical inserts are in the worker's possession before the individual is allowed to work in a mustard agent environment while wearing a respirator. (NOTE: If the worker is enrolled in the PRP, the CMA should notify the certifying official that the individual has poor visual acuity requiring the use of inserts, and should recommend medical restriction from PRP duties, if the employee does not possess the optical inserts. See exceptions in DA PAM 385-61, paragraph 4-4, with regard to the wearing of contact lenses.)

(b) Instruct individuals on the importance of wearing eyewear and the proper use of these items (whether protective or merely corrective, including optical inserts for the protective mask [if required]).

(5) Other clinical tests include a 14- by 17-inch posterior-anterior chest radiograph and a CBC with differential count.

**3-2. Post-Offer, Pre-Placement Examinations for Category II (Supercedes DA PAM 40-173, paragraphs B-2 and B-3)**

a. The post-offer, pre-placement medical surveillance evaluation for Category II is limited to a comprehensive occupational history, with particular attention to skin contact irritants (for example, petroleum distillates, coal tar solvents, chlorinated hydrocarbons, alcohols, glycols, ketones or acetates) or contact allergens (such as, nickel, chromate, epoxy resins, phenolic resins, rubber antioxidants or accelerators, biocides, organic dyes or amines). Inquire also as to any past exposures to alkylating agents: eye, nose or sinus irritants; pulmonary intoxicants; developmental toxins; and chemicals associated with peripheral or central nervous system (CNS) effects

b. The CMA should also obtain a MH and a review of systems, focusing on the skin and eyes, cardiovascular, pulmonary, neurologic and psychiatric systems. For individuals enrolled in the PRP, the medical history should also explicitly address: a list of current medications; past or present history of illicit drug use, substance abuse or dependency; past or present history of hypnosis; or past suicide attempts.

c. If the individual may be issued a respirator or emergency escape device for emergency egress, the individual will complete the OSHA Respirator Questionnaire (or equivalent) provided in section I of the Appendix D, and the CMA should render and document a medical opinion as to the individual's ability to safely wear a respirator for emergency egress purposes.

**3-3. Abnormal findings (Supercedes DA PAM 40-173, paragraph B-4)**

In the event of abnormal findings on the post-offer, pre-placement examination, the CMA—

a. Determines what (if any) functional activity or PPE limitations are necessary to protect the health of the worker.

b. Discusses these with the worker in a face-to-face interview after reviewing the worker's job description.

c. Informs the worker's supervisor or management officials (in a confidential manner) of any work restrictions or reasonable accommodations that might be necessary to protect the health of the worker or to allow him or her to accomplish the essential functions of their job.

d. Informs the certifying official in a confidential manner of any potentially disqualifying information (if the worker is in the PRP), along with the appropriate recommendation for restriction or disqualification. (See AR 50-6, paragraph 2-15a(4).)

**3-4. Periodic Job-Related Examinations for Category I (Supercedes DA PAM 40-173, paragraph B-5)**

The CMA will conduct an annual medical surveillance examination on all workers in Category I to review their occupational exposure during the preceding year, update their medical history, and determine their continued fitness to meet the functional requirements of their jobs. The components listed in Table 2-1 for a Category I periodic exam (as amplified by the descriptions contained in paragraph 3-1) should supplement other hazard-specific medical surveillance tests indicated by worker exposures (if any) to substances other than mustard agent that are listed on the health hazard inventory. (See AR 40-5, paragraph 5-9a.) A repeat EKG, spirometry examination, and CBC with differential count shall be obtained every two (2) years.

**3-5. Periodic Job-Related Examinations for Category II (Supercedes DA PAM 40-173, paragraphs B-6 and B-7)**

The CMA will conduct an annual medical surveillance examination on all Category II workers, which will include an interval work history, MH and review of systems, focusing on any signs, symptoms, or adverse effects that may be connected to exposure to mustard agents or other contact irritants or allergens. No physical examination is required. The CMA will update the OSHA Respirator Questionnaire (or equivalent) and the individual's medical clearance to wear a respirator on an annual basis. The Category II mustard agent medical surveillance examination's content should supplement other hazard-specific medical surveillance tests indicated by worker exposures (if any) to substances that are listed on the health hazard inventory (see AR 40-5, paragraph 5-9a).

**3-6. Periodic Job-Related Examinations - Abnormal findings (Supercedes DA PAM 40-173, paragraphs B-8)**

In the event of abnormal findings on the periodic job-related examination, the CMA—

a. Determines what (if any) functional activity or PPE limitations are necessary to protect the health of the worker.

b. Discusses the limitations with the worker in a face-to-face interview, after reviewing the worker's job description.

c. Informs the worker's supervisor of any work limitations or reasonable accommodations that will be needed to protect the health of the worker or to allow him or her to accomplish the essential functions of the job.

d. If the worker is in the PRP, informs the certifying official in a confidential manner of any potentially disqualifying information, along with the appropriate recommendation for restriction or disqualification.

**3-7. Termination Examinations – Category I (Supercedes DA PAM 40-173, paragraph B-9)**

The CMA will conduct a medical surveillance examination with the components listed in Table 2-1 for a Category I termination examination (as amplified by the descriptions contained in paragraph 3-1). This examination should be supplemented by any other hazard-specific medical surveillance tests indicated by worker exposures to substances other than mustard agent that are listed on the health hazard inventory. A termination chest x-ray, spirometry examination and complete blood count with differential will also be obtained. If the individual declines the termination examination, the CMA shall document this declination in the medical record.

**3-8. Termination Examinations - Category II (Supercedes DA PAM 40-173, paragraphs B-10 and B-11)**

The CMA will conduct a medical surveillance examination with the components listed in Table 2-1 for a Category II termination examination (as amplified by the descriptions contained in paragraph 3-1). This examination should be supplemented by any other hazard-specific medical surveillance tests indicated by worker exposures to substances other than mustard agents that are listed on the health hazard inventory. If the individual declines the termination examination, the CMA shall document this declination in the medical record.

**3-9. Post Exposure and Potential Exposures - Evaluation of Workers with Skin Erythema and Blisters in the Setting of Potential Exposure to Mustard Agents in the Workplace (New Section, not previously addressed in DA PAM 40-173)**

In an occupational health setting where the patient presents with characteristic skin redness, followed by blistering, after work activities in a mustard agent operating area, the CMA or contract medical director should consider obtaining urine samples for the detection of thiodiglycol and related metabolites, OR the presence of mustard-protein/mustard-DNA adducts in the urine, blood, or blister fluid. The characteristic "mustard" histopathology of a blister on skin biopsy (i.e., dermal – epidermal separation with pyknotic nuclei in the germinal epithelium) should also be considered as strongly supportive of the diagnosis or mustard vesication.

a. For every patient presenting with redness, vesicles or bullous lesions, collect a urine specimen and aspirate the blister fluid after suspected exposure. The collection of urine specimens needs to be done under close supervision by a healthcare provider to preclude the possibility of sample tampering. Clean urine cups should be provided for the collection. Immediately transfer 30 milliliters of urine to a plastic sample tube or container (which is non-breakable plastic that can withstand cryogenic temperatures during shipping). Leave enough air space in the container to allow for the expansion of liquid contents in the frozen state. The urine should be collected immediately following suspected exposure. If possible, two additional urine specimens, with 30-milliliter aliquots, need to be obtained one (1) day, two (2) days, three (3) days, and seven (7) days after exposure. The clinic should also provide a 30-milliliter urine sample obtained from one known unexposed individual to serve as a control. Keep all urine and blister fluid samples frozen if immediate shipment is not possible. Ship all urine specimens and blister fluid specimens in sealed containers in dry ice by overnight delivery to the U.S. Army Medical Research Institute of Chemical Defense, ATTN: MCMR-UV-PA, Applied Pharmacology Branch, 3100 Ricketts Point Road, APG, MD 21010-5400. Include a memorandum with the samples that provides information on the time of the suspected exposure, the time of onset of any symptoms and signs in affected workers, the times the samples were taken, the identity of the mustard agents to which workers were potentially exposed, each worker's age and gender, the name of the sample collector, and the competent medical authority's (CMA's) name, address, and telephone number. Call USAMRICD at (410) 436-3276 to advise them that a shipment is being sent.

b. Consider obtaining at least 5 mls of blood collected with anti coagulant (i.e., purple or green top tubes) upon initial evaluation, and at seven days post-exposure. This can also be analyzed for thiodiglycol content and mustard – protein/mustard – DNA adducts. Place a tamper-proof strip with the worker's name, social security number, and the time and date of collection across each tube or container with the worker's initials. Keep all blood samples refrigerated if immediate shipment is not possible. Ship all blood specimens in sealed containers, and maintain as cold as possible (without freezing) during shipment, for overnight delivery to the U.S. Army Medical Research Institute of Chemical Defense, ATTN: MCMR-UV-PA, Applied Pharmacology Branch, 3100 Ricketts Point Road, APG, MD 21010-5400. Include a memorandum with the samples that provides information on the time of the suspected exposure, the time of onset of any symptoms and signs in affected workers, the times the samples were taken, the identity of the mustard agents to which workers were possibly exposed, each worker's age and gender, the name of the sample collector, and the CMA's name, address, and telephone number. Call USAMRICD at (410) 436-3276 to advise them that a shipment is being sent. (NOTE: This particular biological assay is still under development and being refined. Use of the USAMRICD

Applied Pharmacology Laboratory will continue for up to 24 months from the effective date of this interim guidance, during which time processes will be established for obtaining Clinical Laboratory Improvement Act (CLIA) certified assays.)

c. When only small, limited skin contact with mustard agent occurs, it is very difficult to detect the presence of metabolites in blood or urine specimens. The excised skin of the blister or a small 3 to 5-millimeter punch biopsy of the exposed area will greatly enhance the chance of positive identification by histopathology. Immediately freeze the skin sample without any preservative in a clean, sealed tube. A tamper proof strip with the patient's name, social security number, and the time and date of collection should be placed across each tube or container with the patient's initials. A memorandum needs to be included with the specimens, providing information on the time of suspected exposure, onset time of symptoms/signs (if any), time sample taken, possible mustard agents involved, patient's age and gender, name of person collecting sample, as well as the CMA or contract medical director's name, address, and phone number. All sealed containers need to be shipped in dry ice by overnight delivery to the U.S. Army Medical Research Institute of Chemical Defense, ATTN: Chief, Comparative Pathology Branch, 3100 Ricketts Point Road, APG, MD 21010-5400.

d. Take color photographs of all skin, eye, and externally apparent mucous membrane effects (such as areas with blisters, erythema, and edema) before attempting to aspirate the blister fluid or to obtain a punch biopsy. Make certain the camera distance is sufficient to allow the borders or edges of each affected area to be captured in the photograph. It may be desirable to take a direct-on picture, one or more oblique shots, or one or more side views for each affected area. One picture of the affected area with oblique lighting should also be routinely taken: lighting for most pictures may be from the direction of the camera, but oblique lighting often shows contours and colors better. Place a ruler in the photograph to help characterize effects--for example, it may be placed next to one axis of a blister to document the size. Use of a digital camera is encouraged, as these images may be reviewed (with the written, informed consent of the patient) by subject matter experts who may be geographically remote from the location where the alleged exposure occurred.

