

Department of the Army  
Pamphlet 40-8

Medical Services

Occupational Health Guidelines for  
the Evaluation and Control of  
Occupational Exposure to Nerve  
Agents GA, GB, GD, GF and VX

Headquarters  
Department of the Army  
Washington, DC  
XX Month 20XX

## Summary of Change

### DA PAM 40-8

### Occupational Health Guidelines for the Evaluation and Control of Occupational Exposure to Nerve Agents GA, GB, GD, GF, and VX

This revision--

- Adds occupational health information and airborne exposure limits for the nerve agent GF; updates the occupational health information and types of airborne exposure limits (to include Worker Population Limits, Short Term Exposure Limits, Immediately Dangerous to Life or Health Values, and General Population Limits) for nerve agents GA, GB, GD, and VX (integrated throughout).
- Changes the title of Chapter 2 to “Airborne Exposure Limits and Exposure Monitoring” and removes discussion on hygiene practices (paragraph 2-2), contamination control (paragraph 2-3), respiratory protection (paragraph 2-4), and Table 2-2, Respiratory Protective Equipment for Regulated Areas.
- Updates the record keeping, reporting, health education, hazard communication, and training requirements to reflect the latest guidance provided in Occupational Safety and Health Administration standards and Army safety regulations (chapter 3).
- Incorporates latest Occupational Safety and Health Administration guidance on the medical evaluation of respirator wearers and clarifies the policies with regard to the use of the Occupational Safety and Health Administration Respiratory Questionnaire (para 2-2, chapter 4, appendix B, and appendix C).
- Revises and updates medical surveillance category descriptions (chapter 4).
- Updates requirements for preplacement, periodic, and termination examinations along with corresponding medical content; revises physician written opinion requirements to conform with latest Occupational Safety and Health Administration regulations; and adds the criteria and content for conducting potential exposure evaluations (chapter 4 and appendix B).
- Updates red blood cell cholinesterase monitoring procedures to conform to latest U.S. Army Center for Health Promotion and Preventive Medicine Cholinesterase Reference Laboratory requirements; incorporates guidelines for confirmatory testing for red blood cell-cholinesterase depressions greater than 10 percent below baseline by gas chromatography/mass spectrometer; describes specimen collection and shipping procedures; and establishes criteria on when to re-establish a red blood cell-cholinesterase baseline and how frequently to update red blood cell-cholinesterase baselines (chapter 4 and appendix B).
- Adds a summary of the toxicologic bases for the derivation of nerve agent airborne exposure limits, including the short-term exposure limits, immediately dangerous to life and health values, workplace exposure limits and the general population exposure limits (appendix F).

- Deletes qualitative fit testing procedures.
- Updates the latest treatment guidelines for workplace exposure to nerve agents, based upon mild, moderate or severe clinical presentations and revises guidelines for skin decontamination following vapor or liquid exposures to nerve agents (appendix D).

Headquarters  
Department of the Army  
Washington, DC  
XX Month 20XX

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Pamphlet 40-8

Medical Services

Evaluation and Control of Occupational Exposure to Nerve Agents GA, GB, GD, GF, and VX

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By Order of the Secretary of the Army:

ERIC K. SHINSEKI  
General, United States Army  
Chief of Staff

Official:

JOEL B. HUDSON  
Administrative Assistant to the  
Secretary of the Army

**History.** This printing publishes a revision of this publication. Because the publication has been extensively revised, the changed portions have not been highlighted.

**Summary.** This pamphlet outlines occupational health policies and procedures pertinent to nerve agents GA, GB, GD, GF and VX. The medical policies and procedures have been aligned with AR 50-6, AR 385-61, DA PAM 385-61, and DA PAM 50-6.

**Applicability.** This pamphlet applies to the Active Army components and DOD contractors with a nerve agent mission. It does not apply to the Army National Guard or U.S. Army Reserve.

**Proponent and exception authority.** The proponent of this pamphlet is The Surgeon General. The Surgeon General has the authority to approve exceptions to this pamphlet that are consistent with controlling law and regulation. The Surgeon General may delegate the approval authority, in writing, to a division chief within the proponent agency who holds the grade of colonel or the civilian equivalent.

**Suggested improvements.** Users are invited to send comments and suggested improvements on DA Form 2028 (Recommended Changes to Publications and Blank Forms) directly to HQDA (DASG-PPM-NC), 5109 Leesburg Pike, Falls Church, VA 22041-3258.

**Distribution.** This publication is available in electronic format only (EMO, and is intended for command level C for Active Army (Medical Services: Nuclear and Chemical Weapons and Materiel). This publication is not distributed to the Army National Guard or U.S. Army Reserve.

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1 **Chapter 1**

2 **Introduction**

3

4 **1-1. Purpose**

5 This pamphlet--

6 a. Defines the medical surveillance program for all personnel (military and civilian)  
7 that have an exposure potential (see glossary) to GA, GB, GD, GF, and VX (hereinafter  
8 referred to as nerve agents (a sub-set of chemical agents) in both storage and in  
9 demilitarization. (See AR 50-6 and AR 40-5.)

10 b. Provides procedures for the evaluation and control of exposures to the nerve agents  
11 in storage and used in disposal, non-stockpile, training and laboratory operations.

12 c. Does not apply to battlefield operations, domestic responses to terrorist incidents,  
13 outside continental U.S. deployments or low-intensity conflicts.

14

15 **1-2. References**

16 Required and related publications and referenced forms are listed in appendix A.

17

18 **1-3. Explanation of abbreviations and terms**

19 Abbreviations and special terms used in this pamphlet are explained in the glossary.

20

21

1 **1-4. Background**

2 This is the first revision of this publication and is intended to reflect the changes that have  
3 occurred in the procedures for developing workplace exposure standards, re-evaluation of  
4 the supporting database, and changes to the associated regulations.

5  
6 **1-5. Goals**

7 The goal of an occupational health (OH) program supporting nerve agent storage,  
8 disposal, non-stockpile, training, and laboratory operations is to limit workplace  
9 exposures to nerve agents through the use of engineering controls, work practices, and  
10 personal protective equipment (PPE). Ideally, the goal should be zero exposure to nerve  
11 agents; however, zero exposure is not always achievable or feasible and is not verifiable  
12 in the workplace. The development of OH standards, such as airborne exposure limits  
13 (AEL), allows the industrial hygienist to measure the safety and healthfulness of the work  
14 environment against established criteria, which are protective of human health. These  
15 AEL are also used to guide workplace interventions aimed at preventing worker  
16 exposures and ensuring individuals who sustain exposures in excess of allowable limits  
17 receive appropriate medical evaluations and follow-up.

18

19 **1-6. Implementation**

20 The installation commander per AR 385-10 is responsible for ensuring compliance with  
21 these guidelines. Commanders (or contracting officer's representatives) are also  
22 responsible for incorporating the guidance in this pamphlet into the procurement of

1 contractor services initiated after the effective date of this publication. Preexisting  
2 contracts do not require modification.

3

4 **1-7. Waivers and exceptions**

5 a. As a minimum, submit the following information when requesting a waiver or  
6 exception—

7 (1) The reference to the specific requirement and to the specific paragraph for which  
8 the waiver or exception is being made.

9 (2) The reasons why the requirement cannot be met.

10 (3) The interim measure used that compensates for the inability to comply with the  
11 requirement.

12 (4) The action being taken to meet the requirement, and the estimated date the action  
13 will be completed.

14 (5) A statement of the impact if the waiver or exception is not approved.

15 b. Forward the request for waiver, extension of waiver, or exception through command  
16 channels to HQDA (DASG-PPM-NC), 5109 Leesburg Pike, Falls Church, VA 22041-  
17 3258.

18

19 **1-8. Technical assistance**

20 Contact Commanding General, U.S. Army Center for Health Promotion and Preventive  
21 Medicine (USACHPPM), ATTN: MCHB-TS-MOM, Aberdeen Proving Ground,  
22 Maryland 21010-5403 for assistance in implementing the OH standards. For assistance

- 1 in monitoring, contact Commanding General, USACHPPM, ATTN: MCHB-TS-O,
- 2 Aberdeen Proving Ground, Maryland 21010-5403.

1 **Chapter 2**

2 **Airborne Exposure Limits and Exposure Monitoring**

3

4 **2-1. Introduction**

5 Airborne exposure limits are developed from available toxicological data to be protective  
6 of human health. Both the concentration of a chemical and the duration of exposure  
7 determine the dose and therefore the health effect on the worker, so there are different  
8 exposure limits based on the duration of exposure. Sensitivity of the population also has  
9 an effect so general population limits (GPL) are lower than worker limits.

10

11 **2-2. Work practices**

12 The following OH practices must be in place during all nerve agent operations.

13 a. Unprotected individuals shall not be intentionally exposed to--

14 (1) Airborne nerve agent concentrations exceeding the applicable limits in Table 2-1.

15 (2) Direct eye or skin contact with any amount of liquid nerve agent.

16 b. Nerve agent airborne concentrations shall be measured in a manner that allows  
17 representative worker exposure profiles to be reconstructed to assess compliance with  
18 established AEL.

19 c. Personnel who have a nerve agent exposure potential (Category A, B, C, or D) (see  
20 chapter 4) shall be enrolled in a nerve agent medical surveillance program that provides  
21 appropriate medical evaluation and follow-up.

22 d. Personnel shall not be assigned to tasks requiring the use of respirators in nerve  
23 agent operating areas until a competent medical authority (CMA) (see AR 50-6).

1 (1) Performs a medical evaluation (see chapter 4).

2 (2) Determines whether the individual is medically cleared and able to perform the  
3 necessary tasks while wearing a respirator per 29 CFR 1910.134.

4

### 5 **2-3. Airborne exposure limits**

6 Four types of AEL have been established for nerve agents (see Table 2-1): worker  
7 population limits (WPLs), short-term exposure limits (STELs), immediately dangerous to  
8 life or health (IDLH) values, and GPL. Appendix F provides the toxicologic basis for the  
9 derivation of the nerve agent AEL. Each of these AEL values is protective of human  
10 health and is used for the following purposes.

11 a. The WPLs represent the 8-hour time weighted average (TWA) concentration,  
12 measured in milligrams per cubic meter ( $\text{mg}/\text{m}^3$ ), to which nearly all unprotected  
13 personnel may be repeatedly exposed for up to 8 hours per day, 40 hours per week, for a  
14 working lifetime, without adverse health effects.

15 b. The STELs are the concentration to which unprotected personnel can be exposed  
16 continuously for a short period of time (that is, up to 15 minutes) without suffering from  
17 irritation, chronic or irreversible tissue damage, or narcosis of a sufficient degree to  
18 increase the likelihood of accidental injury or impaired self rescue. This concentration  
19 should not be exceeded at anytime during the work shift, even if the 8-hour TWA WPLs  
20 are not exceeded. Exposures above the WPLs and up to the STELs should be no longer  
21 than 15 minutes and should not occur more than four times per day, with at least 60  
22 minutes between successive exposures in this range to protect against accumulative  
23 affects.