## Section 4 - Diagnosis and Treatment of Mustard Agent Intoxication (see DA PAM 40-173, Appendix D)

### 4-1. General (Supercedes DA PAM 40-173, paragraph D-1)

This appendix—

a. Provides general information to medical personnel treating—

(1) Mustard agent intoxication; OR

(2) The clinical effects of mustard agent intoxication, at or below the surety threshold as defined in AR 50-6, Table 6-2, and from research, development, test, and evaluation dilute solutions as defined in AR 50-6, Table 6-1. Although research, development, test, and evaluation solutions may be significantly less hazardous than pure undiluted mustard agents, research, development, test, and evaluation solutions may represent a significant exposure potential to mustard agents.

b. The information provided in section 4 is intended for health providers only. It is NOT intended for first responders, nor intended to replace war-fighting doctrine for SKIN decontamination in the field. This guidance is not intended to replace the direction provided in

DA PAM 385-61, Chapter 7, paragraph 7-8, for decontamination of protective masks, hoods, butyl rubber gloves, or other personal protective equipment. However, the practice of applying 5% sodium or calcium hypochlorite (bleach) directly to skin for the purposes of decontamination shall be discontinued immediately, and the guidance provided in paragraph 4-5 of this document shall be used in its place.

**4-2. Routes of entry (Supercedes DA PAM 40-173, paragraph D-2)**
The routes of entry for mustard agents are inhalation and ingestion, as well as eye and skin contact.

**4–3. Toxicology (Supercedes DA PAM 40-173, paragraph D-3)**

a. Mustard is a vesicant. Besides cutaneous redness and vesication, it—

(1) Produces eye injuries and damage to the respiratory tract.

(2) May be absorbed systemically and cause damage to organ systems with rapidly growing cells that are remote from the site of absorption.

b. The principal cause of injury is the alkylating effect of mustard. The two side chains of sulfur mustard, in the presence of a polar solvent (for example, water), cyclize and become biologically very active. These two chains can attach to two other molecules and specifically bind to the guanine nitrogen in DNA strands, causing cross-linking of DNA and eventually cellular death. Because of the effects on DNA, cell lines with rapid turnover are most affected by the systemic uptake of mustard (for example, the bone marrow and gastrointestinal (GI) tract). Skin sensitization occurs, so individuals with a previous mustard exposure may be affected to a greater degree upon a second exposure.

c. The rate of detoxification of mustard in the human body is slow. Hence, repeated small exposures may have a cumulative effect.

d. Eye absorption results in injuries ranging from mild conjunctivitis to corneal necrosis and opacification. Infection of the ocular lesions is common.

e. Skin absorption of mustard vapor results initially in capillary hyperemia and dermal edema, usually followed by vesication. Skin contact with liquid mustard produces a more marked reaction, often yielding an area of tissue necrosis without vesication, surrounded by an area of erythema and blisters. The skin effects of mustard agent are dependent on the concentration of the agent and the environmental conditions; a hot, humid atmosphere promotes the most severe reactions.

f. Inhalation of mustard causes damage primarily to the nasopharygeal, laryngeal and tracheobronchial mucosa. Moderate exposure results in hyperemia and necrosis of the respiratory mucosa. More severe exposures yield congestion of the pulmonary parenchyma, edema, and atelectasis. Suppurative bronchitis or bronchopneumonia frequently complicates pulmonary lesions and may be the primary cause of death from vapor exposures. Repeated exposures or prolonged inhalation can cause bronchiectasis or chronic bronchitis.

g. If ingestion of mustard occurs, either directly or from liquid-contaminated food or drink, necrosis and desquamation of GI mucosa occurs, producing diarrhea, GI hemorrhage, nausea, and vomiting.

h. Systemic effects can occur after any exposure with much individual variation. Like other alkylating agents, systemic absorption results in injury to the bone marrow, lymph nodes, and spleen producing leukopenia and thrombocytopenia. Other systemic effects include—

(1) Fever.

(2) CNS depression.
(3) Parasympathomimetic effects (bradycardia or cardiac irregularities).
(4) Hemoconcentration.
(5) Shock.

i. In addition to its direct cytotoxic effects, mustard has also been shown to be mutagenic and carcinogenic in animals. Prolonged human exposure has been associated with cancer of the tongue, paranasal sinus, larynx, bronchus, lung, and mediastinum. Tumors observed have been of the squamous or undifferentiated cell types. Consider the possibility of skin cancer because of the frequency of this lesion in animal studies.

j. Since sulfur mustard agent is similar in its effects to nitrogen mustard, which has been associated with human leukemia, this disease might also be expected to occur in humans chronically exposed to mustard.

**4–4. Signs and symptoms (Supercedes DA PAM 40-173, paragraph D-4)**

a. The acute signs and symptoms following mustard exposure are not immediate—they are delayed in appearance. The duration of the latent period and the degree of injury are both dependent on the severity of the exposure as well as the organs affected. The delay of onset is typically 4 to 6 hours but may range from less than 1 hour up to several days.

b. The eye is the most sensitive organ system and may become inflamed at mustard concentrations, which do not affect the skin or respiratory tract significantly. Mustard agent conjunctivitis may be present with lacrimation, grittiness in the eye, and erythema of the lids and conjunctiva. More severe exposures may produce—

(1) Photophobia.
(2) Blepharospasm.
(3) Pain.
(4) Corneal erosions.
(5) Iritis.
(6) Conjunctival vascularization.
(7) Ulceration.
(8) Corneal opacification.

c. Skin exposure to mustard vapor is marked by the delayed appearance of erythema and edema, later followed by the development of vesication or blisters. Itching and burning may occur during the erythematous phase. Multiple small vesicles arise in the erythematous skin and gradually enlarge and coalesce to form typical large, fragile, yellowish bullae. These are usually painless. Liquid mustard contamination of the skin may result in an area of gray-white necrotic skin surrounded by erythema and vesication.

d. Respiratory effects of mustard occur as a result of vapor or aerosol exposures, with the onset time and intensity related to the degree of exposure. The airway injury associated with mustard exposure involves inflammation of the respiratory mucosa in the upper and lower airways. This damage begins in the upper airways and descends to the lower airways in a dose-dependent manner. Upper airway problems include damage to the epithelial lining of the nose, sinuses, pharynx, larynx, trachea, and bronchi. Usually, the terminal bronchioles and alveoli are affected only after a very large inhalation exposure; this is usually a pre-terminal event. Severe exposure leads to deeper damage involving the connective tissue and smooth muscle of the airways. Early changes to the epithelium include congestion with edema, hyperemia, and petechial hemorrhages, followed by necrosis, and later sloughing of the mucosa

with more severe exposures. During the later reparative stages, metaplastic stratified squamous epithelium covers the damaged surfaces.

e. Central airway involvement with mucosal inflammation and necrosis may progress to pseudomembrane formation. These membranes, much like those seen with diphtheria, may peel off and obstruct more peripheral airways. Bronchoscopy may be necessary for removal of the sloughed membranes. Small airway and/or central airway inflammation will lead to a severe hacking cough with prominent dyspnea.

f. After the initial inhalation of mustard, damage to lung tissue leads to congestion, edema, and in severe cases, a chemical pneumonia over the first 24 to 48 hours. These changes are accompanied by an increase in the white blood cell (WBC) count, a mild temperature elevation, and pulmonary infiltrates. Some 2 to 4 days later, signs of bacterial infection may occur, with a higher WBC count, a shift in the differential, new infiltrates, and a change in sputum production with purulence. There may also be areas of airway collapse in severe cases.

g. Gastrointestinal effects of intense mustard exposures include nausea and vomiting. These effects are thought to be in part cholinergic. There may be some added effect of mustard swallowed from ingested, contaminated water (for example, the sailors in Bari Harbor) or from swallowed tracheal secretions, which have trapped some mustard.

h. Central Nervous System (CNS) effects are occasionally seen with fatigue, depression, anxiety, and agitation. It is difficult to separate CNS effects from mustard exposure versus the post-traumatic stress syndrome.

i. As an alkylating agent, sulfur mustard may have potent bone marrow effects. There is an initial leukocytosis followed by progressive effects on rapidly proliferating cells of the hematopoetic system. Leukopenia begins to appear at 3 to 5 days post-exposure with WBC count approaching zero by 7 to 10 days for severely exposed individuals. Systemic absorption of mustard may be sufficient to create a profound leukopenia with associated sepsis/pneumonitis and death. A leukopenia of less than 200 WBCs per cubic millimeter is a bad prognostic sign. Death from pneumonitis usually occurs at 8 to 10 days with some scattered cases up to 2 to 3 weeks.

j. Chronic mustard-induced illness is most commonly referable to the eyes, skin, respiratory tract, or bone marrow.

(1) Delayed, recurrent keratoconjunctivitis of the eyes has been documented in some cases as long as 45 years after the original exposure.

(2) Healing of mustard blisters may result in skin exfoliation and may leave residual areas of hypo- or hyperpigmentation; rarely, there may be residual scarring in places where deeper burns have occurred or where skin grafting was attempted prematurely.

(3) Dyspnea, productive cough, loss of exercise tolerance, frequent pulmonary infections, chronic bronchitis, bronchiectasis, and changes in pulmonary function tests may indicate possible mustard-induced chronic lung disease.

(4) The development of leukoplakia, masses, or ulcerations that fail to heal on the skin or in the upper respiratory tract may indicate carcinoma. Other respiratory tract symptoms, such as chest pain, dyspnea, cough, hemoptysis, or hoarseness, could also suggest a respiratory tract malignancy.

(5) Findings consistent with leukemia may also occur. These include lymph node enlargement, purpura, anemia, weakness, fever, frequent infections, splenomegaly, and leukopenia. (NOTE: The latent period for mustard-induced carcinoma or leukemia is likely to

be twenty years or greater following exposure.)

**4–5. Diagnosis and treatment (Supercedes DA PAM 40-173, paragraph D-5)**

a. The diagnosis of sulfur mustard exposure in the workplace is primarily a clinical exercise, based upon the history of exposure, clinical signs, symptoms, and the time course between exposure and onset of symptoms. Confirmatory tests, such as the urinary thiodiglycol assay, may be helpful if they are positive. However, this assay may be non-diagnostic for very mild dermal exposures and has never been used to confirm purely inhalational exposures. When a patient presents with erythema and blisters, it is important to rule out other items in the differential diagnosis, such as—

(1) Delayed hypersensitivity (type IV) allergic contact dermatitis.

(2) Contact irritation.

(3) Contact urticaria syndrome.

b. The urinary thiodiglycol assay may be very helpful, particularly for dermal exposures resulting in erythema or vesication affecting greater than 1 percent of the body surface area. Mustard is hydrolyzed and metabolized to thiodiglycol in the body and excreted in the urine. The immediate collection of urine followed by the collection of urine specimens on days 1, 2, 3 and 7 following exposure will allow the clinician to quantify the amount of thiodiglycol excreted, its half-life in the body, and excretion kinetics. Generally, urinary thiodiglycol excretion peaks 48 to 72 hours after exposure, with a first order half-life of elimination of between 1 and 1.5 days. This assay is very specific for sulfur mustard, but requires specialized gas chromatography/mass spectrometry (see TB MED 296, Chapter 2).

c. Decontamination of mustard-exposed casualties, either vapor or liquid, should be accomplished in the field or the demilitarization facility within the first two minutes following exposure to prevent cellular damage. If not accomplished within the first several minutes, decontamination should still be performed to ensure any residual liquid mustard is removed from the skin or clothes or to ensure any trapped mustard vapor is removed with the clothing. Removing trapped mustard vapor will prevent vapor off-gassing or subsequent cross-contamination of other healthcare providers or the healthcare facility. Physical removal of the mustard agent, rather than detoxification or neutralization, is the most important principle in patient decontamination. Mustard is not detoxified by water alone and will remain in decontamination effluent (in dilute concentrations) if hydrolysis has not taken place.