1 c. The IDLH values are the—

2 (1) Maximum concentration from which, in the event of respirator failure, one could  
3 escape within 30 minutes without a respirator and without experiencing any escape  
4 impairment or irreversible health effects.

5 (2) Operational concentration above which the use of a self-contained breathing  
6 apparatus (or a combination airline respirator with an auxiliary self-contained breathing  
7 apparatus) is required.

8 d. The GPLs represent the concentration to which nearly all unprotected members of  
9 the general population may be exposed indefinitely, 24 hours per day, 7 days a week, for  
10 a lifetime, without experiencing adverse health effects.

11

12 **2-4. Exposure monitoring**

13 The purposes of exposure monitoring are to protect the worker from developing illnesses  
14 from the exposure to a potentially toxic chemical, to assess the effectiveness of  
15 engineering controls, and to determine at some future point if the exposures of a group  
16 caused some unexpected effect. Monitoring must be quantitative and accurate, and the  
17 monitoring records must be maintained.

18 a. Routine operations

19 (1) The installation commander, chemical activity commander, or site project  
20 manager (This designation also includes the Contracting Officer's Representative at  
21 chemical disposal sites.) shall conduct continuous monitoring per Department of the  
22 Army Pamphlet (DA PAM) 385-61 to comply with the AEL in Table 2-1.

23 (2) Air sampling to evaluate a worker's exposure profile.

1 (a) The installation commander, chemical activity commander or site project  
2 manager shall collect representative general area air samples. Representative samples  
3 should be interpreted as meaning low-level monitoring in the personnel’s immediate  
4 vicinity, at a sufficient number of points to capture the worker’s exposure profile during  
5 those agent operations and at a sampling height that reflects where the worker’s breathing  
6 zone is expected to be.

7 (b) The collection of representative full-period consecutive samples from the  
8 breathing zone of individuals performing the agent operation tasks is recommended but  
9 not required. Breathing-zone monitoring does not have to be near real-time monitoring to  
10 be effective, and these samples are not indicated for workers wearing self-contained  
11 breathing apparatuses or combination airline respirators with an auxiliary self-contained  
12 air supply.

13 b. New agent operations

14 (1) Monitor areas with new operations during the first five days to verify the  
15 adequacy of engineering controls.

16 (2) Re-monitor—

17 (a) Quarterly for one operating day.

18 (b) Following any significant damage or repairs to the ventilation system.

19 (c) Following significant changes in the operation (re-monitoring is not required if  
20 the only change is using a nerve agent of lower volatility).

21 c. Cleanup after a spill or accidental release. Conduct general area monitoring to  
22 confirm that the atmospheric concentrations do not exceed the WPLs in Table 2-1.

1 d. Exposure measurements. For airborne nerve agent monitoring equipment, use a  
2 method of measurement that—

3 (1) Has an accuracy of plus-or-minus 25 percent at the 95 percent confidence level for  
4 the WPLs, STELs, and IDLH values. The data used to comply with the accuracy  
5 specification should be limited to the found concentration, generated by the near real-  
6 time monitor or laboratory instrument used to quantitatively detect nerve agents and the  
7 target concentration from the nerve agent challenge standard. This performance  
8 specification will be evaluated for each near real-time monitor and laboratory instrument.  
9 The minimum number of data points to perform this evaluation should be ten or higher.  
10 The facility will generate site-specific short-term acceptance criteria to ensure  
11 compliance with the accuracy specification or if the number of data points is less than  
12 ten.

13 (2) Demonstrates an accuracy of plus-or-minus 40 percent at the 95 percent  
14 confidence level for monitoring nerve agents at the GPL. The less stringent accuracy  
15 specification is due to technological limitations of current sampling and analytical  
16 technology. The data used to comply with the accuracy specification will be limited to  
17 the found concentration, generated by the laboratory instrument used to quantitatively  
18 detect nerve agents, and the target concentration from the nerve agent challenge standard.  
19 This performance specification will be evaluated for each laboratory instrument. The  
20 minimum number of data points to perform this evaluation should be ten or higher. The  
21 facility will generate site-specific short-term acceptance criteria to ensure compliance  
22 with the accuracy specification or if the number of data points is less than ten.

1 (3) Demonstrates this accuracy and precision over the range of 0.5 to 2.0 times the  
 2 applicable AEL in Table 2-1.

3

4 **Table 2-1**  
 5 **Airborne Exposure Limits for Nerve Agents GA, GB, GD, GF, and VX (in mg/m<sup>3</sup>)\***

6	7 AEL	8 GB	9 GA	10 GD	11 GF	12 VX
13	14 WPLs	15 0.0001	16 0.0001	17 0.00003	18 0.00003	19 0.00001
20	21 STELs	22 0.0004	23 0.0004	24 0.0002	0.0002	0.00004
	IDLH values	0.1	0.1	0.05	0.05	0.01
	GPL	0.000003	0.000003	0.000001	0.000001	0.0000003

17 Notes:

18 WPLs are an 8-hour TWA.

19 STELs are a 15-minute TWA.

20 IDLH values are a ceiling concentration above which the use of a self-contained  
 21 breathing apparatus is required.

22 GPL are a 24-hour TWA.

23

24 \*See Appendix F for a summary of the toxicologic basis for these values.

1 **Chapter 3**

2 **Administrative Requirements**

3

4 **3-1. Record keeping**

5 a. General. The occupational health medical surveillance program as described in AR  
6 40-5 is composed of both general medical and workplace surveillance and job-specific  
7 surveillance. The job-specific surveillance is based on the physical requirements and  
8 exposure risks of specific jobs. The nerve agent medical surveillance program is a job-  
9 specific surveillance program and is a part of the overall occupational and environmental  
10 health program. The CMA shall maintain the medical records of personnel enrolled in  
11 the nerve agent medical surveillance program in accordance with the requirements of AR  
12 40-66, AR 40-5, and 29 CFR 1910.1020. The medical record should include the results  
13 of post-offer, pre-placement; periodic job-related; and termination examinations (see  
14 chapter 4 and appendices B and C), as well as respirator screenings/clearances and the  
15 results of any nerve agent exposure or potential exposure evaluations. Civilian medical  
16 records (x-rays) must be maintained for 40 years or the duration of the individual's  
17 employment plus 30 years, whichever is longer. (See AR 40-66, para 7-10a). The  
18 remainder of the medical record must be retained for the duration of employment plus 30  
19 years (29 CFR 1910.1020 (d) (1) (i)).

20 b. Air-monitoring records. Documentation of a worker's exposure potential to nerve  
21 agents is important in assessing the present and past exposure history and in documenting  
22 compliance with the established AEL listed in Table 2-1.

1       (1) The installation commander or chemical activity commander designates and  
2 assures that the personnel who maintain the air-monitoring records are qualified to  
3 interpret, correlate, and forward the results to the CMA. (See DA Pam 385-61, para 3-7a  
4 through c.)

5       (2) The CMA incorporates atmospheric monitoring data on exposed workers or  
6 potentially exposed workers (see glossary) into the medical record on Standard Form  
7 (SF) 600 (Medical Record – Chronological Record of Medical Care), DA Form 4700  
8 (Medical Record - Supplemental Medical Data), or other appropriate forms. (See  
9 Appendix E for criteria for potential exposure.) Any medical record entry of exposure or  
10 potential exposure above the WPLs, STELs, or IDLH values prescribed in Table 2-1,  
11 shall include—

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

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

18       c. Employee access. The CMA—

19       (1) Provides the affected individuals, former employees, or their designated  
20 representatives access to the air-monitoring records associated with exposure or potential  
21 exposure evaluations. (See DA Pam 385-61, para 3-7d.)

1 (2) Makes available the medical records containing the examination content described  
2 in paragraph 3-1a for inspection and copying per AR 40-66, AR 50-6, and 29 CFR  
3 1910.1020.

4

5 **3-2. Information and reporting requirements**

6 a. The installation commander or chemical activity commander, in coordination with  
7 other appropriate personnel, provides the following information to the CMA:

8 (1) A copy of this pamphlet.

9 (2) A written description of the affected individual's duties as they relate to the nerve  
10 agent exposure potential in routine or emergency operations.

11 (3) The air-monitoring results of an individual's potential exposure, measured or  
12 estimated, under the circumstances defined in Appendix E.

13 (4) A description of any PPE used or to be used.

14 b. If an individual is removed from work because of signs and symptoms commonly  
15 associated with exposure to nerve agents or if the CMA believes that a potential exposure  
16 evaluation provides clinical or biochemical evidence of a nerve agent exposure effect, the  
17 occurrence should be—

18 (1) Immediately reported to the installation commander, chemical activity  
19 commander, or site project manager or his or her designated representative.

20 (2) Reported to the certifying official (if a chemical surety related event, see  
21 AR 50-6) as potentially disqualifying information.

22 (3) Documented in the medical record.

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

5  
6 **3-3. Employee health education**

7 a. Employee health training. The CMA reviews and concurs or non-concurs with all  
8 employee-training materials, standing operating procedures, or plans dealing with issues  
9 such as contamination avoidance, personal protection, decontamination procedures,  
10 buddy-aid, self-aid, and essential first aid practices.

11 b. Access to health education materials. The CMA coordinates with the installation  
12 commander, chemical activity commander, or site project manager to ensure that a copy  
13 of all health education materials used in the health education program or training are  
14 readily available to all individuals with the potential for exposure.

15 c. Hazard communication information. Methods of instruction may include formal  
16 classes, work area meetings, audiovisual and computer-based presentations as  
17 appropriate. As a minimum, the installation commander, chemical activity commander,  
18 or site project manager shall annually repeat health-related training as described below.

19 (1) The installation commander, chemical activity commander, or site project  
20 manager, with technical assistance from the CMA, shall, through a written hazard  
21 communication program, define the mechanisms for training workers about the exposure  
22 potential to nerve agents and the protective measures necessary for the job.

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

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

5           (b) Methods used by the installation or chemical activity to recognize and evaluate  
6 work areas with a nerve agent exposure potential.

7           (c) An explanation of the potential acute and chronic health effects associated with  
8 nerve agent exposure and the purpose and description of the nerve agent medical  
9 surveillance program (see Chapter 4 and Appendices B and C).

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

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

16          (f) Emergency evacuation and notification procedures.

17          (3) The CMA shall provide technical assistance, monitor selected training sessions,  
18 and approve, in writing, the program of instruction and lesson plans.

19          (4) The installation commander, chemical activity commander, or site project  
20 manager documents hazard communication training, in writing, to include the signature  
21 of both the trainee and the approving authority. Document training for all DA employees  
22 on Department of Defense (DD) Form 1556 (Request, Authorization, Agreement and

1 Certification of Training and Reimbursement) or other appropriate forms, and incorporate  
2 this documentation permanently in the employee's official personnel folder.

3

4 **3-4. Material safety data sheets**

5 a. The employee must have direct access to the MSDS' content and location. The  
6 MSDS are products of the material developer. To obtain copies of the current MSDS,  
7 contact the U.S. Army Soldier, Biological Chemical Command, ATTN: AMSSB-RCB-  
8 RS (Safety Office), Building 3330, Aberdeen Proving Ground, MD 21010-5423.

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

1 **Chapter 4**

2 **Nerve Agent Medical Surveillance Program**

3

4 **4-1. Introduction**

5 a. The nerve agent medical surveillance program is part of a comprehensive  
6 occupational and environmental health program that preserves health and prevents work-  
7 related disease. Medical surveillance may be defined as the ongoing, systematic,  
8 evaluation of employees at risk of exposure to achieve early recognition and prevention  
9 of clinical disease. The nerve agent medical surveillance program is part of a larger  
10 hazard-specific medical surveillance program, which includes other chemical, physical,  
11 and biological hazards that have been included by the industrial hygienist on a current  
12 inventory of OH hazards. When conducting a nerve agent medical surveillance  
13 examination, the CMA should also consult the health hazard inventory or industrial  
14 hygienist to determine what (if any) other exposures have occurred (or are likely to  
15 occur) at or above the action levels established for each chemical or physical hazard.  
16 Based on this information, the CMA determines the appropriate medical surveillance  
17 questions or test and examination elements for those exposure hazards.

18 b. The CMA establishes the nerve agent medical surveillance program for personnel  
19 with a significant exposure potential to nerve agents (see app B) and assures that  
20 employees assigned to one of four medical surveillance categories (A, B, C, or D) by the  
21 certifying officials have been enrolled in the nerve agent medical surveillance program.  
22 Personnel with a high risk of nerve agent exposure (that is, Category A) will receive the  
23 most extensive examinations and the most frequent red-blood cell cholinesterase (RBC-

1 ChE) monitoring. Table 4-1 presents the nerve agent category-specific medical  
2 surveillance requirements.

3 c. Appendix D provides the information on the diagnosis and treatment of nerve agent  
4 intoxication.

5  
6 **4-2. Nerve agent medical surveillance categories**

7 The installation certifying official recommends medical surveillance category  
8 assignments for all personnel with a nerve agent exposure potential to the CMA, based  
9 upon the employees' activities in nerve agent operating areas. This assignment can be  
10 found on the chemical duty position roster.

11 a. Category A includes personnel—

12 (1) With a high nerve agent exposure potential due to the nature of the agent  
13 operations being conducted.

14 (2) Who may be routinely required (that is, on the average, once a week or four times  
15 per month) to make entries or to work for prolonged periods in areas with high  
16 concentrations of nerve agent (that is, greater than the IDLH values). These areas also  
17 require the use of a self-contained breathing apparatus or a combination airline respirator  
18 with an auxiliary self-contained air supply, along with the appropriate dermal protective  
19 ensemble.

20 b. Category B includes personnel with—

21 (1) A lower nerve agent exposure potential. These individuals are infrequently  
22 required (that is, less than once a week) to make entries or to work for prolonged periods  
23 in areas with high concentrations of nerve agents (that is, above IDLH values), but may

1 have periodic activities that require work in nerve agent concentrations between the  
2 WPLs and IDLH values. Examples of such activities might include (but are not limited  
3 to)—

4 (a) Hotline or decontamination activities. (See DA Pam 385-61.)

5 (b) Air-monitoring technician or 3X-monitoring activities.

6 (c) Maintenance or surveillance operations conducted in nerve agent storage or  
7 disposal facilities.

8 (d) Demilitarization protective ensemble (DPE) stand-by activities.

9 (e) Chemical accident/incident response by initial response force members.

10 (2) Job requirements involving the wearing of air-purifying or atmosphere-supplying  
11 respirators and dermal protective ensembles during nerve agent training, emergency  
12 response exercises, or other related duties.

13 c. Category C includes personnel—

14 (1) With minimal probability of exposure to nerve agents except under accident  
15 conditions, but whose activities may place them periodically in close proximity to nerve  
16 agent operating areas.

17 (2) Who would not be engaged in activities where concentrations of nerve agent  
18 would exceed the WPLs and would likely be required to wear respiratory protective  
19 equipment only for emergency egress.

20 d. Category D includes—

21 (1) Transient visitors to nerve agent operating areas where there is an extremely  
22 limited exposure potential. An example of this visitor would be personnel required to  
23 observe, review or inspect activities within a chemical exclusion area (in storage or

1 disposal facilities) where the use of engineering controls does not completely preclude  
2 the risk of accidental exposure. (NOTE: Casual visitors receiving familiarization or  
3 orientation tours through facilities where nerve agent operations are not ongoing or where  
4 exposures have been precluded by engineering controls NEED NOT be assigned to  
5 category D.)

6 (2) Laboratory personnel working with research, development, test and evaluation  
7 dilute solutions of nerve agents.

8

9 **4-3. Medical surveillance examinations**

10 Four examinations may be conducted as part of the nerve agent medical surveillance  
11 program. These include post-offer, pre-placement; periodic job-related; termination, and  
12 potential exposure evaluations.

13

14 **4-4. Post-offer, pre-placement examinations**

15 a. All personnel assigned to work in areas with a nerve agent exposure potential shall  
16 receive a post-offer, pre-placement medical surveillance examination to—

17 (1) Document that the employee—

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

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

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

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

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

4 b. This examination should be performed by or under the supervision of the CMA and  
5 at no cost to the employee. See Appendix B for the examination requirements by medical  
6 surveillance category.

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

9 (1) Conducted within 90 days prior to work assignment to an area involving the  
10 potential exposure to nerve agents. If this examination was not conducted specifically as  
11 a post offer, pre-placement examination, the CMA should review the examination results  
12 and render a written opinion in the medical record as to its acceptability as a post offer,  
13 pre-placement examination.

14 (2) Consistent with the requirements outlined in Appendix B, section I. If the  
15 examination does not include all of the requirements, the CMA should perform the  
16 procedures that were omitted.

17

18 **4-5. Periodic job-related examinations**

19 a. The installation commander or chemical activity commander assures that all  
20 personnel assigned to work in areas with an exposure potential to nerve agents receive the  
21 appropriate periodic job-related examinations to include RBC-ChE monitoring.

22 Appendix B, section II, details the periodic examination requirements by medical  
23 surveillance category. The CMA performs the appropriate category-specific, periodic

1 examination and informs the certifying official of those individuals who do not have  
2 current periodic examinations.

3 b. Periodic job-related examinations are—

4 (1) Usually performed on an annual basis.

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

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

12 (a) Himself or herself over time.

13 (b) Groups of workers with greater or lesser degrees of exposure.

14

15 **4-6. Termination examinations**

16 a. The CMA performs a termination examination on individuals within 30 days before  
17 or after removal from the nerve agent medical surveillance program. The examination  
18 documents the employee’s health status at the time of termination, particularly for organ  
19 systems that may have been affected by nerve agent exposure. Appendix B, section III  
20 details the termination examination requirements by medical surveillance category.

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

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

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

5 c. The installation commander or chemical activity commander ensures that a  
6 termination examination (to include RBC-ChE determination) has been administered or  
7 offered to workers who—

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

10 (2) Have been permanently disqualified or administratively terminated from the  
11 chemical personnel reliability program (PRP) and who no longer have nerve agent  
12 exposure potential. (See AR 50-6, paragraph 2-21.)

13

14 **4-7. Post exposure and potential exposure evaluations**

15 This pamphlet requires medical evaluations be performed in the event of accidental  
16 exposure or potential exposure to nerve agents. In the past, the criteria used to identify  
17 potential exposures have varied between chemical weapon storage and disposal sites.

18 This variability has led to different implementation criteria for event-driven medical  
19 evaluations of these patients.

20 a. An exposed worker is any individual (working in a nerve-agent operating area) who  
21 exhibits clinical signs or symptoms of nerve agent intoxication. In addition, a worker is  
22 presumed to have been exposed to nerve agents (even if asymptomatic) if he or she has—

1 (1) An acute depression in ChE activity (10 percent or greater) from the baseline  
2 while working in a nerve-agent operating area.

3 (2) No immediate history of contact with other ChE-inhibiting substances.

4 (3) No corresponding reduction in red cell mass.

5 (4) Urine assays that (see paragraph B-15e) confirm the presence of phosphonic acid  
6 metabolites specific for nerve agents, as described in Technical Bulletin, Medical (TB  
7 MED) 296.

8 b. A potentially exposed worker is an individual who works in a nerve-agent operating  
9 area where—

10 (1) Levels of nerve agent—

11 (a) Exceed the protective capability of the PPE.

12 (b) Are detectable at or above the applicable AEL.

13 (2) A breach in the PPE has occurred or where a failure of engineering controls has  
14 occurred.

15 c. If an individual has been accidentally exposed or is potentially exposed, the CMA  
16 should—

17 (1) Obtain information concerning the circumstances of the exposure or potential  
18 exposure and provide the appropriate medical examinations (for example, RBC-ChE  
19 monitoring) and emergency treatment as needed (see Appendix E and DA Form XX1,  
20 DA Form XX2, and DA Form XX3).

21 (2) Document in the medical record the results of the examination and an opinion as  
22 to whether a nerve agent exposure (see glossary) has occurred.

1 (3) Record any air-monitoring measurements in the medical record (see para 3-1b(2)).  
2 See Appendix C, section II, for the content of a nerve agent exposure and potential  
3 exposure evaluation.

4 d. Appendix E provides additional potential exposure evaluation criteria for GB and  
5 VX operations.

6

7 **4-8. Documentation of medical opinion**

8 The CMA records a written opinion in the medical record for each medical examination.

9 This opinion includes—

10 a. The results of the medical examination and testing.

11 b. A statement about any detected medical condition that would place the individual's  
12 health at an increased risk of impairment if exposed to nerve agents.

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

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

16

17 **4-9. Red blood cell-cholinesterase activity determinations**

18 a. Quality assurance.

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

1 (2) All clinics or laboratories performing RBC-ChE activity determinations in support  
2 of the nerve agent medical surveillance program must comply fully with the provisions of  
3 TB MED 590 and related USACHPPM procedures. Participation in the external quality  
4 assurance/quality control program is mandatory.

5 b. Monitoring RBC-ChE for DOD contractors.

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

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

17 (3) The CMA will investigate any ChE depression greater than 10 percent from the  
18 baseline (see appendix B) and maintains the RBC-ChE records per paragraph B-14.

19 c. Red-blood cell-cholinesterase monitoring. Specific requirements for RBC-ChE  
20 monitoring in support of the nerve agent medical surveillance program are provided in  
21 Appendix B, section IV.