(1) **(Supercedes DA PAM 50-6, paragraph 6-5b(2)(e)"note")** Vapor-exposed mustard agent casualties should be decontaminated by removing all clothing in a clean air environment and shampooing or rinsing the hair to prevent vapor off-gassing.

(2) **[Supercedes DA PAM 50-6, paragraphs 6-5b(3)(a) and 6-5b(3)(b); and DA PAM 385-61, skin decon provisions of paragraphs 7-8b and c.]** Liquid-exposed mustard agent casualties (particularly their skin and hair) should be decontaminated by—

(a) Washing the skin surface and hair in warm or hot water at least three times. The rapid physical removal of a chemical agent is essential. Scrubbing of exposed skin with a stiff brush or bristles is discouraged, because skin damage may occur and may increase absorption of agent. Use liquid soap (dispose of container after use and replace), copious amounts of water, and mild to moderate friction with a single-use sponge or washcloth in the first and second washes. The third wash should be a rinse with copious amounts of warm or hot water. Shampoo can be used to wash the hair. If warm or hot water is not available, but cold water is, use cold water. Do not delay decontamination to obtain warm water. Two permissible alternative skin decontaminants

include the M291 Skin Decontaminating Kit (SDK) and a 0.5% sodium hypochlorite solution. (NOTE: The use of the M291 SDK and/or 0.5% sodium hypochlorite on skin is appropriate in situations where soap and water may not be as efficacious in physically removing particular types of mustard agents, such as those used in certain research and development laboratories. Neither soap and water, 0.5% sodium hypochlorite, or the M291 SDK have been shown to be more efficacious than the other for physically removing every type of mustard agent from the skin.) If used, the 0.5% sodium hypochlorite should be applied with mild to moderate friction, with a single-use sponge or washcloth in the first and second washes. The third wash should be a rinse to remove any residual sodium hypochlorite with copious amounts of warm or hot water.

(b) Rinsing the eyes, mucous membranes, or open wounds with sterile saline or water. Flush the eyes immediately with sterile saline or water by tilting the head to the side, pulling the eyelids apart with gloved fingers and pouring slowly into the eyes. A Morgan lens may also be used for continuous eye irrigation.

(3) **(Supercedes DA PAM 50-6, paragraph 6-5d.)** The healthcare provider should—

(a) Check the casualty after the three washes to verify adequate decontamination (i.e., less than or equal to 0.003 $mg/m^3$) BEFORE allowing patient entry to the treatment area within the military or contractor-operated medical treatment facility. This is normally accomplished by monitoring the patient at the medical treatment facility with a near real time, low level air monitoring device to detect any evidence of mustard agent vapor off-gassing. (NOTE: In cases where immediate, life-saving care is required, and delays in obtaining near real time monitoring would compromise patient survival, the Medical Response Team Leader may certify the patient free from contamination based upon the verified observation of patient decontamination procedures, without air monitoring results.) If initial decontamination efforts prove inadequate (i.e., residual mustard agent concentrations coming off of the victim exceed 0.003 $mg/m^3$), repeat the entire process, giving special attention to the hair, intertriginous areas, open wounds or foreign bodies, and consider the alternative skin decontaminants mentioned above. Patients should be prominently tagged as decontaminated before being transported to definitive care facilities off-post.

(b) Be prepared to stabilize conventional injuries during the decontamination process.

(c) Protect the airway while conducting decontamination and assure appropriate placement of the respirator over the uncontaminated face. The initial assessment of the casualty can best be performed in an agent-free environment where the health care provider is able to "look, listen, and feel" unencumbered by protective clothing. However, careful decontamination can be a time consuming process. Healthcare providers at fixed medical treatment facilities shall be prepared to enter the contamination reduction zone of the decontamination area in the appropriate level of PPE to evaluate and treat the casualty during this process. This will also provide some measure of psychological support and reassurance to exposed victim.

d. Erythema may appear as early as 2 or as late as 24 to 48 hours after exposure, depending on the intensity of exposure. For mild erythema, no treatment is usually needed. It is much like mild sunburn with the same recovery time. The objective is to prevent secondary infection. More marked erythema with associated pain and itching needs treatment much as for a moderate to severe second-degree sunburn. Systemic analgesics for pain and antihistamines for itching should be provided for symptomatic relief.

e. Small blisters in non-critical areas should be left intact. If the blister is about to rupture, use a good aseptic technique to drain the blister and cover it lightly with a sterile dressing. Antibiotic ointment, such as silver sulfadiazine, should be applied to larger lesions to prevent

infection. The blister fluid itself is not a vesicant. For crops of blisters or large areas of vesication, hospitalization may be required, and frequent, careful debridement of the affected areas is needed. Whirlpool baths may be useful in the routine care of mustard burns. Skin healing may take weeks to months.

f. Unlike thermal burns, chemical burns do not require large amounts of fluid replacement. Do not over hydrate; however, some fluid replacement is needed since the patients frequently do not drink adequate amounts of fluids to stay hydrated.

g. The main goals of eye treatment for mustard exposed victims are to prevent infection, corneal scarring, and loss of vision. Since mustard fixes to tissue within the first 2 minutes after exposure, irrigation of the eyes with saline during this timeframe is helpful in removing any remaining mustard around the eyelids, on the face, or on the eyelashes. In most cases, however, affected individuals will present for medical attention much later than the first 2 minutes following exposure, after developing signs and symptoms of exposure. In these cases, aggressive attempts to pry apart severely painful, blepharospastic eyelids to accomplish irrigation is of questionable value, and it may create unnecessary physical and emotional trauma.

h. Early assessment of the patient's visual acuity is important, and a careful examination of the cornea and conjunctivae membranes with a slit lamp (whenever possible) is important. Early consultation with an ophthalmologist is also advisable.

i. For mild cases of conjunctivitis, use soothing eye drops or eye irrigation 3 to 4 times daily. Ophthalmic antibiotic drops or ointments are also recommended. A mydriatic, such as homatropine, is recommended to keep the pupil dilated and to prevent the development of synechiae. Vaseline on the eyelid margins is recommended to prevent the lid margins from adhering. Topical analgesics may be used for initial clinical evaluation or to obtain a visual acuity, but are not recommended for repeated use since corneal damage may result. Topical steroids may be helpful if used in the first 48 hours following the injury.

j. The treatment of inhalation exposures to sulfur mustard follows the same precepts that are applied to other inhalation injuries. First priority is given to ensuring the establishment of a patent airway and appropriate airway management. Irritation of the nose, sinuses, and throat, as well as hoarseness or a non-productive cough, are early symptoms of airway involvement. These symptoms may progress, depending on the degree of mustard exposure. Bronchospasm may follow, especially for those patients with pre-existing reactive airway diseases such as asthma. In such cases, bronchodilators may be of value. Patients with evidence of worsening symptoms need to have their $pO_2$ and $pCO_2$ monitored, and their acid-base status followed closely.

k. Laryngospasm and vocal cord edema should be suspected whenever respiratory stridor or hoarseness is present. Under these circumstances, inspection of the vocal cords may be appropriate, followed by endotracheal intubation. Blind nasotracheal intubation is not appropriate in this clinical setting. These patients will need adequate oxygenation since there may be associated lower airway disease that will manifest later. Cool mists, with antitussives and soothing demulcents to relieve coughing and airway irritation are useful.

l. Patients with significant inhalation exposures to sulfur mustard may develop a chemical pneumonitis during the first 24 to 48 hours following exposure. Cultures should be done on the sputum to identify any specific organism(s) before starting antibiotics. The immune status of these patients should be evaluated, since leukopenia may develop secondary to bone marrow depression at about 4 to 5 days after a significant mustard exposure.

m. Severe respiratory distress will require supplemental oxygen and assisted ventilation. Care should be taken when hydrating patients with significant body surface area skin burns. Over-

hydration of these patients may result in "third spacing" of fluids within damaged lungs and may worsen ventilation/perfusion mismatches. The initial nausea or vomiting that arises during the first 24 to 48 hours following mustard exposures may be treated with antiemetics. Persistent vomiting and diarrhea may require intravenous fluid replacement and the maintenance of electrolyte balance.

## Section 5 - Potential Exposure Evaluation Criteria for Mustard Agent Operations (New Paragraph, not previously addressed in DA PAM 40-173)

### 5-1. Introduction

Certain medical evaluations must be performed in the event of an accidental exposure or potential exposure to mustard agents. This section provides the criteria to be used for deciding when to conduct potential exposure evaluations during H, HD, or HT operations.

a. An exposed worker is defined as an individual (with a mustard agent exposure potential) who exhibits clinical signs or symptoms consistent with a vesicant exposure effect (e.g., skin erythema, or erythema followed by blistering, after a latent period). This diagnosis should be confirmed by the presence of laboratory-significant quantities of thiodiglycol and related metabolites in the urine, OR the presence of mustard-protein/mustard-DNA adducts in the urine, blood, or blister fluid. The characteristic "mustard" histopathology of a blister on skin biopsy (i.e., dermal – epidermal separation with pyknotic nuclei in the germinal epithelium) should also be considered as strongly supportive of the diagnosis of mustard vesication.

b. A potentially exposed worker is defined as an individual (with a mustard agent exposure potential) who is present within a chemical limited area or exclusion area where levels of mustard agent—

(1) exceed the respiratory or dermal protective capability of intact PPE as defined in paragraphs 5-3a OR

(2) are detectable at the established dermal threshold concentrations for mustard agents (see paragraph 5-3a(2)) of this document) and there is a breach in PPE; OR

(3) exceed the STEL and there is a failure in engineering controls involving unprotected personnel.

### 5-2. Policies

a. These potential exposure guidelines apply to potential exposure scenarios to mustard agents in military training, and in storage, disposal, non-stockpile, testing and laboratory operations. See paragraph 5-3 for potential exposure criteria.

b. All operational events meeting the potential exposure criteria shall be reported immediately to the responsible official or their designee. Any exposed or potentially exposed worker shall be sent immediately to the supporting medical facility for a medical evaluation (see paragraph 2-7 and Section II of the Appendix D).

### 5-3. Criteria

a. Mustard operations. Individuals shall be considered potentially exposed when any one of the following criteria are met.

(1) Mustard agent concentrations exceed the authorized level for the PPE being worn during entry. The authorized levels are—

(a) up to the maximum use concentration for the M40 respirators (see Endnote 1), and other air purifying respirators approved by the Office of the Director of Army Safety for chemical agent operations (see DA PAM 385-61, paragraph 4-8.)

(b) up to the maximum use concentration for a self-contained breathing apparatus, supplied air respirator, or combination airline respirator (with an auxiliary self-contained breathing apparatus) worn with anything other than OSHA Level A (vapor tight) ensembles.

(2) A breach or tear occurs during activities in OSHA Level A and HD agent vapor is detectable at or above 0.10 $mg/m^3$ or liquid contamination is known to exist. (The routes of exposure that are of principal concern are dermal vapor or liquid skin contact; the specified concentration was derived by taking the OTSG approved percutaneous vapor minimal effects concentration-time profile for sulfur mustard, and dividing by a 30 minute exposure duration for egress.)

(3) Loss of engineering controls, upset conditions, or mishaps which result in a which result in a mustard agent concentration that exceeds the short term exposure limit concentration (see Appendix D), in areas where the individual is unprotected (that is, no respiratory protection for mustard agents is being worn).

(4) An individual develops signs or symptoms consistent with mustard agent exposure effect during or following any entry into a mustard chemical limited or exclusion area.

(5) An OSHA Level A or B cut out in an airlock occurs in which mustard concentrations are greater than the maximum use concentration for the M40 respirators (see Endnote 1), , and the worker is switched from an SCBA to an M40 respirator.