22

23

Table 4-1

Category specific medical surveillance<sup>1</sup>

Category	Post-offer, pre-placement	Periodic <sup>2</sup>	Termination
A	Occupational history Medical history (MH) Physical examination Electrocardiogram (EKG) PPE evaluation Audiometric examination Visual acuity Pupillary reactivity Baseline RBC-ChE	Interval Occ. history Interval MH Physical Exam EKG (every 5 years) PPE evaluation Audiometric examination Visual acuity Pupillary reactivity RBC-ChE <sup>3</sup> (every 3 yrs)	Interval Occ. history Interval MH RBC-ChE
B	Same as category A	Same as category A	Same as category A
C	Occ. history MH Baseline RBC-ChE Respirator questionnaire as required <sup>4</sup>	Interval Occ history/ MH RBC-ChE <sup>3</sup> (every 3 yrs) Respirator questionnaire as required <sup>4</sup>	RBC-ChE Interval Occ history/MH Respirator questionnaire as required <sup>4</sup>
D	Baseline RBC-ChE <sup>4</sup> Respirator questionnaire as required <sup>4</sup>	Respirator questionnaire as required <sup>4</sup>	Respirator questionnaire as required <sup>4</sup>

<sup>1</sup>See Appendix B for detailed guidance.

<sup>2</sup>Denotes annual requirement, unless otherwise mentioned.

<sup>3</sup>Re-established by a two-sample blood draw at least every three years.

<sup>4</sup>Category C and D employees entering nerve agent operating areas may be issued military respirators or emergency escape devices for emergency egress. 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 Appendix C for the Occupational Safety and Health Administration (OSHA) Respirator Questionnaire and Medical Clearance Form.

**Appendix A**  
**References**

**Section I**  
**Required Publications**

**AR 40-5**

Preventive Medicine (cited in paras 1-1a, 3-1a, B-5b, and B-6)

**AR 40-66**

Medical Record Administration and Health Care Documentation (cited in paras 3-1a, 3-1c, B-14b, and B-14c)

**AR 50-6**

Chemical Surety (cited in paras 1-1a, 2-2d, 3-1c, 3-2b, 4-6c, B-1c, B-4d, D-1a, and E-2c)

**DA PAM 385-61**

Toxic Chemical Agent Safety Standards (cited in paras 2-4a, 3-1b, 3-1c, and 4-2b)

**TB MED 590**

Red Blood Cell-Cholinesterase (RBC-ChE) Testing and Quality Assurance (cited in paras 4-9a and b)

**Section II**  
**Related Publications**

A related publication is merely a source of additional information. The user does not have to read it to understand this pamphlet.

**AR 11-34**

The Army Respiratory Protection Program

**AR 385-10**

The Army Safety Program

**AR 385-61**

The Army Chemical Agent Safety Program

**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

**TB MED 296**

Assay Techniques for Detection of Exposure to Sulfur Mustard, Cholinesterase Inhibitors, Sarin, Soman, GF, and Cyanide

**TB MED 502/DALM 1000.2**

Respiratory Protection Program

**TB MED 509**

Spirometry in Occupational Health Surveillance

**29 CFR 1630**

Regulations to Implement the Equal Employment Provisions of the Americans with Disabilities Act. Available from <http://www4.law.cornell.edu/cfr/29p1630.htm>

**29 CFR 1910.1020**

Access to Employee Exposure and Medical Records (copies are available from the [http://www.osha-slc.gov/OshStd\\_data/1910\\_11020.html](http://www.osha-slc.gov/OshStd_data/1910_11020.html))

**29 CFR 1910.134**

Respiratory Protection (Available from [http://www.osha-slc.gov/OshStd\\_data/1910\\_0134.html](http://www.osha-slc.gov/OshStd_data/1910_0134.html))

**53 FR 8504**

Final Recommendations for Protecting the Health and Safety Against Potential Adverse Effects of Long-Term Exposure to Low Doses of Agents: GA, GB, VX, Mustard Agent (H, HD, T) and Lewisite (L)

**Unnumbered publication**

ERDEC-TR-489, Evaluation of Airborne Exposure Limits for G-Agents: Occupational and General Population Exposure Criteria, Mioduszewski et al., April 1998 and an ERRATA, SAB, Johnson 2000

**Unnumbered publication**

ECBC-TR-074, MS-1745, Evaluation of Airborne Exposure Limits for VX: Worker and General Population Exposure Criteria, Reutter et al., February 2000

**Unnumbered publication**

McKee, WHE, and Woolcott, R., Report on Exposures of Unprotected Men and Rabbits to Low Concentrations of Nerve Gas Vapour, PRP-143, Porton Down, 1949

**Unnumbered publication**

Mumford, S.A. Physiological Assessment of the Nerve Gases, Porton Memorandum 39, 1950

**Section III**  
**Referenced Forms**

**DA Form 4700**

Medical Record - Supplemental Medical Data

**DD Form 1556**

Request, Authorization, Agreement, and Certification of Training and Reimbursement

**OF 23**

Charge-out Record

**SF 507**

Clinical Record

**SF 512**

Clinical Record - Plotting Chart

**SF 557**

Miscellaneous Laboratory Slip

**SF 600**

Medical Record – Chronological Record of Medical Care

**Section IV**  
**Prescribed Forms**

**DA Form XX1**

Written Recommendation for Use of Respiratory Protective Devices

**DA Form XX2**

Medical Clearance for Respirator Use

**DA Form XX3**

Potential Exposure Evaluation Data Sheet and Clinical Record

1 **Appendix B**  
2 **Medical Surveillance Program for Personnel with a Significant Exposure Potential**  
3 **to Nerve Agents**

4  
5 **Section I**  
6 **Post-Offer, Pre-Placement Examinations**

7  
8 **B-1. Categories A and B personnel**

9 The CMA—

10 a. Obtains a comprehensive—

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

15 (2) The MH and review of systems, to include the OSHA Respirator Questionnaire or  
16 equivalent (see Appendix C), focusing on the skin, eyes, nose/throat, pulmonary,  
17 cardiovascular, neurologic and reproductive systems.

18 b. Administers a general physical examination—

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

1       (2) To detect any significant abnormalities in visual acuity or hearing or abnormalities  
2 of the skin or cardiovascular, pulmonary or neurologic systems, which might make the  
3 individual more susceptible to the effects of nerve agents.

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

5           (1) Electrocardiogram at rest. At the discretion of the CMA, an individual may obtain  
6 an exercise tolerance test (that is, stress EKG) if the individual is to perform strenuous  
7 activities using PPE.

8           (2) Evaluation of the individual’s physical ability to perform work involving potential  
9 exposure to nerve agents using the required dermal and respiratory protective ensembles  
10 (PPE). This evaluation uses reliable evidence such as history (for example, recent  
11 successful completion of a mask confidence exercise) or observations (for example, a use  
12 test) that show the individual can safely and effectively use the required PPE and that no  
13 physiological or psychological conditions impair the individual’s ability to use this  
14 equipment. For this evaluation, document this evidence and the written medical opinion  
15 of the individual’s ability to use such equipment in the individual’s medical record.

16           (a) In addition to reviewing the worker’s responses to the OSHA Respirator  
17 Questionnaire, the CMA must document baseline pulmonary function tests including, as  
18 a minimum, the forced vital capacity and the 1-second forced expiratory volume. (See  
19 TB MED 509.) Subsequent evaluations of physiologic capabilities to wear a respirator  
20 do not require repeated documentation of pulmonary function studies unless specifically  
21 required by the CMA. Abnormal pulmonary function tests alone are not grounds for  
22 disqualification. If there are abnormal pulmonary function tests, consider the following  
23 before disqualifying an individual from respiratory PPE use: The individual’s MH and

1 age; the nature of the work to be performed while wearing respiratory PPE; the type of  
2 respiratory PPE employed; the results of the tests of cardiovascular status; and if  
3 necessary, a use test.

4 (b) The CMA must inform the certifying official, in a confidential manner, about  
5 any individual in the chemical PRP who appears to be physically or psychologically  
6 unable to wear dermal or respiratory protective ensembles (See AR 50-6, para 2-8e.) If  
7 work practices require activities to be performed in full protective clothing (that is, air-  
8 purifying or atmosphere-supplying respirators with an encapsulating protective  
9 ensemble), document the individual's ability to withstand heat stress in the medical  
10 record and enroll the individual in a heat stress prevention program.

11 (3) Audiometric examination to determine the individual's auditory acuity per DA  
12 PAM 40-501.

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

14 (a) All individuals will have corrected near and distant visual acuity of 20/40 or  
15 better in at least one eye. If corrective lenses are required to provide this acuity, order the  
16 lenses before the individual's placement in the workplace.

17 (b) Provide individuals working in eye hazardous areas or jobs with appropriate  
18 protective eyewear (see DA PAM 40-506), to include, but not to be limited to,  
19 prescription and plano-industrial safety glasses and chemical splash goggles.

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

1 (5) Determination of the individual's baseline RBC-ChE activity as required by  
2 paragraph B-12.

3

4 **B-2. Category C personnel**

5 a. No post-offer, pre-placement examination is required; however, the CMA should  
6 obtain a comprehensive occupational history with specific emphasis on prior potential  
7 exposures to ChE-inhibiting substances.

8 b. The CMA should also obtain a MH and a review of systems, focusing on the skin  
9 and eyes, cardiovascular, pulmonary, neurologic and psychiatric systems.

10 c. If the individual may be issued a military respirator or emergency escape device for  
11 emergency egress, the individual will complete the OSHA Respirator Questionnaire  
12 provided in Appendix C, and the CMA should render and document a medical opinion as  
13 to the individual's ability to safely wear a respirator for emergency egress purposes.

14 d. The CMA will also obtain a determination of the individual's baseline RBC-ChE  
15 activity per paragraph B-12.

16

17 **B-3. Category D personnel**

18 a. No post-offer, pre-placement examination is necessary. However, if a respirator or  
19 emergency-escape device is to be issued to the worker for emergency egress purposes,  
20 the individual will complete the OSHA Respirator Questionnaire contained in  
21 Appendix C.

1     b. The CMA will obtain a determination of the individual’s RBC-ChE baseline per  
2 paragraph B-12. An RBC-ChE baseline does not necessarily have to be established at the  
3 installation visited.

4     c. Base the need for an RBC-ChE baseline determination on the likelihood, frequency,  
5 and level of potential nerve agent exposure. NOTE: Personnel may require a baseline  
6 RBC-ChE determination when they are not in the PRP and not on a chemical duty  
7 position roster. The installation commander or chemical activity commander should not  
8 assume, for example, that all chemical surety inspectors or all foreign diplomats require a  
9 baseline, since the risk of exposure may vary greatly from case to case. As general  
10 guidance--

11         (1) Transient visitors who are required to observe, review, or inspect nerve agent  
12 operations (where engineering controls do not completely preclude the risk of accidental  
13 exposure) should be considered category D personnel.