(6) DPE life support system air sampling indicates mustard concentrations greater than 50 times the workplace airborne exposure limit (taken as an 8-hour workplace time-weighted average exposure limit). (This is based upon test data on the efficacy of the DPE in-line charcoal filter.)

Endnote 1. See Table 1 of this guidance for H and HD and for chemical Agents L and HT see AR 385-61, Table 2-2.

# Appendix C

## Developing Chemical Casualty Estimates
## For the
## Most Probable Event (MPE) and Maximum Credible Event (MCE)

## Appendix C

Developing Chemical Casualty Estimates for the Most Probable Event (MPE) and Maximum Credible Event (MCE)

1. Chapter 6, paragraph 6-2d, of DA Pamphlet 50-6, states that the installation or activity commander, in coordination with the installation medical authority (IMA) or contract medical director (CMD), should establish casualty estimates for the installation or activity's MPE and MCE. The description of the MPE should include: the number and type of casualties anticipated (that is, pure chemical, mixed chemical and conventional, or pure conventional casualties), the possible routes of exposure (that is, inhalation, dermal, ocular or ingestion), the anticipated severity of injuries (that is, mild, moderate or severe), and the medical capabilities and staffing levels required to treat these casualties. From the hazard analysis standpoint, the MCE is the worst event that could occur at any time, with maximal release of agent from a munition, bulk container, or process resulting from unintended, unplanned, or accidental occurrence that has a reasonable probability of occurring. In contrast, the MPE refers to the worst potential event likely to occur during routine handling, storage, maintenance, surveillance, or demilitarization operations resulting in the release of agent and the exposure of personnel. For medical planning purposes, the equipping, staffing and resourcing of an installation or contractor-operated medical treatment facility (MTF) must be sufficient to provide care for casualties generated by the MPE and to staff the medical response team (MRT) (paragraph 6-3). The MCE, though less likely to occur than the MPE, may generate types and numbers of casualties beyond the capability of the installation or contractor-operated MTF. For this reason, medical contingency plans, in the form of memoranda of agreement (MOAs), are essential to ensure that treatment is provided expeditiously.

2. This appendix addresses MPEs and MCEs for estimating on-post casualties. MCEs for other purposes, such as explosive safety siting, limiting chemical agent operations, or Chemical Stockpile Emergency Preparedness Program (CSEPP) exercises, may differ from the MCEs developed from this guidance for medical planning purposes.

3. The goal of the MPE casualty estimating process is to arrive at a reasonable basis for the medical equipping, staffing and resourcing of the MRT. The size and composition of the MRT required to support the MPE should be explicitly stated.

4. The role of the IMA or CMD in this process should be to provide technical medical input to a multi-disciplinary working group, which is convened and chaired by the installation or activity commander or his or her designated representative. This working group should be representative of the expertise required to develop the MPE, and include, but not be limited to: operations personnel, safety specialists, quality assurance specialists (ammunition surveillance) (QASAS), medical representatives, industrial hygiene personnel, chemical surety officers, and other subject matter experts. The content of the IMA/CMD input should include the routes of chemical agent exposure for the victims, the severity of the signs and symptoms in each victim, the type and

quantities of antidotes required to manage these casualties, the type and quantity of advanced life support supplies and equipment necessary to treat these victims, and the number and type of healthcare providers required on the MRT (both in the field and at the clinic) to handle these casualties.

5. The most critical step in the development of chemical casualty estimates is the choice of possible accident scenarios that meet the spirit and intent of the DA PAM 50-6 definition of an MPE or MCE. For the purpose of developing these casualty estimates, the MPE should be derived from internal accident scenarios (i.e, dropped pallets or munitions, forklift accidents, re-warehousing or containerization accidents, etc.) that could occur at least once during the anticipated life of a chemical storage or disposal facility that do **not** involve explosions, detonations or other energetic events.

6. When choosing accident scenarios for the MPE, the working group should consider previously-conducted risk assessments, prior chemical event reports, or job hazard analyses (JHAs) conducted for specific operations. The JHA process results in the assignment of risk assessment codes, based upon definitions of hazard severity and hazard probability. In developing the MPE, the working group should consider accident scenarios with at least a marginal hazard severity and a remote probability. For purposes of the equipping, staffing and resourcing of the MRT, use the MPE that demands the most medical resources. It is recommended that one MPE be established for each type of chemical agent being stored, disposed of, or utilized (in the case of live agent training scenarios) at the installation or activity, and that these MPEs be reviewed every two years or when there are any significant changes in operations.

7. Once the accident scenarios or MPEs are established, the next step in the process is to identify the number of workers, observers, or other personnel who are likely to be in the immediate vicinity of the accident, and who may sustain vapor or liquid exposures to chemical agent. The number of workers involved is often identified in the specific standing operating procedure associated with the particular operation, along with the level of protective equipment to be worn (both dermal and respiratory protection). The personal protective equipment (PPE) worn should be considered when determining potential routes of exposure. Possible compromise of PPE should also be considered (i.e., breaking the seal of the air-purifying respirator, as well as tears or rips in PPE) when determining routes of exposure. Once the routes of exposure are determined, the resulting casualties should be characterized as to type (chemical, non-chemical, or mixed) and severity (mild, moderate, or severe). The definitions of mild, moderate, and severe nerve agent casualties are provided in the OASA (I&E) Memorandum (most current version), entitled "Interim Guidance on Nerve and Mustard Agent Decontamination and Medical Services in Industrial Activities", 10 June 2003. The use of the D2PC or D2Puff downwind hazard computer modeling system may, in some cases, be helpful in estimating the downwind hazard distance for the 1% lethality, no deaths and no effects dosages.

8. Initiating events for chemical accidents often involve scenarios, such as a dropped munitions or destabilized pallets, which may also precipitate traumatic or other non-

chemical injuries. The IMA/CMD should also attempt to identify and estimate the number of traumatic injuries that could occur in association with the MPE. These injuries may be superimposed on chemical agent exposure, or result in non-chemical injuries. The trauma associated with initiating events may be the result of direct penetrating trauma, blunt trauma, or resultant strains or sprains associated with rapid egress or the avoidance of injury.

9. After estimating the number of casualties, routes of exposure, and severity and types of injuries or exposures, the IMA/CMD should describe the specific types of medical capability that will be needed to treat these injuries. This capability description should include the specific types of care required, the number and types of healthcare providers required to provide it, a rough description of the medical supplies and equipment necessary for the provision of that care, and the type of medical transport required from the location where the first echelon of MRT care is being provided. Any specialized, definitive evaluations requiring skilled technicians, such as red blood cell cholinesterase monitoring or urinary thiodiglycol testing, should also be mentioned.

10. In contrast to the MPE, the MCE should be derived from potential explosive events and/or other accident scenarios. Casualty estimates for the MCE should be arrived at through a similar process as described in paragraphs 3 through 9 of this appendix, with several differences. The MCE may result in the release of a larger quantity of agent, over a longer distance, and involve a significant number of traumatic injuries from fragmentation, blunt trauma, and penetrating trauma. The number and type of casualties should be described, with recognition that the consequences of an MCE may be beyond the capability of the government or contractor-operated health clinic to deal with, necessitating the development of external support agreements with off post hospitals and ambulance companies. The casualty estimates for the MCE should be provided in the same document developed for the MPE, but in a separate section.

11. Once the MPE, MCE, and casualty estimates have been agreed upon by the working group, these document should be signed by the installation and/or activity commander, and the IMA or CMD of the supporting MTF. A sample MPE and MCE to illustrate this process is provided in the attachment.

12. Point of contact for this appendix is LTC Lisa Black, MC, at (703) 681-0650, or Dr. Roger G. McIntosh, at (443) 402-2688.

XXXX-XXX-X (50-6) SAMPLE MEMORANDUM

MEMORANDUM FOR Site Project Manager, Cedar Creek Chemical Disposal Facility
Commander, Cedar Creek Chemical Depot (CCCD)

Subject: Developing Chemical Casualty Estimates for the Most Probable Event (MPE) and the Maximum Credible Event (MCE)

1. Reference Department of Army Pamphlet (DA PAM) 50-6, 26 March 2003, Chemical Accident/Incident Response and Assistance (CAIRA) Activities.

2. Chapter 6, paragraph 6-2d, of DA Pamphlet 50-6, states that the installation or activity commander, in coordination with the installation medical authority (IMA) or contract medical director (CMD), should establish casualty estimates for the installation or activity's MPE and MCE. The description of the MPE should include: the number and type of casualties anticipated (that is, pure chemical, mixed chemical and conventional, or pure conventional casualties), the possible routes of exposure (that is, inhalation, dermal, ocular or ingestion), the anticipated severity of injuries (that is, mild, moderate or severe), and the medical capabilities and staffing levels required to treat these casualties. From the hazard analysis standpoint, the MCE is the worst event that could occur at any time, with maximal release of agent from a munitions, bulk container, or process resulting from unintended, unplanned, or accidental occurrence that has a reasonable probability of occurring. In contrast, the MPE refers to the worst potential event likely to occur during routine handling, storage, maintenance, surveillance, or demilitarization operations resulting in the release of agent and the exposure of personnel. For medical planning purposes, the equipping, staffing and resourcing of an installation or contractor-operated medical treatment facility (MTF) must be sufficient to provide care for casualties generated by the MPE and to staff the medical response team (MRT) (paragraph 6-3). The MCE, though less likely to occur than the MPE, may generate types and numbers of casualties beyond the capability of the installation or contractor-operated MTF. For this reason, medical contingency plans, in the form of memoranda of agreement (MOAs), are essential to ensure that treatment is provided expeditiously.

3. A meeting was held on 26 March 2003 with the Contract Medical Director; Chief, Ammunition Surveillance; Plant Superintendent; Chief, Risk Management; and the Chemical Surety Officer. The current stockpile at CCCD is composed of VX ton containers. The following MPE and MCE were felt to capture the number and types of casualties that could be associated with on-going operations at the CCCD Disposal Facility.

4. MPE: Unloading of VX Ton Containers:

a. While unloading a VX ton container, the lifting beam fails and a single ton container falls to the concrete, glancing off the head and shoulders of the front

spotter. One of the plugs on the ton container is damaged, and a 3-gallon liquid puddle of VX collects on the road.

b. There are six workers in this operation; each is dressed in cotton coveralls, butyl boots and leather gloves, with slung M40 masks. They include a forklift operator, a front spotter, a rear spotter, a supervisor, a truck driver and an escort. There could also be a safety representative and environmental representative in the nearby vicinity.

c. During this mishap, the front spotter, dressed in this same level of protection, could have traumatic injuries to the head and neck, and a liquid skin VX exposure during the ensuing accident, along with potential vapor inhalation or vapor skin exposure. This individual could sustain an immediate cervical spine injury, concussion or compressed skull fracture from the trauma of falling ton container. Two of the five other individuals could potentially become cross-contaminated with VX liquid while providing first aid and rendering assistance to the front spotter.

d. The number of casualties associated with this MPE would be three. The spotter will be a mixed, chemical/conventional casualty, with severe liquid VX exposure (requiring thorough immediate skin decontamination with soap and water, 3 Mark I kits, diazepam, endotracheal intubation and assisted ventilation) and a head injury (requiring head/neck immobilization and/or inline traction). The other two casualties may be mild liquid skin exposures, requiring no more than immediate skin decontamination, observation, and one Mark I kit, if they become symptomatic with local signs or symptoms, such as sweating and fasciculations. Red blood cell cholinesterase (RBC-ChE) determinations will be necessary to confirm nerve agent exposure. The total quantities of atropine, 2-PAMCL and diazepam for the MRT to have on hand for this MPE would include 10 Mark I kits, three 1-gram vials of 2-PAMCL, and 30 mg of injectable atropine for intravenous usage.

e. Based upon this MPE, the staffing, resourcing and equipping of the CCCD Medical Response Team (MRT) should be sufficient to evaluate, stabilize and transport these three casualties. At a minimum, staffing should include an MRT of four healthcare providers, including one physician Medical Response Team Leader (on call within sixty minutes), one nurse practitioner, and two paramedics. There should also be an advanced life support (ALS) equipped ambulance to transport the severe VX agent casualty with c-spine/head injuries by appropriately trained and qualified healthcare providers, and one laboratory technician to perform the RBC-ChE assay. The MRT should be augmented by a two or three person non-medical decontamination team and one ACAMs monitoring technician, who would respond to the clinic (if required) to assist with patient decontamination efforts and ensure the absence of residual contamination prior to allowing the patient access to treatment areas of the MTF. Sufficient patient transport capabilities should exist to transport

the two other mild VX liquid skin exposed patients to Soybean Community Hospital for observation and evaluation in a timely fashion, if required.

5. The MCE for CCCD Disposal Facility (for medical planning purposes) involves the rupture of one fallen or mechanically damaged ton container during handling operations outside the facility that results in an agent release involving 25% of the contents (i.e., 45-50 gallons) on a bare concrete surface. The one percent lethality distance for this MCE is 17 meters. There may be as many as 12 workers who are in the immediate vicinity, wearing the PPE previously described in the MPE, when this event occurs. During this mishap, it is anticipated that there could be one severe liquid exposure, two mild liquid exposures and up to six mild vapor exposed individuals. The number and type of casualties associated with this MCE would likely overwhelm the capability of the CCCD MRT. Back up support would be required, as well as definitive care for the one trauma victim and other nerve agent casualties at Soybean Community Hospital and the local VA Hospital—two hospitals with whom CCCD has Memoranda of Agreement in place. Transport services would also be required from the Aroostock County EMS System, with whom CCCD also has an MOA.

6. Questions or comments concerning the MPE, MCE or casualty estimates may be directed to the undersigned at (999) 999-9999.

**Frank Smith**
Commanding
CCCD

Concur:

_____ _____
Wilson T. Huggins Date
Contract Medical Director
CCCD Disposal Facility

_____ _____
Robert Martin Date
Commanding
CCCA

Appendix D

# Medical Evaluation of Respirator Wearers and Potential Exposures to Chemical Warfare Agents

# Section I -- The OSHA Respirator Questionnaire

## MEDICAL RECORD—SUPPLEMENTAL MEDICAL DATA

For use of this form see AR 40-66; the proponent agency is the Office of The Surgeon General

| REPORT TITLE | OTSG APPROVED *(Date)* |
|---|---|
| OSHA RESPIRATOR QUESTIONNAIRE | |

1. Your age (to nearest year):

2. Sex (circle one): Male/Female

3. Your height: ft. in.

4. Your weight: lbs.

5. Your job title:

6. A phone number where you can be reached by the healthcare professional who reviews this questionnaire (include the Area Code):

7. The best time to phone you at this number:

8. Has your employer told you how to contact the healthcare professional who will review this questionnaire (circle one): Yes/No

9. Check the type of respirator you will use (you can check more than one category, if applicable):

a. N. R. or P disposable respirator (filter-mask, non-cartridge type only).

b. Other type (for example, half- or full-face piece type, powered-air purifying, supplied-air, self-contained breathing apparatus).

10. Have you worn a respirator (circle one): Yes/No

If "yes," what type(s):

Part A. Section 2. (Mandatory) Questions 1 through 9 below must be answered by every employee who has been selected to use any type of respirator (please circle "yes" or "no").

1. Do you currently smoke tobacco or have you smoked tobacco in the last month: Yes/No

2. Have you ever had any of the following conditions?

a. Seizures (fits): Yes/No

b. Diabetes (sugar disease): Yes/No

(continued top of next column)

c. Allergic reactions that interfere with your breathing: Yes/No

d. Claustrophobia (fear of closed-in places): Yes/No

e. Trouble smelling odors: Yes/No

3. Have you ever had any of the following pulmonary or lung problems?

a. Asbestosis: Yes/No

b. Asthma: Yes/No

c. Chronic bronchitis: Yes/No

d. Emphysema: Yes/No

e. Pneumonia: Yes/No

f. Tuberculosis: Yes/No

g. Silicosis: Yes/No

h. Pneumothorax (collapsed lung): Yes/No

i. Lung cancer: Yes/No

j. Broken ribs: Yes/No

k. Any chest injuries or surgeries: Yes/No

1. Any other lung problem that you've been told about: Yes/No

4. Do you currently have any of the following symptoms of pulmonary or lung illness?

a. Shortness of breath: Yes/No

b. Shortness of breath when walking fast on level ground or walking up a slight hill or incline: Yes/No

c. Shortness of breath when walking with other people at an ordinary pace on level ground: Yes/No

(continued top of next column)

d. Have to stop for breath when walking at your own pace on level ground: Yes/No

e. Shortness of breath when washing or dressing yourself: Yes/No

f. Shortness of breath that interferes with your job: Yes/No

g. Coughing that produces phlegm (thick sputum): Yes/No

h. Coughing that wakes you early in the morning: Yes/No

i. Coughing that occurs mostly when you are lying down: Yes/No

j. Coughing up blood in the last month: Yes/No

k. Wheezing: Yes/No

l. Wheezing that interferes with your job: Yes/No

m. Chest pain when you breath deeply: Yes/No

n. Any other symptoms that you think may be related to lung problems: Yes/No

5. Have you ever had any of the following cardiovascular or heart problems?

a. Heart attack: Yes/No

b. Stroke: Yes/No

c. Angina: Yes/No

d. Heart failure: Yes/No

e. Swelling in your legs or feet (not caused by walking): Yes/No

f. Heart arrhythmia (heart beating irregularly): Yes/No

g. High blood pressure: Yes/No

*(Continue on reverse)*

| PREPARED BY *(Signature & Title)* | DEPARTMENT/SERVICE/CLINIC | DATE |
|---|---|---|
| | | |

**PATIENT'S IDENTIFICATION** *(For typed or written entries give: Name—last, first, middle; grade; date; hospital or medical facility)*

☐ HISTORY/PHYSICAL
☐ OTHER EXAMINATION OR EVALUATION
☐ DIAGNOSTIC STUDIES
☐ TREATMENT
☐ FLOW CHART
☐ OTHER *(Specify)*

**DA FORM 4700**
**1 MAY 78**

*U.S. Government Printing Office:1994 — 300727/10398

5. Have you ever had any of the following cardiovascular or heart problems? (Cont'd)

h. Any other heart problem that you've been told about: Yes/No

6. Have you ever had any of the following cardiovascular or heart symptoms?

a. Frequent pain or tightness in your chest: Yes/No

b. Pain or tightness in your chest during physical activity: Yes/No

c. Pain or tightness in your chest that interferes with your job: Yes/No

d. In n the past two years, have you noticed your heart skipping or missing a beat: Yes/No

e. Heartburn or indigestion that is not related to eating: Yes/No

f. Any other symptoms that you think may be related to heart or circulation problems: Yes/No

7. Do you currently take medication for any of the following problems?

a. Breathing or lung problems: Yes/No

b. Heart trouble: Yes/No

c. Blood pressure: Yes/No

d. Seizures (fits): Yes/No

8. If you've used a respirator, have you ever had any of the following problems? (If you've never used a respirator, check the following space and go to question 9:)

a. Eye irritation: Yes/No

b. Skin allergies or rashes: Yes/No

c. Anxiety: Yes/No

d. General weakness or fatigue: Yes/No

e. Any other problem that interferes with your use of a respirator: Yes/No

9. Would you like to talk to the healthcare professional who will review this questionnaire about your answers to this questionnaire: Yes/No

---

Questions 10 to 15 below must be answered by every employee who has been selected to use either a full-face piece respirator or a self-contained breathing apparatus. For employees who have been selected to use other types of respirators, answering these questions is voluntary.

(continued top of next column)

10. Have you ever lost vision in either eye (temporarily or permanently): Yes/No

11. Do you currently have any of the following vision problems?

a. Wear contact lenses: Yes/No

b. Wear glasses: Yes/No

c. Color blind: Yes/No

d. Any other eye or vision problem: Yes/ No

12. Have you ever had an injury to your ears, including a broken ear drum: Yes/No

13. Do you currently have any of the following hearing problems?

a. Difficulty hearing: Yes/No

b. Wear a hearing aid: Yes/No

c. Any other hearing or ear problem: Yes/ No

14. Have you ever had a back injury: Yes/No

15. Do you currently have any of the following musculoskeletal problems?

a. Weakness in any of your arms, hands, legs, or feet: Yes/No

b. Back pain: Yes/No

c. Difficulty fully moving your arms and legs: Yes/No

d. Pain or stiffness when you lean forward or backward at the waist: Yes/No

e. Difficulty fully moving your head up or down: Yes/No

f. Difficulty fully moving your head side to side: Yes/No

g. Difficulty bending at your knees: Yes/No

h. Difficulty squatting to the ground: Yes/ No

i. Climbing a flight of stairs or a ladder carrying more than 25 lbs: Yes/No

j. Any other muscle or skeletal problem that interferes with using a respirator: Yes/No

(continued top of next column)

Part B: Any of the following questions, and other questions not listed, may be added to the questionnaire at the discretion of the healthcare professional who will review the questionnaire.

1. In your present job, are you working at high altitudes (over 5,000 feet) or in a place that has lower than normal amounts of oxygen: Yes/No

If "yes," do you have feelings of dizziness, shortness of breath, pounding in your chest, or other symptoms when you're working under these conditions: Yes/No

2. At work or at home, have you ever been exposed to hazardous solvents, hazardous airborne chemicals (e.g., gases, fumes, or dust), or have you come into skin contact with hazardous chemicals: Yes/No

If "yes," name the chemicals if you know them:

3. Have you ever worked with any of the materials, or under any of the conditions, listed below:

a. Asbestos: Yes/No

b. Silica (e.g., in sandblasting): Yes/No

c. Tungsten/cobalt (e.g., grinding or welding this material): Yes/No

d. Beryllium: Yes/No

e. Aluminum: Yes/No

f. Coal (for example, mining): Yes/No

g. Iron: Yes/No

h. Tin: Yes/No

i. Dusty environments: Yes/No

j. Any other hazardous exposures: Yes/No

If "yes," describe these exposures:

4. List any second jobs or side businesses you have:

5. List your previous occupations:

6. List your current and previous hobbies:

7. Have you been in the military services? Yes/No

If "yes," were you exposed to biological or chemical agents (either in training or combat): Yes/No

8. Have you ever worked on a HAZMAT team? Yes/No

(continued top of next page) 

Standard Form 507

GPO : 1587 0 – 183-989

| CLINICAL RECORD | ~~Report on S.F.~~ _____ or Continuation of DA 4700 RESPIRATORY MEDICAL QUESTIONNAIRE *(Strike out one line) (Specify type of examination or data)* |
|---|---|

*(Sign and date)*

9. Other than medications for breathing and lung problems, heart trouble, blood pressure, and seizures mentioned earlier in this questionnaire, are you taking any other medications for any reason (including over-the-counter medications): Yes/No

If "yes," name the medications if you know them:

10. Will you be using any of the following items with your respirator(s)?

a. HEPA Filters: Yes/No

b. Canisters (for example, gas masks): Yes/ No

c. Cartridges: Yes/No

11. How often are you expected to use the respirator(s) (circle "yes" or "no" for all answers that apply to you):

a. Escape only (no rescue): Yes/No

b. Emergency rescue only: Yes/No

c. Less than 5 hours per week: Yes/No

d. Less than 2 hours per day: Yes/No

e. 2 to 4 hours per day: Yes/No

f. Over 4 hours per day: Yes/No

12. During the period you are using the respirator(s), is your work effort:

a. Light (less than 200 kcal per hour): Yes/ No

(continued top of next column)

If "yes," how long does this period last during the average shift: hrs. mins.