14         (2) Casual visitors who may be receiving familiarization or orientation tours through  
15 facilities where nerve agent operations are not ongoing or where exposures are precluded  
16 by engineering controls need not be considered Category D personnel.

17  
18     **B-4. Abnormal findings**

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

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

23         b. Discusses these with the worker after reviewing the worker’s job description.

1 c. Informs the worker’s supervisor of any work restrictions or reasonable  
2 accommodations that might be necessary to protect the health of the worker or to allow  
3 him or her to accomplish the essential functions of their job.

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

7

8 **Section II**

9 **Periodic Job-Related Examinations**

10

11 **B-5. Categories A and B personnel**

12 a. The CMA will obtain a determination of the individual’s RBC-ChE baseline per  
13 paragraph B-12. An RBC-ChE baseline does not necessarily have to be established at the  
14 installation visited.

15 b. Base the need for an RBC-ChE baseline determination on the likelihood, frequency,  
16 and level of potential nerve agent exposure. NOTE: Personnel may require a baseline  
17 RBC-ChE determination when they are not in the PRP and not on a chemical duty  
18 position roster. The installation commander or chemical activity commander should not  
19 assume, for example, that all chemical surety inspectors or all foreign diplomats require a  
20 baseline, since the risk of exposure may vary greatly from case to case. As general  
21 guidance—

22

1 (1) Transient visitors who are required to observe, review, or inspect nerve agent  
2 operations (where engineering controls do not completely preclude the risk of accidental  
3 exposure) should be considered category D personnel.

4 (2) Casual visitors who may be receiving familiarization or orientation tours through  
5 facilities where nerve agent operations are not ongoing or where exposures are precluded  
6 by engineering controls need not be considered Category D personnel.

7 (3) The tests in Table 4-1 should supplement other hazard-specific medical  
8 surveillance tests indicated by worker exposures (if any) to substances other than nerve  
9 agent that are listed on the health hazard inventory. (See AR 40-5, para 5-9a.)

10

11 **B-6. Category C personnel**

12 For workers designated in Category C, the CMA will take an interval work history, MH  
13 and review of systems, focusing on any signs, symptoms, or adverse effects that may be  
14 connected to exposure to nerve agents or other ChE-inhibiting substances. A  
15 periodic/annual job-related examination is not necessary. Instruct individuals who  
16 continue to wear respirators for emergency egress purposes to complete the OSHA  
17 Respirator Questionnaire. (See Appendix C.) The CMA should also obtain a  
18 determination of RBC-ChE activity. The nerve agent examination's content should  
19 supplement other hazard-specific medical surveillance tests indicated by worker  
20 exposures (if any) to substances other than nerve agent that are listed on the health hazard  
21 inventory (see AR 40-5, para 5-9a).

22

23

1 **B-7. Category D personnel**

2 A periodic job-related examination is not required. If a respirator clearance is required,  
3 the individual should complete the OSHA Respirator Clearance Form contained in  
4 Appendix C. The CMA should also maintain a current baseline RBC-ChE.

5  
6 **B-8. Abnormal findings**

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

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

10 b. Discusses the limitations with the worker after reviewing the worker’s job  
11 description.

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

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

18  
19

1 **Section III**

2

3 **Termination Examinations**

4

5

6 **B-9. Categories A and B personnel**

7

8 The CMA will update the occupational exposure history and medical review of systems  
9 as previously described in paragraph B-5. If as a result of any of the previous  
10 examinations, the individual was referred for specialty consultation, the CMA should  
11 refer the individual again for follow-up evaluation. A termination RBC-ChE will also be  
12 obtained.

13

14 **B-10. Category C personnel**

15

16 The CMA will update the occupational exposure history and medical review of systems  
17 as previously described in paragraph B-6. A termination examination is not needed  
18 before termination of employment, but a termination RBC-ChE is required.

19

20 **B-11. Category D personnel**

21 A termination examination is not required.

22

23

1 **Section IV**

2 **RBC-ChE Monitoring**

3

4 **B-12. RBC-ChE baseline**

5 Determination of the individual's baseline RBC-ChE activity is required due to the  
6 variability between individuals. A baseline RBC-ChE is defined as the average of two  
7 separate measurements obtained at least 24 hours and no more than 14 working days  
8 apart. During the time between the two RBC-ChE measurements, the individual should  
9 not be allowed to enter agent-operating areas and should be warned to avoid exposure to  
10 any ChE-inhibiting substances. If these two measurements vary by more than 0.05 delta  
11 pH units, a third measurement should be obtained. In this case, the baseline RBC-ChE  
12 activity will then become the average value of all three measurements. The RBC-ChE  
13 baselines may fluctuate in some workers monitored over a period of time. This  
14 fluctuation reflects the natural physiological enzyme variance in humans.

15 a. Elevation or depression of RBC-ChE activity greater than 10 percent of the baseline  
16 value is grounds for re-establishing a new RBC-ChE baseline, provided that  
17 organophosphate exposure is ruled out as the cause of any transient RBC-ChE  
18 depression. The elevation or depression must have been documented over a period of  
19 three months or longer by at least three separate ChE assays.

20 b. As a minimum, an individual's RBC-ChE baseline must be re-computed once every  
21 three years. For Category A, B and C personnel, re-computation of the baseline value is  
22 made using the mean of at least four RBC-ChE values in a three-year period. Follow the  
23 procedures described in paragraph B-12.

1 c. Any re-establishment, adjustment, or re-computation of the baseline value must be  
2 approved (that is, initialed off on the SF 512, Clinical record, plotting chart, or  
3 equivalent) by the CMA and must be accompanied by a medical record entry as to the  
4 reasons for re-establishment. The approved, re-computed baseline will be drawn in ink  
5 on a new SF 512 and annotated using the words “Recalculated Baseline” and the date of  
6 the re-computation. (NOTE: Locally approved, computer-generated forms may be used  
7 in lieu of SF 512s, as long as all other requirements are complied with.)

8

9 **B-13. Frequency of RBC-ChE monitoring**

10 a. Category A personnel. The RBC-ChE baseline must be established and then  
11 updated every three years (with two new blood draws) to detect any drift or change.

12 b. Category B personnel. The RBC-ChE baseline must be established and then  
13 updated every three years (with two new blood draws) to detect any drift or change. Link  
14 the frequency of RBC-ChE monitoring to the frequency of the potential for exposure to  
15 nerve agent. The RBC-ChE, after irreversible inhibition by nerve agent GB, will  
16 regenerate at the replacement rate for RBCs (that is, roughly 1 percent increase in RBC-  
17 ChE activity per day). Following nerve agent VX exposures, RBC-ChE activity  
18 regenerates at a rate of 1 percent per hour for the first day and then slows to 1 percent per  
19 day thereafter.

20 c. Category C personnel. The RBC-ChE baseline must be established and then  
21 updated every three years (with two new blood draws) to detect any drift or change.

22 d. Category D personnel. Periodic RBC-ChE monitoring is not required except to  
23 establish a new RBC-ChE baseline every three years (see paragraph B-12).

1 e. Potentially exposed workers. The RBC-ChE determinations should be performed as  
2 soon as practical following exposure. (NOTE: RBC-ChE determinations are not  
3 required to clinically manage the nerve agent-exposed casualty. They are used as part of  
4 the potential exposure evaluation to clinically confirm or rule out the occurrence of a  
5 nerve agent exposure. Asymptomatic individuals who are being evaluated for potential  
6 exposure to nerve agents should not be returned to duties in nerve agent operating areas,  
7 until the absence of depression from baseline activity has been confirmed.)

8

9 **B-14. Recording RBC-ChE monitoring determinations**

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

16 b. Incorporate the SF 512 in the medical record per AR 40-66, paras 5-13 and 7-12. In  
17 the event that the SF 512 is maintained separately from the medical record (that is, in  
18 laboratory notebooks), insert an Optional Form (OF) 23, Charge-out Record, into the  
19 medical record identifying the responsible custodian.

20 c. Upon the employee's removal from the nerve agent medical surveillance program  
21 (which only occurs with a transfer to work activities not having a nerve agent exposure  
22 potential, retirement, or a permanent change in duty station), place the SF 512 in the  
23 medical record per AR 40-66, para 5-13.

1 **B-15. Action levels**

2 a. The RBC-ChE activity should be determined when signs and symptoms of systemic  
3 uptake of nerve agents are apparent. In addition, local (minor) signs, such as miosis or  
4 localized sweating, will necessitate an immediate RBC-ChE determination and  
5 immediate removal of the employee from further duties in nerve agent operating areas,  
6 until the RBC-ChE results are known.

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

12 (1) RBC-ChE has reached a value of at least 80 percent of the individual's baseline  
13 value.

14 (2) Individual has been asymptomatic for at least 1 week. The CMA should annotate  
15 and initial the SF 512 indicating the period of removal from work referred to in paragraph  
16 B-14.

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

21 (1) Results of any relevant laboratory investigations.

22 (2) Occupational history.

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

3 (4) Workplace investigations.

4 (5) Physical examinations.

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

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

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

18 (2) Determine concentration of nerve agent (in mg/m<sup>3</sup>) in the worker's immediate  
19 vicinity.

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

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

22 e. For ChE depressions of 10 percent or greater that are associated with potential  
23 exposures to GB, GD, or GF, the CMA should consider obtaining urine samples for

1 detection of phosphonic acid metabolites as described in TB MED 296. The following  
2 procedures should be followed when collecting urine samples; they should also be done  
3 under close supervision by a health care provider to preclude the possibility of sample  
4 tampering.

5 (1) Provide clean urine cups for the collection.

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

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

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

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

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

20 (7) Ship all sealed containers in dry ice by overnight delivery to the U.S. Army  
21 Medical Research Institute of Chemical Defense, ATTN: MCMR-UV-PA, Applied  
22 Pharmacology Branch, 3100 Ricketts Point Road, APG, MD 21010-5400. If immediate  
23 shipping is not possible, urine samples need to be kept frozen.

**Appendix C**

**Medical Evaluation of Respirator Wearers and Potential Exposures to Nerve Agents**

**Section I**

**The OSHA Respirator Questionnaire**



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

- 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 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)

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

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:

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:

(continued top of next column)

(continued top of next column)

(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 \_\_\_\_\_



1 **Appendix D**

2 **Diagnosis and Treatment of Nerve Agent Intoxication**

3

4 **D-1. General**

5 This appendix—

6 a. Provides general information to medical personnel treating—

7 (1) Nerve-agent intoxication.

8 (2) The clinical effects of acetylcholinesterase inhibition, from nerve agents above or

9 below the surety threshold as defined in AR 50-6, Table 6-2, and from research,

10 development, test, and evaluation dilute solutions as defined in AR 50-6, Table 6-1.