Examples of a light work effort are sitting while writing, typing, drafting, or performing light assembly work; or standing while operating a drill press (1 - 3 lbs.) or controlling machines.

b. Moderate (200 to 350 kcal per hour): Yes/No

If "yes," how long does this period last during the average shift: hrs. mins.

Examples of moderate work effort are sitting while nailing or filing; driving a truck or bus in urban traffic; standing while drilling, nailing, performing assembly work, or transferring a moderate load (about 35 lbs.) at trunk level; walking on a level surface about 2 mph or down a 5-degree grade about 3 mph; or pushing a wheelbarrow with a heavy load (about 100 Lbs) on a level surface.

c. Heavy (above 350 kcal per hour): Yes/ No

If "yes," how long does this period last during the average shift: hrs. mins.

Examples of heavy work are lifting a heavy load (about 50 lbs.) from the floor to your waist or shoulder; working on a loading dock shoveling: standing while bricklaying or chipping castings; walking up an 8-degree grade about 2 mph; climbing stairs with a heavy load (about 50 Lbs).

13. Will you be wearing protective clothing and/or equipment (other than the respirator) when you're using your respirator: Yes/No

If "yes," describe this protective clothing and/or equipment:

(continued top of next column)

14. Will you be working under hot conditions (temperature exceeding 77° F: Yes/No

15. Will you be working under humid conditions: Yes/No

16. Describe the work you'll be doing while you're using your respirator(s):

17. Describe any special or hazardous conditions you might encounter when you're using your respirator(s) (for example, confined spaces, life-threatening gases):

18. Provide the following information, if you know it, for each toxic substance that you'll be exposed to when you're using your respirator(s):

Name of the first toxic substance:

Estimated maximum exposure level per shift:

Duration of exposure per shift

Name of the second toxic substance:

Estimated maximum exposure level per shift:

Duration of exposure per shift:

Name of the third toxic substance:

Estimated maximum exposure level per shift:

Duration of exposure per shift:

The name of any other toxic substances that you'll be exposed to while using your respirator:



*(Continue on reverse side)*

| PATIENT'S IDENTIFICATION *(For typed or written entries give: Name – last, first, middle; grade; date; hospital or medical facility)* | REGISTER NO. | WARD NO. |
|---|---|---|
| | | |

~~REPORT ON~~ _____ or CONTINUATION OF DA 4700

Standard Form 507
GENERAL SERVICES ADMINISTRATION AND
INTERAGENCY COMMITTEE ON MEDICAL RECORDS
FPMR 101-11 .80 6-8
OCTOBER 1975 507-106

# Appendix D

## MEDICAL CLEARANCE FOR RESPIRATOR USE

**Name**_____

**Date**_____

**SS#**_____ **Date of Birth**_____ **Sex** ___**M** ___**F**

**Height**____**ft** ____**in** **Weight** _____**lbs** _____

**Job Title**_____

**Employer**_____--

**Type of Respirator Used (Circle all that apply)**

**Full-face negative pressure air purifying** **Emergency escape device**

**Powered air-purifying respirator** **Other (list)**_____

**Optical inserts required? YES NO**

**If yes, possesses inserts? YES NO**

**Level of Work Effort (Circle one)**

**Light** **Moderate** **Heavy** **Strenuous**

**Extent of Usage**

**Daily** **Occasionally** **Rarely – or for emergency escape purposes**

**Length of Time of Anticipated Effort in Hours**

_____

**Special work Considerations (that is, high places, temperature, or protective clothing)**

_____

_____

_____

**Employer Representative**

---

# Appendix D

Written Recommendation for Use of Respiratory Protective Devices

**I have completed a medical evaluation of_____for the use of the respiratory device(s) listed above and in compliance with 29 CFR 1910.134 effective April 8,1998. Based upon my evaluation, I find that this individual is/is not able to wear these device(s) in a safe and healthful manner. I have/have not identified the following limitations on the use of these respirator:**

_____

**In my judgment, this individual does/does not require a follow-up medical examination to make a final determination as to their ability to wear the respiratory protective devices listed above.**

**The individual named above has been given a copy of this written recommendation and has been advised to request a follow-up medical evaluation if he or she develops medical signs or symptoms, which impair his or her ability to safely use this respiratory protective device as intended.**

_____ _____

**Printed signature and title of licensed healthcare practitioner** **Date**

## Potential Exposure Evaluation Data Sheet and Clinical Record Form

DATA SHEET FOR COLLECTING INFORMATION ON CHEMICAL AGENT EXPOSED OR POTENTIALLY EXPOSED WORKERS

1. Name of worker: _____ SYMPTOMATIC? YES NO

If symptomatic, please describe:

_____

2. Chemical Agent Exposure Information:
(CIRCLE THE CORRECT ITEMS)

| | | | |
|---|---|---|---|
| **AGENT:** | GB | VX | HD |
| **PHYSICAL STATE:** | VAPOR | AEROSOL | LIQUID |
| **POTENTIAL ROUTE:** | EYE | INHALATION | SKIN |

3. Level of PPE worn
(CIRCLE THE CORRECT ITEMS)

| | | | |
|---|---|---|---|
| OSHA LEVEL A | OSHA LEVEL B | OSHA LEVEL C | OSHA LEVEL D |
| SUPPLIED AIR | SCBA | M40 | SLUNG MASK |
| DPE SUIT | M3 SUIT | APRON | CPUs |
| GLOVES | CPUs | EED | UNPROTECTED |

OTHER: _____

4. Estimated time, date and location at which event occurred:

_____

Duration of exposure/potential exposure (mi:nutes): _____

Time elapsed since initial event (minutes or hours):

_____

5. Estimated concentration of agent in workplace where exposure occurred:

(IF KNOWN) _____ $mg/m^3$
or
_____ x TWA

6. Was the detection of agent confirmed by a second means of detection?
(CIRCLE THE CORRECT ITEM) YES NO PENDING

7. Has the exposed or potentially exposed worker:
(CIRCLE THE CORRECT ITEM)

| | | |
|---|---|---|
| changed and removed clothing: | YES | NO |
| been showered or decontaminated? | YES | NO |
| received any treatment? | YES | NO |

IF TREATMENT HAS BEEN RECEIVED, PLEASE DESCRIBE:

_____

Information received from:

_____

Name of clinic person recording data (include date and time recorded):

_____

POTENTIAL EXPOSURE EVALUATION CLINICAL RECORD FORM – MUSTARD AGENTS

Date_____ Time_____ PRP Notification

Temp_____ BP_____ P_____ RR_____ Weight_____lbs

POTENTIAL AGENT HD HT OTHER

CHIEF COMPLAINT/ EXPOSURE HISTORY:

_____

_____

_____

REVIEW OF SYSTEMS

| | NO | YES | | NO | YES |
|---|---|---|---|---|---|
| GRITTY EYES | | | NASAL BURNING | | |
| BLURRED VISION | | | SINUS PAIN | | |
| EYE PAIN | | | SORE THROAT | | |
| HEADACHE | | | COUGHING | | |
| NAUSEA | | | WHEEZING | | |
| VOMITING | | | HOARSENESS | | |
| DIARRHEA | | | STINGING SKIN | | |

PHYSICAL EXAM

EYE:

| | NO | YES (DESCRIBE) |
|---|---|---|
| LACRIMATION | | _____ |
| CONJUNCTIVAL REDNESS | | _____ |
| BLEPHAROSPASM | | _____ |
| KERATITIS (SLIT LAMP) | | _____ |
| PUPIL SIZE | OD_____mm | OS_____mm |

RESPIRATORY

| | NO | YES (DESCRIBE) |
|---|---|---|
| STRIDOR | | _____ |
| WHEEEZES | | _____ |
| PHARYNGEAL REDNESS | | _____ |
| EPISTAXIS | | _____ |
| SINUS TENDERNESS | | _____ |
| LARYNGEAL EDEMA | | _____ |

SKIN

| | NO | YES (DESCRIBE SIZE AND LOCATION) |
|---|---|---|
| ERYTHEMA | | _____ |
| VESICLES | | _____ |

BULLAE _____

URTICARIA _____

OTHER FINDINGS:

_____
_____
_____
_____

WRITTEN OPINION (SEE PARAGRAPH 2-8):

_____
_____
_____
_____

PLAN:

_____
_____
_____
_____

_____ PHYSICIAN SIGNATURE

_____ DATE

PHYSICIAN STAMP

# Appendix E

# Types of Health-Based Criteria
# For
# Determining Suitability for Public Release

# Appendix F

1. **Purpose and Scope.** Table F-1 summarizes the types of health-based concentration criteria that that may be used in risk assessments to determined suitability of public (unrestricted) release of items/equipment/facilities exposed to chemical agent. [1,2] It also describes the situations and applications when such criteria can be used. The criteria include various air monitoring concentration levels ($mg/m^3$) as well as concentration levels that would be used to assess extracts from soil or other solid media (mg/kg). Depending on item/site/scenario, a single criteria may be selected, or a combination if criteria and sampling approaches may be chosen. This document does not given specific sampling procedure guidance, which will typically require item/site specific considerations.

2. **Introduction.** While DA approaches to manage chemical agent-contaminated items, equipment, facilities and waste have provided adequate and effective protection to workers and the public, the Army as 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/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 those used by other Federal and State environmental health agencies.

    b. Management and disposition of CWA contaminated equipment, tools, facilities, and wastes (or even potentially contaminated equipment, tools, facilities and wastes) have often relied on different measures, including concentration limits, analytical sensitivity, and decontamination/ 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. The interpretations of these terms have in many cases been negotiated with local regulators for specific purposes, which results in the same term having a different meaning in different states.

4. **Health-Based Approach.** The USACHPPM recommends future applications of more situation-specific, health-based criteria for assessing the safety and appropriateness of environmental management decisions. Specifically, the use of "health-based" criteria is recommended over some of the historical approaches and terms described in paragraph 5, below. 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 results 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 one to characterize or quantify the degree of risk a person is at, 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 agency (e.g. US EPA) in environmental/health decision-making.

5. **Existing Terminology and Applications**

   a. 3X/5x. As described in the associated DA policy, the historical use of these decontamination level terms is currently being changed, largely due to the lack of parallel terminologies/procedures used by regulators and industrial for toxic industrial chemicals. The '5X' level has historically been the criteria cited for determining suitability for public/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 5X 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 or 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 /Quantification Limits". As detection limits can vary per laboratory, equipment, analytical method, matrix sampled, and 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 USEPA 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.

c. Field Drinking Water Standards (FDWS) and Waste Control Limits (WCL). FDWS were developed to address the potential intentional contamination of soldier drinking water supplies on the battlefield (reference 1). These levels were based on the assumption that soldiers consume up to 15 liters for up to 7 days. For many years, the FDWS were the only documented CWA concentration limits for media other than air. For lack of an alternative, these concentration levels (20 ppb for nerve agents and 200 ppb for HD) have been used as the acceptable levels for disposal of CWA waste off Army sites as well as to ascertain effectiveness of decontamination procedures. These FDWS have also been referred to as Waste Control limits (WCL). Application of safe *drinking water* levels as the WCLs is overly conservative (overly protective) when applied to a waste stream which is clearly not consumed.