11 Although research, development, test, and evaluation solutions may be significantly less

12 hazardous than pure undiluted nerve agents, research, development, test, and evaluation

13 solutions may represent a significant exposure potential to highly toxic substances.

14 b. Is not intended to provide doctrine on self-aid, buddy-aid, or first aid to non-medical

15 personnel.

16

17 **D-2. Routes of entry**

18 The routes of entry for nerve agents are inhalation and eye and skin absorption. Ingestion

19 is rarely a route of entry.

20

21 **D-3. Toxicology**

22 a. Nerve agents GA, GB, GD, GF and VX are readily absorbed and are hazardous

23 through all routes of exposure, in both liquid and vapor forms. The most prominent

1 physiological effects result from inhibition of the ChE enzymes distributed throughout  
2 the nervous system. The resultant excess acetylcholine at the site of the parasympathetic  
3 nerve endings produces—

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

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

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

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

21

22

1 **D-4. Signs and symptoms**

2 a. The onset of the signs and symptoms following exposure to nerve agents may occur  
3 within seconds, minutes, or hours, depending upon the concentration, dosage, and route  
4 of entry, as well as the type and physical state of the nerve agent.

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

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

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

12 (b) Rhinorrhea or excessive salivation.

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

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

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

20 (b) Nausea, vomiting, or diarrhea.

21 (3) Severe signs and symptoms are those in which the central nervous system and  
22 multiple organ systems are involved. Severe nerve agent intoxication may include the  
23 signs and symptoms of moderate exposure, plus generalized weakness or

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

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

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

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

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

6

#### 7 **D-5. Treatment**

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

14       b. Self-protection. Although casualties contaminated with liquid nerve agent are  
15 unlikely to present directly to health care providers before decontamination in the field,  
16 medical personnel performing triage or supervising the initial treatment of nerve agent  
17 casualties should assume the presence of liquid-agent contamination, unless a "vapor  
18 only" exposure history is confirmed, or low-level air monitoring has documented the  
19 absence of residual nerve agent contamination. When handling potentially contaminated  
20 casualties, health care providers should wear air-purifying or atmosphere-supplying  
21 respirators, with a dermal protective ensemble covering exposed skin. Whenever  
22 possible, areas of known liquid contamination should be decontaminated prior to patient  
23 handling to minimize exposure risks; however, if the nerve agent casualty exhibits

1 symptoms requiring two or more shots of atropine or has significant injuries, properly  
2 protected medical personnel should respond to the contaminated site to treat the patient.  
3 In industrial operations, such as demilitarization plants, the proximity of medical support  
4 allows medical personnel to arrive at the injury site early in the decontamination process.  
5 In this case medical personnel should don proper PPE and evaluate the exposed workers.  
6 This will allow for early diagnosis and treatment if required and will facilitate  
7 psychological support to the worker.

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

14 (1) Vapor-exposed nerve agent casualties should be decontaminated by removing all  
15 clothing in a clean air environment and shampooing or rinsing the hair to prevent vapor  
16 off-gassing.

17 (2) Liquid-exposed nerve agent casualties should be decontaminated by—

18 (a) Washing in warm or hot water at least three times. Use liquid soap (dispose of  
19 container after use and replace), copious amounts of water, and mild to moderate friction  
20 with a single-use sponge or washcloth in the first and second washes. Scrubbing of  
21 exposed skin with a brush is discouraged, because skin damage may occur and may  
22 increase absorption. The third wash should be a rinse with copious amounts of warm or  
23 hot water. Shampoo can be used to wash the hair. The rapid physical removal of a

1 chemical agent is essential. If warm or hot water is not available, but cold water is, use  
2 cold water. Do not delay decontamination to obtain warm water.

3 (b) Rinsing the eyes, mucous membranes, or open wounds with sterile saline or  
4 water.

5 (3) The healthcare provider should—

6 (a) Check the casualty after the three washes to verify adequate decontamination  
7 before allowing entry to the military treatment facility. If the washes were inadequate,  
8 repeat the entire process.

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

11 (c) Protect the airway while conducting decontamination and assure appropriate  
12 placement of the respirator over the uncontaminated face. The initial assessment of the  
13 casualty can best be performed in an agent-free environment where the health care  
14 provider is able to “look, listen, and feel” unencumbered by protective clothing.  
15 However, careful decontamination can be a time consuming process. The health care  
16 provider may have to enter the contaminated area to treat the casualty during this process.

17 d. Maintenance of airway patency and ventilation. Initial treatment of the nerve agent-  
18 intoxicated casualty should begin with the primary survey of airway, breathing, and  
19 circulation. Some degree of respiratory tract involvement is seen in most cases of nerve  
20 agent vapor intoxication. In conscious patients who have received relatively minor  
21 exposures, administration of atropine will reverse bronchoconstriction, reduce secretions,  
22 improve airflow, and reduce the work of breathing. However, severely intoxicated  
23 casualties with fulminant secretions, significant stridor or wheezing, agonal respirations,

1 and an altered level of consciousness require the early establishment of a definitive  
2 airway. Here, the order of treatment and assessment may be best summarized as  
3 “AABC”, that is antidote, airway, breathing and circulation. Airway resistance may be  
4 initially high (50 to 70 centimeters of water) due to bronchoconstriction and copious  
5 secretions. Adequate atropinization will reverse these muscarinic effects of nerve agent  
6 intoxication and will allow easier ventilation. Endotracheal intubation is the airway of  
7 choice. Assisted ventilation with high partial pressures of oxygen may be required for up  
8 to several hours following exposure for individuals with flaccid paralysis or central  
9 respiratory depression. Periodic suctioning of secretions will also improve ventilation  
10 and enhance air exchange.

11 e. Antidote administration. Three medications are used to treat the signs and  
12 symptoms of nerve-agent intoxication: atropine, pralidoxime chloride, and diazepam.  
13 The general indications for use of these antidotes are discussed first, followed by a  
14 discussion of their use in the treatment of mild, moderate, or severe nerve-agent  
15 intoxication.

16 (1) Atropine is an anticholinergic compound, which antagonizes the muscarinic  
17 effects of acetylcholine. It may be administered intramuscularly (IM), intravenously  
18 (IV), or through the endotracheal tube. Parenteral atropine will reverse muscarinic  
19 effects such as rhinorrhea, salivation, sweating, bronchoconstriction, bronchorrhea,  
20 nausea, vomiting, and diarrhea. Miosis and ciliary body spasms are not reversed by  
21 parenteral atropine; relief of intractable pain in or around the eye requires the instillation  
22 of 1 percent homatropine or atropine, repeated as needed at intervals of several hours for  
23 1 to 3 days. Severe symptoms may require the local instillation of 1 percent atropine

1 sulfate ointment. Although the intravenous route of atropine administration is preferred  
2 when treating systemic effects, it should be avoided in hypoxemic patients, since studies  
3 have documented the occurrence of ventricular fibrillation when atropine is administered  
4 IV to hypoxemic animals. The initial parenteral dose is 2 to 6 mg, with subsequent doses  
5 titrated to the severity of nerve-agent signs and symptoms. Side effects in non-exposed  
6 individuals may include tachycardia, dry mouth, blurred vision, mydriasis, a very  
7 transient atrio-ventricular dissociation, mild sedation, and delirium in doses greater than  
8 10 mg. The greatest potential problem from the administration of atropine in a non-  
9 nerve-agent-intoxicated person is inhibition of sweating; this with exertion can cause heat  
10 injury in warm weather.

11 (2) Pralidoxime chloride (2-PAMCl) is an oxime, which displaces the nerve agent  
12 from the esteratic site of ChE when administered before aging of the affected enzyme  
13 takes place. (NOTE: 2-PAMCl is particularly effective in reactivating ChE enzymes  
14 following exposures to GA, GB, GF and VX; it is ineffective in reactivating ChE systems  
15 poisoned by GD due to the rapid aging phenomenon seen with this nerve agent).  
16 Pralidoxime chloride reverses some of the nicotinic effects of acetylcholine, principally  
17 skeletal muscle fasciculations, twitching, and fatigue. The initial dose is 600 mg IM; 2-  
18 PAMCl may also be administered by intravenous infusion (1 gram in  
19 250 cubic centimeters of Normal Saline), given over a 20 to 30 minute time period. The  
20 principal side effects from 2-PAMCl in a non-poisoned person are dizziness, blurred  
21 vision, double vision, dysgeusia, and nausea/vomiting. Hypertension may be seen at high  
22 doses (greater than 15 milligrams per kilogram body weight) but may be treated with  
23 intravenous phentolamine (5 mg intravenous push). Administration can be IM or IV; if

1 the IV route is selected, it must be given very SLOWLY. In the military medical supply  
2 system, atropine and 2-PAMCl are packaged together as auto-injectors in the MARK I kit  
3 for the field expedient administration of these antidotes. Each MARK I kit contains 2 mg  
4 of atropine sulfate in one injector and 600 mg of pralidoxime chloride in a second  
5 injector. Each chemical agent worker is issued three MARK I kits inside the protective  
6 mask carrier for personal use.

7 (3) Diazepam is an anticonvulsant drug used to decrease seizure activity and to  
8 reduce brain injury caused by prolonged seizures. Animal studies have clearly indicated  
9 a correlation between prolonged seizure activity and the occurrence of brain injuries  
10 following nerve agent GD exposure. Although there are no controlled animal studies to  
11 support the use of diazepam, "preconvulsant" treatment for other than severely  
12 intoxicated GD casualties, the health care provider should consider the use of diazepam  
13 in unconscious, severely intoxicated GB or VX casualties, after administering atropine  
14 and pralidoxime chloride. The initial dose of diazepam is 2 to 5 mg IV or 10 mg IM,  
15 with additional doses as required.

16 (4) Mild nerve-agent intoxication may occur following vapor or liquid exposures and  
17 has a varied clinical presentation. The occurrence of miosis and rhinorrhea alone  
18 following vapor exposures generally requires observation only. If accompanied by chest  
19 tightness or upper respiratory tract secretions, which do not subside, an initial dose of 2  
20 mg IV or IM atropine should be given, with repeat doses given at 5 to 10 minute intervals  
21 as required. (A patient has been adequately atropinized when secretions are diminishing  
22 and ventilation is accomplished with ease; the need for more atropine should never be  
23 assessed by pulse rate or the presence of miosis.) Treatment of mild liquid exposures is

1 more problematic, due to the slower uptake and onset of clinical effects. The onset of  
2 sweating or muscle fasciculations at a known site of liquid exposure within 1 to 2 hours  
3 suggests the imminent development of more serious, systemic effects and should be  
4 treated with 2 mg of atropine IM or IV and 600 mg of 2-PAMCl IM or 1 gram of 2-  
5 PAMCl very slowly (20 to 30 minutes) IV.

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

17 (6) Severe nerve-agent intoxication requires the immediate establishment of a  
18 definitive airway, along with an assessment of ventilation and perfusion. Respiratory  
19 failure also requires aggressive antidote administration to relieve bronchospasm,  
20 minimize secretions, reduce the work of breathing, and improve respiratory muscle  
21 function. For these patients, the initial dose of atropine should be 6 mg. Additional  
22 atropine by the IV route, once hypoxemia has been reversed, should be given at 3 to 5-  
23 minute intervals as required to support airway management. Severely intoxicated

1 casualties may require up to 15 to 20 mg atropine over the first 3 hours of treatment. An  
2 IV infusion of 2-PAMCl should be given as previously described, with 1-gram infusions  
3 repeated at hourly intervals as required, for up to three doses. Diazepam should be used  
4 in patients who are seizing and should be considered for use in patients who have signs of  
5 severe intoxication whether or not they are seizing.

6 f. Supportive care. In the peacetime environment, moderate to severe nerve agent  
7 exposures are unlikely to occur except in the setting of laboratory accidents, storage  
8 disposal, remediation sites or after terrorist attacks. Under these conditions, other  
9 conventional injuries may be superimposed upon the nerve agent exposure. The  
10 priorities for emergency medical treatment of mixed conventional-nerve agent casualties  
11 should be based upon traditional priorities established for advanced cardiac life support  
12 and advanced trauma life support. Primacy should always be given to maintaining  
13 airway, breathing and circulation. Other injuries or illnesses uncovered during the  
14 secondary survey should be treated with available resources after resuscitative care has  
15 been rendered. Fluid and electrolyte requirements are usually minimal, unless  
16 superimposed burns or blood loss cause a decrease in cardiac output. Head trauma may  
17 be difficult to assess when seen in association with the altered levels of consciousness  
18 and pupillary changes of a severe nerve agent vapor exposure and may require early  
19 neurosurgical consultation. *Torsades de pointes*, a rapid, multifocal ventricular  
20 arrhythmia, has been reported in humans following organophosphorus-pesticide  
21 intoxication and may require immediate treatment following the latest advanced cardiac  
22 life support guidelines.

1 **Appendix E**

2 **Potential Exposure Evaluation Criteria for GB and VX Nerve Agents**

3

4 **E-1. Introduction**

5 Certain medical evaluations must be performed in the event of an accidental exposure or  
6 potential exposure to nerve agents. This appendix provides guidance to field personnel as  
7 to the criteria to be used for conducting potential exposure evaluations during GB and  
8 VX operations. These criteria have been developed with input from the field to ensure  
9 that medical evaluations of potentially exposed individuals take place whenever the  
10 potential for medically significant dermal or respiratory exposure exists.

11 a. An exposed worker is an individual who works in a nerve agent operating area and  
12 who exhibits clinical signs or symptoms of nerve agent intoxication. The individual  
13 should be presumed to have been exposed to nerve agents (even if asymptomatic) if—

14 (1) An acute depression in ChE activity of 10 percent or greater from their RBC-ChE  
15 baseline has occurred.

16 (2) No immediate history of contact with other ChE-inhibiting substances or a  
17 corresponding reduction in red cell mass exists.

18 (3) Urine assays confirm the presence of phosphonic acid metabolites specific for  
19 nerve agents (see TB MED 296).

20 b. A potentially exposed worker is an individual who—

21 (1) Works in an agent operating area where levels of nerve agent exceed the  
22 protective capability of the PPE or are detectable at or above the applicable airborne  
23 exposure limits.

1 (2) Has experienced a breach in the PPE or a failure in engineering controls.

2

3 **E-2. Policies**

4 These policies apply to all storage, disposal (including stockpile and no-stockpile  
5 operations), and laboratory facilities. They do not apply to training operations at live  
6 agent training facilities, for example FT Leonard Wood, Missouri.

7 a. All operational events meeting the potential exposure criteria shall be reported  
8 immediately to the installation or chemical activity commander. Any exposed or  
9 potentially exposed worker shall be sent immediately to the supporting medical facility  
10 for a medical evaluation (see paragraph 4-8 and Appendix C).

11 b. Potentially exposed individuals should not be returned to duty in an agent operating  
12 area until the CMA has medically cleared them. The agent operating area is any portion  
13 of an agent area where workers are actively conducting agent operations.

14 c. A potential exposure will not be considered a chemical event until the—

15 (1) Potential exposure evaluation has been completed.

16 (2) CMA has rendered a written opinion of the exposure effect. (See AR 50-6 for a  
17 complete listing of chemical event criteria.)

18

19 **E-3. Criteria**

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

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

1 (a)  $\geq 50$  WPL ( $0.005 \text{ mg/m}^3$ ) for M40 respirators.

2 (b)  $\geq 10,000$  WPL ( $1 \text{ mg/m}^3$ ) for a self-contained breathing apparatus or  
3 combination airline respirator with an auxiliary self-contained breathing apparatus worn  
4 with ensembles other than the DPE.

5 (c)  $\geq 100 \text{ mg/m}^3$  for DPE. NOTE: The National Institute of Occupational Safety  
6 and Health has designated the assigned protection factor of 50 for negative pressure, air  
7 purifying respirators and 10,000 for self-contained breathing apparatuses. The limit of  
8  $100 \text{ mg/m}^3$  for DPE entries is based on human volunteer testing conducted in 1976.

9 (2) A breach or tear occurs during entry in a DPE, modified Army level A, or Army  
10 level A ensembles, and nerve agent vapor is detectable at or above 50 WPL ( $0.005$   
11  $\text{mg/m}^3$ ) or liquid contamination is known to exist.

12 (3) Loss of engineering controls, upset conditions, or mishaps which result in a nerve  
13 agent concentration  $\geq 1$  STEL ( $0.0004 \text{ mg/m}^3$ ) in areas where the individual was  
14 unprotected (that is, no respiratory protection for nerve agents is being worn).

15 (4) An individual develops signs or symptoms consistent with nerve agent exposure  
16 effect during entry, and nerve agent vapor is detectable at or above the WPL ( $0.0001$   
17  $\text{mg/m}^3$ ), or liquid contamination is known to exist.

18 (5) A DPE cut out in an airlock occurs in which the agent concentration is  $\geq 50$  WPL  
19 ( $0.005 \text{ mg/m}^3$ ), and the DPE wearer is switched from the SCBA backpack to an M40  
20 respirator.

21 (6) DPE life support systems' air sampling indicates agent concentrations  $\geq 1$  STEL  
22 ( $0.0004 \text{ mg/m}^3$ ) during entry.

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

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

5 (a)  $\geq 50$  WPL ( $0.0005 \text{ mg/m}^3$ ) for M40 respirators.

6 (b)  $\geq 10,000$  WPL ( $0.1 \text{ mg/m}^3$ ) for an self-contained breathing apparatus or a  
7 combination airline respirator with an auxiliary self-contained breathing apparatus worn  
8 with ensembles other than DPE.

9 (c)  $\geq 100 \text{ mg/m}^3$  for DPE entries.

10 (2) A breach or tear occurs in a DPE, modified Army level A, or Army level A  
11 ensembles, and nerve agent vapor is detectable at or above 50 WPL ( $0.0005 \text{ mg/m}^3$ ) or  
12 liquid contamination is known to exist.

13 (3) A loss of engineering controls, upset conditions, or mishaps which result in agent  
14 concentrations  $\geq 1$  STEL ( $0.00004 \text{ mg/m}^3$ ) occur in areas where the individual was  
15 unprotected (that is, no respiratory protection for nerve agents is worn).

16 (4) An individual develops signs or symptoms consistent with nerve agent exposure  
17 effect during entry.

18 (5) A DPE cut out in an airlock occurs in which the agent concentration is  $\geq 50$  WPL  
19 ( $0.0005 \text{ mg/m}^3$ ), and the DPE wearer is switched from the self-contained breathing  
20 apparatus backpack to an M40 respirator.

21 (6) DPE life support systems' air sampling indicates agent concentrations  $\geq 1$  STEL  
22 ( $0.0004 \text{ mg/m}^3$ ) during entry.

1 **Appendix F**

2 **Toxicologic Basis for Derivation of Airborne Exposure Limits**

3

4 **F-1. Exposure Criteria**

5 a. Previously established AEL for nerve agents GB and GA were promulgated by the  
6 Center's for Disease Control in 1988 (Federal Register, Vol. 53, No. 50, 1988, Page 8504  
7 – 8507) and published as Army policy thereafter. A more recent analyses of nerve agent  
8 toxicity has been documented in the following reports:

9 (1) *Evaluation of Airborne Exposure Limits for G-Agents: Occupational and General*  
10 *Population Exposure Criteria*; ERDEC TR-489, Mioduszewski et al., April 1998 and an  
11 ERRATA , SAB, Johnson, 2000. Available from [http://chppm-  
www.apgea.army.mil/hrarcp/pages/caw/index.html](http://chppm-<br/>12 www.apgea.army.mil/hrarcp/pages/caw/index.html)

13 (2) *Evaluation of Airborne Exposure Limits for VX: Occupational and General*  
14 *Population Exposure Criteria*; ECBC-TR-074, Reutter et al, February 2000. Available  
15 from <http://chppm-www.apgea.army.mil/hrarcp/pages/caw/index.html>

16 b. These reports describe the selection of a critical adverse effect and the associated  
17 study from which exposure limits are then extrapolated. To establish AEL, the selected  
18 critical study is used in conjunction with a risk assessment method that includes  
19 adjustments for maximal projected exposure duration, estimated dose, and several  
20 “uncertainty factors” (UF) to account for data and study limitations. This approach is  
21 consistent with current risk assessment models being used by other regulatory agencies  
22 when establishing exposure limits/health guidelines for toxic chemicals. The Center's for  
23 Disease Control has reviewed the conclusions of these reports and endorsed the

1 toxicological basis for the changes to the previously existing criteria as well as the  
2 establishment of new AEL. The following paragraphs summarize the information and  
3 conclusions drawn from the subject reports. (NOTE: Some of the key studies are  
4 directly referenced; however, for a complete listing of the supporting data and studies  
5 evaluated, see the technical reports listed above.)

6

7 **F-2. Discussion and conclusions**

8 a. Summary of findings and technical basis for AEL.

9 (1) Technical basis for nerve agent GB. In deriving exposure criteria for the nerve  
10 agents, data from human short-term nerve agent GB vapor exposures (single as well as  
11 repeated) and chronic nerve agent GB vapor exposures in animals were compared. The  
12 Center's for Disease Control took human inhalation exposure data from a study  
13 conducted by McKee and Woolcott in 1949 (see Appendix A) to derive the AEL for  
14 nerve agent GB. This study was selected as the "critical study" for deriving the STEL,  
15 WPL, and GPL, because mild effects (miosis) did not occur until repeated exposures  
16 occurred in humans, indicating a cumulative effect of the exposures. The IDLH value  
17 was based on an acute human exposure study by Mumford, 1950, which estimated a  
18 critical concentration for borderline incapacitation. (See Appendix A.) Specific  
19 calculations and a unique set of UF were applied to the data to derive the specific AEL.  
20 Specific calculations and UF are listed in paragraph F-3.