6. **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 for an unrelated scenario. As described in references 1, 2, and 6, the use of scientifically accepted, and preferably USEPA endorsed, environmental risk-assessment methodology (e.g., USEPA Region IX) is currently recommended by the USACHPPM 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 F-1 for key criteria and their particular applications.

**References:**

1. DA Technical Bulletin –Medical (TB-Med) 577, Sanitation and Surveillance of Field Drinking Water.

# Appendix E

2. AR 385-61: *The Army Chemical Agent Safety Program*; Safety; Feb 1997.

3. DA Pam 385-61: *Toxic Chemical Agent Safety Standards*; Safety; Mar 1997.

4. Army-proposed Draft Utah Chemical Agent Rule; May 1999.

5. Health Based Environmental Screening Levels for Chemical Warfare Agents; USACHPPM/ORNL technical report; March 99.

6. DASA (ESOH) AILE Memorandum, Subject: Health Based Environmental Screening Levels for Chemical Warfare Agents, May 99.

Questions concerning this appendix should be forwarded to:

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## Types of Health-Based Criteria

| **Types of health-based criteria that may be used in risk assessment to determined suitability of public (unrestricted) release of items/equipment/facilities exposed to chemical agent [1,2]** | | | | |
|---|---|---|---|---|
| Criteria name | Description of criteria | Application purpose | Considerations for appropriate use | Example scenarios |
| **GPL** (General Population Limit) | A highly protective vapor exposure criterion (mg/m$^3$) for24-hr/daily, lifetime exposure of the general population including those more susceptible individuals: a no observed adverse effect level (NOAEL) - represents an exposure at or below which there are no anticipated adverse health effects from either short or long-term repeated exposures (i.e., that occur 24 hrs daily for up to 70yrs). | May be used with appropriate sampling (i.e., item is contained, with proper heating/temperature to facilitate off-gassing and collection of potential contaminant release to air) to demonstrate no risk of a continued (daily, multiple year) release of agent at levels of public health concern. | May be particularly useful if there is concern that a matrix/item of porous/semi porous material that may (theoretically) contain absorbed residual agent that could 'off-gas' over time at low concentrations. Also, if item or equipment includes complex surface or construction (composites, different parts with crevices, etc.) that may at least theoretically contain residual agent deposits. Particularly appropriate application if such (porous/complex) items have been in contact with liquid/aerosol agent. | 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. |

| **Types of health-based criteria that may be used in risk assessment to determined suitability of public (unrestricted) release of items/equipment/facilities exposed to chemical agent [1,2]** | | | | |
|---|---|---|---|---|
| **AEGL - LEVEL 1** (Acute Exposure Guideline Level- 1) – 8 hour | 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 (NOEL) or threshold at or below which there are no anticipated noticeable effects | May be used with appropriate sampling (i.e., item is contained with proper heating/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/ facilities that have not been contaminated by liquid/ aerosol agent or which includes simple non-porous items/surfaces that have undergone decontamination. Based on material/ construction, such decontaminated items would not be expected to have absorbed significant agent that would pose contact hazard or that would be continuously released over period of time. | if an accidental release occurred and no liquid but vapors were detected in area otherwise not routinely exposed containing equipment or vehicles – could use AEGL 1- 8 hr to ensure area/items cleared for unrestricted public use. |

| **Types of health-based criteria that may be used in risk assessment to determined suitability of public (unrestricted) release of items/equipment/facilities exposed to chemical agent [1,2]** | | | | |
|---|---|---|---|---|
| **HBESL[3]** (Health-Based Environmental Screening Level) - residential | A highly protective soil/solid matrix exposure criterion (mg/kg) for24-hr/daily, lifetime exposure of the general population including those more susceptible individuals: a no observed adverse effect level (NOAEL) - represents an exposure at or below which there are no anticipated adverse health effects from either short or long-term repeated exposures (i.e., that occur 24 hrs daily up to 70 yrs). | May be used alone or in conjunction with vapor exposure criteria described 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/on an item/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/area of concern. | Facilities/ areas with concentrate or soil of potential (liquid) contamination or adsorption from extended high vapor concentrations could be sampled and extract analyzed (e.g. through GC/MS) for presence of agents. This approach also allows assessment of potential breakdown products as well. |

| **Types of health-based criteria that may be used in risk assessment to determined suitability of public (unrestricted) release of items/equipment/facilities exposed to chemical agent [1,2]** | | | | |
|---|---|---|---|---|
| **NHWCL[4]** (non-hazardous waste exemption level | A soil/solid matrix exposure criterion (mg/kg) derived as an estimate below at or which a worker at a municipal landfill/ construction debris facility ( non-hazardous waste) would not be expected to have adverse health effect even from occasional repeated exposures over several years | For WASTE management – to support release to a non-RCRA permitted TSDF - may be used alone or in conjunction with vapor exposure criteria. | 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/area of concern. | To support decision* to manage and dispose of concrete, pallets as a non-hazardous waste. * ultimately waste management decisions are subject to state specific laws and regulations. |

[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/scenario dependent and must be assessed in accordance with specific sampling procedures and anticipated use knowledge

[3] Health-Based Environmental Screening Levels for Chemical Warfare Agents, USACHPPM/ORNL Technical Report, March 1999.

[4] Memorandum, Dept of Army Ctr for Health Promotion and Preventive Medicine, MCHB-EES; SUBJ: Response to State of Oregon Comments on the Proposed Utah Chemical Agent Rule, 23 Oct 2000 and associated attachments: USACHPPM Information Paper "Management Criteria for Chemical Warfare Agent Contaminated Waste and Media," Oct 2000, and USACHPPM Technical Paper "Chemical Warfare Agent Health-Based Waste Control Limits, Sept 2000.

# Appendix F

# Related Publications

## Appendix G
## Related Publications

**AR 11–34**
The Army Respiratory Protection Program

**AR 25–400–2**
The Modern Army Recordkeeping System (MARKS)

**AR 40–3**
Medical, Dental, and Veterinary Care

**AR 40–5**
Preventive Medicine

**AR 40–48**
Nonphysician Health Care Providers

**AR 40–66**
Medical Record Administration and Healthcare Documentation

**AR 40–68**
Quality Assurance Administration

**AR 40–400**
Patient Administration

**AR 40–501**
Standards of Medical Fitness

**AR 50–6**
Nuclear and Chemical Weapons and Materiel-Chemical Surety

**AR 385–10**
Army Safety Program

**AR 385–40**
Accident Reporting and Records

**AR 385–61**
The Army Chemical Agents Safety Program

**AR 385–64**
U.S. Army Explosives Safety Programs

## Appendix F

**AR 600–85**
Alcohol and Drug Abuse Prevention Program.

**DA Pam 40–8**
Occupational Health Guidelines for the Evaluation and Control of Occupational Exposure to Nerve Agents GA, GB, GD and VX

**DA Pam 40–173**
Occupational Health Guidelines for the Evaluation and Control of Occupational Exposure to Mustard Agents H, HD, and HT

DA Pam 40–501

Hearing Conservation Program

**DA Pam 40–503**
Industrial Hygiene Program

DA Pam 40-506

The Army Vision Conservation and Readiness Program

**DA Pam 50–6**
Chemical Accident or Incident Response and Assistance (CAIRA) Operations

**DA Pam 385–61**
Toxic Chemical Agent Safety Standards

**DA Pam 385–64**
Toxic Chemical Agent Safety Standards

**DA Pam 600–85**
Army Substance Abuse Program Civilian Service

**CHAPTER 1 - 29 CFR 1910.120** Hazardous Waste Operations and Emergency Response Standard

**29 CFR 1910.134** Respirator Protection

**29 CFR 1910.130** Bloodborne Pathogens Standard

**29 CFR 1910.1020** Access to Exposure Records

**42 CFR 84** Approval of Respiratory Protective Devices

## Glossary

### Section I
### Abbreviations

**ANSI**

American National Standards Institute

**CAS**

chemical abstracts service

**CDC**

Centers for Disease Control and Prevention

**CFR**

Code of Federal Regulations

**CMA**

Competent Medical Authority

**CMD**

Contract Medical Authority

**COR**

Contracting Officer's Representative

**CSDF**

Chemical Security Defense Force

**CSMSPD**

Chemical Surety Medical Support Program Director

**CWA**

Chemical Warfare Agent

**DA**

Department of the Army

**DAAMS**

Depot Area Air Monitoring System

**DOD**

Department of Defense

**DPE**

demilitarization protective ensemble

**DSN**

defense switched network

**EKG**

electrocardiogram

**$FEV_1$**

forced expiratory volume in 1 second

## Glossary

**fpm**
feet per minute
**FVC**
forced vital capacity
**GPL**
General Population Limit
**IH**
Industrial Hygiene
**IMA**
installation medical authority
**m**
meter
**MACOM**
Major Command
**mg**
milligram(s)
**MH**
medical history
**ml**
milliliters
**MSDS**
material safety data sheet
**MSHA**
Mine Safety and Health Administration
**MTF**
medical treatment facility
**NRC**
National Research Council
**OH**
occupational history
**PE**
physical examination
**PLHCP**
physician or licensed healthcare practitioner
**PPE**
personal protective equipment
**RBC-ChE**

red blood cell cholinesterase

**RDTE**

research, development, test, and evaluation

**SCBA**

self-contained breathing apparatus

**SOP**

standing operating procedure

**TAP**

toxicological agent protective

**TWA**

time-weighted average

**UAP**

Unescorted Access Program

**VA**

Visual acuity

**WPL**

Worker Population Limit

## Section II
## Terms

**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 GA**
The chemical dimethylphosphoramidocyanidate, also known as tabun, chemical abstracts service (CAS) registry number 77-81-6, in pure form and in the various impure forms that may be found in storage as well as in industrial, depot, or laboratory operations.

**Agent GB**
The chemical isopropyl methylphosphonofluoridate, also known as sarin, CAS registry number 107-44-8, in pure form and in the various impure forms that may be found in storage as well as in industrial, depot, or laboratory operations

**Agent GD**
The chemical phosphonofluoridic acid, methyl-1, 2, 2-trimethylpropyl ester, also known as soman, CAS registry 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.

## Glossary

**Agent GF**

The chemical methylphosphonofluoridic acid, cyclohexyl ester, also known as cyclosarin, CAS registry 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.

**Agent 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.

**Agent HD**

The chemical called distilled mustard or bis(2-chloroethyl) sulfide, chemical abstract service registry No. 505-60-2. HD is H that has been purified by washing and vacuum distillation to reduce sulfur impurities

**Agent HT**

A vesicant mixture that consists of 60 percent bis(2-chloroethyl) sulfide and 40 percent bis(2-chloroethylthioethyl) ether, chemical abstract service registry No. 63918-89-8.

**Agent VX**

The chemical phosphonothioic acid, methyl-S-(2-(bis(1-methylethyl)amino)ethyl) 0-ethyl ester, CAS registry 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.

**Airborne exposure limits**

Allowable concentrations in the air for workplace and general population exposures. AELs include worker population limits (WPLs), short term exposure limits (STELs), immediately dangerous to life or health values (IDLHs), and general population limits (GPLs).

**Certifying official**

For military and Army civilian personnel, the commander/director or supervisor responsible for chemical agent operations and having sufficient personal contact with all subordinate personnel reliability program (PRP) employees to permit continuing evaluation of their performance and reliability. For Army contractor personnel, the COR designated by the contracting officer is the certifying official. The certifying official certifies that personnel being considered for assignment to chemical duties meet the requirements of the PRP.

# Glossary

**Chemical Limited Area**
For nerve agent medical surveillance purposes in this document, the chemical limited area is defined as 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). For laboratory facilities, the chemical limited area is the inside of a laboratory room and/or where nerve agents (surety or dilute materials) are stored in secure containers. For non-stockpile operations, the chemical limited area shall be considered an operating area or physical location where entry and exit are restricted and controlled, and where nerve agents are being recovered, processed, analyzed, packaged, handled, stored and/or disposed of. For live agent training facilities, the chemical limited area shall be 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 Limited Area**

For mustard agent medical surveillance purposes in this document, the chemical limited area is defined as 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). For laboratory facilities, the chemical limited area is the inside of a laboratory room and/or where mustard agents (surety or dilute materials) are stored in secure containers. For non-stockpile operations, the chemical limited area shall be considered an operating area or physical location where entry and exit are restricted and controlled, and where mustard agents are being recovered, processed, analyzed, packaged, handled, stored and/or disposed of.

**Chemical Worker**
An employee who by virtue of duties, duty locations, job descriptions, and operations, could reasonably be exposed to chemical agent above the Worker Population Limit (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 agent exposure.

**Clean**
Free of chemical agent contamination by either never having been exposed to liquid or aerosol chemical agent and to vapor concentrations exceeding the 15-minute TWA STEL or where air concentrations have been monitored and verified to be below the suitable chemical agent exposure limit for the appropriate population.

**Conditionally clean**- a condition where an item has been shown to be free of chemical warfare agent at levels that are considered appropriately safe for a certain set of assumed human exposure conditions (such as for adult workers with limited exposure potential) that can (will) be achieved through a controlled (restricted) use environment

**Clean (for unrestricted use) -** a condition where an item has been shown to be free of chemical warfare agent at levels that are safe for unrestricted human use applications. This classification can be given to items/facilities

not considered to have ever been contaminated, or to previously contaminated items/facilities that have undergone decontamination, monitoring, and risk assessment to ensure agent residue has been removed.

**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 surety program. Physician assistants and nurse practitioners must be supervised by licensed physicians

**Contaminated(CW)**

A general term referring to a condition where an item, facility, or waste is considered or known to have chemical warfare agent at some level of potential health concern on or contained in the matrix.

**Continuously Controlled**

A situation where the atmosphere is continuously monitored during the presence of chemical agent to determine concentration levels, the type of agent hazard (vapor, aerosol, liquid) is known e.g.: unpack room at demilitarization facility.

**Contracting Officer's Representative**

The individual who has primary responsibility for awarding, monitoring, administering, and ensuring compliance with a contract. The COR may also serve as certifying official.

**Decontamination**

The process of making any person, object, or area safe 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.

**Decontamination, Gross**

An emergency wash for victims or mitigation personnel when immediate action is required to remove a chemical. Also called primary decontamination. In the case of chemical agent emergencies, a preliminary decontamination is done near the scene to allow the wearer to safely remove a chemical protective garment. However, before the exposed garment can be worn again, it must be thoroughly decontaminated to remove any chemical that may have been absorbed into the protective barrier.

**Egress, Emergency**

The unplanned exiting from an operational area when a medical necessity occurs (i.e., an immediately life-threatening or serious medical condition) to one or more of the workers requiring removal for immediate medical attention.

**Egress, Non-routine**

The unplanned exiting from an operational area due to one or more of the following conditions: 1. Damage and/or malfunction of PPE; 2. The measured level of chemical agent concentration exceeds the design capability of PPE being used; 3. Unplanned removal of PPE due to an unusual occurrence, i.e.; can not decontaminate to the appropriate level; 3. Unplanned removal of PPE due to an unusual occurrence, i.e.; can not decontaminate to the appropriate level; 5. An unacceptable risk occurs to the worker placing the worker in a situation, which necessitates immediate egress, but not requiring emergency medical response

**Egress, Routine**

Exiting from an operational area after completion of mission, planned activity, task, or end-of-shift (e.g.: : 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, Primary**

The device, room or structure immediately surrounding the 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 (e.g. 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/glovebox is located or a corridor/observation vestibule adjacent to an agent storage/operations room. This includes closed system (filtered bunkers, filtered igloos, overpack containers, on site containers, demilitarization operating facilities and outdoor glovebox operations) designed to protect unprotected workers or the ambient environment.

**Equipment Decontamination Plan**

A plan developed and approved for decontaminating and releasing tools, supplies, equipment and facilities to the public.

**Exceedance**

The measured amount of chemical agent concentration above a given agent concentration reference point, e.g. the measured concentration of 5 x $10^{-5}$(0.00005) goes above the WPL's 8-hour TWA concentration of GB of 3 x $10^{-5}$ (0.00003000) mg/$m^3$ by .00002 mg/$m^3$ by 2 x $10^{-5}$ (.00002) mg/m3. There fore the exceedance is 2 x $10^{-5}$ (.00002) mg/m3.

**Exception**

A determination approved by the Secretary of the Army or his or her designee, waiving for a limited time or purpose, a policy or procedure contained in a DA publication.

# Glossary

### Excursion

An increase in the concentration of chemical agent present in an environment above a given agent concentration reference point, e.g. the concentration goes above the WPL's 8-hour TWA concentration of GB of 3 x $10^{-5}$ (0.00003000) mg/$m^3$.

### Exposed worker -- H, HT, HD

An exposed worker is defined as an individual (with a mustard agent exposure potential) who exhibits clinical signs or symptoms consistent with a vesicant exposure effect (e.g., skin erythema, or erythema followed by blistering, after a latent period). This diagnosis should be confirmed by the presence of laboratory-significant quantities of thiodiglycol and related metabolites in the urine, OR the presence of mustard-protein/mustard-DNA adducts in the urine, blood, or blister fluid. The characteristic "mustard" histopathology of a blister on skin biopsy (i.e., dermal – epidermal separation with pyknotic nuclei in the germinal epithelium) should also be considered as strongly supportive of the diagnosis of mustard vesication.

### Exposed worker – Nerve Agent

An exposed worker is defined as an individual (with a nerve agent exposure potential) who exhibits clinical signs or symptoms of nerve agent intoxication. In addition, a worker is presumed to have been exposed to nerve agents (even if asymptomatic) if he or she— (1) has a confirmed acute depression in RBC-ChE activity (greater than 10%) from baseline following work activities in a nerve agent chemical limited area; AND (2) has had no immediate history of contact with other cholinesterase-inhibiting substances, such as carbamates or organophosphate pesticides; AND (3) has nerve agent urinary metabolites, as identified by the U.S. Army Medical Research Institute of Chemical Defense (USAMRICD) on GC/MS analysis (see TB MED 296), or other validated nerve agent-specific biomarkers.

### Exposure Potential

Refers to workplace conditions in which mustard agents (either surety or non-surety materiels) 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.

### General Population Limits (GPL).

The maximum concentration to which the general population may be exposed 24 hours per, 7 days a week, for a 70 year lifetime. Applies to the entire general population, including all ages and medical conditions

# Glossary

### Government Control

Refers to items which are under direct government control, (e.g.: property book item), used by a operator under a government contract operating on a government facility (e.g.: government furnished equipment), under control of a transportation agent hired by the government, (e.g.: Federal Express) or control of a service provider contractor (e.g.: off installation specialty repair shop)

### Immediately Dangerous To Life Or Health (IDLH)

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 shall be unaffected by the environment for up to 30 minutes without any respirator being worn. IDLH also includes atmospheres where oxygen content by volume is less than 19.5 percent.

### 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 published by the National Safety Council or in other literature recommended by the American Board of Industrial Hygiene.

### Installation Medical Authority

IMA refers to the unit surgeon, command surgeon, U.S. Army Medical Department Activity/U.S. Army Medical Center commander, or the Department of Army civilian or military installation director of health services, responsible for the provision of medical support at the unit, command, activity, or installation concerned.

### Monitoring

The continued or periodic act of seeking to determine whether a chemical agent is present.

### 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 presences or concentrations of chemical agent requires processing of the sample away from the collection point, e.g. Depot Area Air Monitoring System (DAAMS). Therefore, the results are

derived at a later time, possibly hours or even days later. Consequently, they cannot be used at the work place to make decisions on the worker's environment or safety.

**Monitor, Real or Near-Real Time**

An environmental sample of the work place, which may possibly contain chemical agents, systematically collected at a fixed point in the work place and then analyzed in or near the work place indicating the presence and concentration of chemical agent with in seconds or minutes depending upon the monitoring device being used, e.g. MINICAMS. Consequently, the results can be used at the work place to make decisions on the worker's environment or safety.

**Non-Stockpile**

Refers to the mission of the Product Manager for Non-Stockpile Chemical Materiel (PMNSCM), which includes the ultimate treatment and disposal of recovered chemical warfare materiel, binary chemical warfare materiel, former chemical weapons production facilities, and miscellaneous chemical warfare materiel (including delivery systems, contaminated metal parts, etc.)

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**Potential Exposure Evaluation**

A medical evaluation conducted by a competent medical authority, which documents workplace exposure activities, concentrations of chemical agent, levels of protective equipment worn, medical review of systems, and relevant physical examination results on a potentially exposed worker.

**Potentially Exposed Worker - Mustard**

A potentially exposed worker is defined as an individual (with a mustard agent exposure potential) who is present within a chemical limited area or exclusion area where levels of mustard agent— (1) exceed the respiratory or dermal protective capability of intact PPE as defined in Appendix A, paragraphs 5-3a OR (2) are detectable at the established dermal threshold concentrations for mustard agents (see Appendix A, paragraph 5-3a(2)) of this document) and there is a breach in PPE; OR (3) exceed the STEL and there is a failure in engineering controls involving unprotected personnel.

**Potentially Exposed Worker – Nerve Agent**

A potentially exposed worker is defined as an individual (with a nerve agent exposure potential) who is present within a chemical limited area or exclusion area where levels of nerve agent—(1) exceed the respiratory or dermal protective capability of intact PPE as defined in paragraphs 5-3a,b,c,d, and e, OR(2) are detectable at the established dermal threshold concentrations for specific nerve agents (see Appendix B, paragraphs 5-3a(2), b(2), c(2), d(2) and e(2) of this document) and there is a breach in PPE; OR(3) exceed the STEL and there is a failure in engineering controls involving unprotected personnel.

**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.

**Responsible Official**

The installation or activity commander, director site project manager, contracting officer's representative, or designee, who is a government employee, and who has legal or management responsibility for overseeing or conducting nerve agent operations.

**Short Term Exposure Limit (STEL)**

The maximum concentration to which unprotected chemical workers may be exposed to for up to 15 minute continuously.

**Time-Weighted Average (TWA)**

A maximum level or concentration of a chemical agent, averaged over an a specified length of time, to which employees may be exposed, e.g. STEL is a 15-minute time-weighted average.

**Uncontrolled Environment**

A situation where the atmosphere is not continuously monitor during the presence of chemical agent to determine concentration levels or the type of agent hazard (vapor, aerosol, liquid) is unknown or cannot be identified, e.g.: an storage magazine.

**Unmasked Workers**

Employees without M40 Chemical-Biological Gas Masks or other approved commercial respirators.

**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. See AR 385-61, page 18, 5-1

**Vapor Screening Procedure**

A defined process for isolating and then monitoring for chemical agent vapor concentrations in 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.

**Worker Population Limits (WPL)**

Maximum allowable 8 hr 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.