21 (2) Technical basis for nerve agents GA, GD, and GF. Due to data limitations and  
22 property similarities, derivation of criteria for nerve agents GA, GD, and GF were based  
23 upon relative potencies of these agents versus the ability to induce, as with nerve agent

1 GB, mild effects (for example, miosis) in humans. Nerve agents GA and GB are  
2 considered equipotent in this regard and half as potent as nerve agents GD and GF.

3 (3) Technical basis for nerve agent VX. Although some studies of VX were  
4 evaluated, study limitations led to derivation of criteria for VX from the estimated  
5 relative potency of this agent versus nerve agent GB's ability for inducing mild effects  
6 (for example, miosis) in humans. Nerve agent VX is considered to be 10 times more  
7 potent than GB in this regard.

8 b. Comparison of currently recommended AEL with existing AEL. The currently  
9 recommended AEL for nerve agents GA, GB, GD, GF, and VX are given in Table F-1,  
10 along with a comparison to previously established criteria. The currently recommended  
11 AEL values are based upon an evaluation of whether a significant difference exists  
12 between the previous AEL values and the calculations of the recent analyses.

13 (1) Long-term exposure AEL (WPLs and GPL). The existing AEL for nerve agents  
14 GB, GA, and GD (WPLs and GPL) remain unchanged, because the uncertainty of  
15 estimates derived using the currently accepted long-term exposure risk assessment  
16 method are considered to span perhaps an order of magnitude or greater. The existing  
17 AEL (WPLs and GPL) for GB, GA, and GD remain unchanged, since they vary from the  
18 recalculated values by only a factor of 2 to 3 and are thus not considered to be different.  
19 Therefore, the existing AEL for G-agents are considered reasonable estimates of airborne  
20 concentrations, which are considered thresholds for given levels of human toxic response.  
21 For nerve agent VX, the existing WPL was also determined to be an appropriate AEL;  
22 however, the VX GPL was determined to be inadequate in terms of estimated relative

1 potency to nerve agent GB. The revised VX GPL is 10 times lower than that previously  
2 cited in Army regulations.

3 (2) IDLH. The IDLH values previously cited in Army regulations are considered to  
4 be somewhat inadequate given the potential for increased sensitivity of females in the  
5 worker population. Specifically, revised IDLH values for all the nerve agents are one-  
6 half of those IDLH values previously cited in Army regulations

7 (3) STELs. Since STELs for nerve agents have not previously been established, there  
8 is no comparison to be made. However, previous operational use of the WPL for alarm  
9 applications is overly protective. Such applications warrant reconsideration and possible  
10 implementation of the STELs.

11

### 12 **F-3. Derivation of AEL for nerve agents (WPL, STEL, IDLH and GPL)**

13 a. The derivation of the WPL for nerve agent GB from human data by Mioduszewski  
14 et al (1998) (see Appendix A) is based on the following equation:

15

$$16 \quad \text{WPL} = \text{LOAEL} \times \frac{\text{Resp}_{\text{exptl}} \times \text{Exp}_{\text{exptl}}}{\text{Resp}_{\text{occup}} \times \text{Exp}_{\text{occup}}} \times \frac{1}{\text{UF}_s \times \text{MF}}$$

17

18 Where—

- 19 (1) LOAEL = Lowest observed adverse effect level (mg/m<sup>3</sup>).
- 20 (2) Resp<sub>exptl</sub> = Experimental respiratory volume (liter per minute (L/min)).
- 21 (3) Resp<sub>occup</sub> = Occupational respiratory volume (20.8 L/min).
- 22 (4) Exp<sub>exptl</sub> = Experimental exposure (min/day x days/wk).
- 23 (5) Exp<sub>occup</sub> = Occupational exposure (480 min/day x 5 days/wk).

1 (6) UF<sub>S</sub> = Uncertainty factors.

2 (7) MF = Modifying factor.

3 b. For the purpose of establishing occupational exposure criteria, a study conducted by  
4 McKee and Woolcott in 1949 was selected by Mioduszewski et al., 1998 as the most  
5 appropriate study. The WPL was calculated as follows—

$$6 \quad \text{WPL} = 0.000033 \text{ mg/m}^3$$

$$7$$

$$8 \quad \text{WPL} = 0.06 \text{ mg/m}^3 \times \frac{10 \text{ L/min} \times 20 \text{ min/day} \times 4 \text{ day/wk}}{20.8 \text{ L/min} \times 480 \text{ min/day} \times 5 \text{ days/wk}} \times \frac{1}{1 \times 1 \times 3 \times 10 \times 1 \times 1}$$

$$9$$

10 Where—

11 (1) LOAEL = 0.06 mg/m<sup>3</sup>.

12 (2) UF<sub>H</sub> = 1 (To protect sensitive subpopulations).

13 (3) UF<sub>A</sub> = 1 (To extrapolate from animals to humans).

14 (4) UF<sub>L</sub> = 3 (To extrapolate from a LOAEL to a No Observed  
15 Adverse Effect Level).

16 (5) UF<sub>S</sub> = 10 (To extrapolate from a subchronic to chronic exposure).

17 (6) UF<sub>D</sub> = 1 (To adjust for inadequacies in the database).

18 (7) MF = 1 (to adjust for deficiencies in the study).

19

#### 20 **F-4. Derivation of STEL for nerve agent GB**

21 a. The derivation of the STEL by Mioduszewski et al (1998) from human data is based  
22 on the following equation:

$$23 \quad \text{STEL} = \text{LOAEL} \times \frac{\text{Resp}_{\text{exptl}} \times \text{Exp}_{\text{exptl}}}{\text{Resp}_{\text{occup}} \times \text{Exp}_{\text{occup}}} \times \frac{1}{\text{UF}_S \times \text{MF}}$$

1 Where—

2 (1) LOAEL = In  $\text{mg}/\text{m}^3$ .

3 (2)  $\text{Resp}_{\text{exptl}}$  = Experimental respiratory volume (L/min).

4 (3)  $\text{Resp}_{\text{occup}}$  = Occupational respiratory volume (20.8 L/min).

5 (4)  $\text{Exp}_{\text{exptl}}$  = Experimental exposure (min).

6 (5)  $\text{Exp}_{\text{occup}}$  = Occupational exposure (60 min; 4 STEL per day).

7 (6)  $\text{UF}_s$  = Uncertainty factors.

8 (7) MF = Modifying factor.

9 b. The McKee and Woolcott (1949) (see Appendix A) study on human volunteers was  
 10 considered the most appropriate by Mioduszewski et al (1998) for deriving a STEL for  
 11 nerve agent GB. The threshold sign of miosis was observed after a single, 40-minute  
 12 exposure to  $0.062 \text{ mg}/\text{m}^3$  in one group of 4 human volunteers. The STEL was calculated  
 13 as follows:

$$14 \quad \text{STEL} = 0.06 \text{ mg}/\text{m}^3 \times \frac{10 \text{ L}/\text{min} \times 40 \text{ min} \times 1 \text{ day}/\text{week}}{20.8 \text{ L}/\text{min} \times 60 \text{ min} \times 5 \text{ days}/\text{week}} \times \frac{1}{1 \times 1 \times 3 \times 3 \times 1 \times 5}$$

16

$$17 \quad \text{STEL} = 0.0004 \text{ mg}/\text{m}^3$$

18

19 Where—

20 (1) LOAEL =  $0.06 \text{ mg}/\text{m}^3$ .

21 (2)  $\text{UF}_H$  = 1 (To protect sensitive subpopulations).

22 (3)  $\text{UF}_A$  = 1 (To extrapolate from animals to humans).

23 (4)  $\text{UF}_L$  = 3 (To extrapolate from a LOAEL to a No Observed  
 24 Adverse Effect Level).

1 (5)  $UF_S$  = 3 (To extrapolate from a short term to a long term  
2 exposure).

3 (6)  $UF_D$  = 1 (To adjust for inadequacies in the database).

4 (7) MF = 5.

5

#### 6 **F-5. Derivation of IDLH concentration for nerve agent GB**

7 a. Mioduszewski et al (1998) proposes that the IDLH concentration (for 30 minutes)  
8 for nerve agent GB be based upon short-term human exposure data contained in a study  
9 by Mumford completed in 1950 (see Appendix A). The Mumford study reviewed data  
10 from acute human exposures (ranging from 1.5 to 8 minutes) to nerve agent GB vapor  
11 and concluded that Cts above  $15 \text{ mg min/m}^3$  produced a marked fall in blood AchE with  
12 concomitant pronounced symptoms of systemic nerve gas poisoning, including  
13 generalized weakness, nausea and vomiting, in addition to eye and respiratory effects.  
14 The effective concentration (EC) for borderline incapacitation (pronounced signs and  
15 symptoms of systemic nerve gas poisoning, including generalized weakness, nausea and  
16 vomiting in addition to eye and respiratory effects) was identified as a 1.5-minute  
17 exposure to  $10 \text{ mg/m}^3$ . By adjusting the minute volume from 15 L/min to 42 L/min,  
18 Mioduszewski et al (1998) approximated increased respiratory volumes anticipated  
19 during escape conditions.

20 b. Adjusting the EC for a 30-minute exposure was completed by using the following  
21 calculation—

22

23

$$EC_{(30 \text{ min})} = EC \times (1.5 \text{ min}/30 \text{ min}) = 10 \text{ mg/m}^3 \times (0.05) = 0.5 \text{ mg/m}^3$$

24

1 c. Adjusting the EC<sub>(30 min)</sub> for 42 L/min (minute volume anticipated during escape  
2 activity) to calculate IDLH for a 30-minute exposure period was calculated as follows:

$$3 \quad \text{IDLH}_{(30 \text{ min})} = \text{EC}_{(30 \text{ min})} \text{ mg/m}^3 \times (15 \text{ L/min}) \div (42 \text{ L/min}) = 0.18 \text{ mg/m}^3$$

$$4 \quad \text{IDLH}_{(30 \text{ min})} = 0.2 \text{ mg/m}^3$$

5  
6  
7  
8 d. Additional information was found in the literature to suggest the possibility that  
9 gender differences in sensitivity to G-agent vapors may exist among observed  
10 experimental animals. Therefore, the IDLH for nerve agent GB was further down-  
11 adjusted by a factor of 2 to estimate the IDLH value considered protective for a female  
12 occupational worker population; thus, the recommended IDLH is 0.2 mg/m<sup>3</sup> divided by 2  
13 or 0.1 mg/m<sup>3</sup>.

$$14 \quad (1) \text{ IDLH}_{(30 \text{ min})} \text{ for GB (based on male human data)} = 0.18 \text{ mg/m}^3 \text{ or } 0.2 \text{ mg/m}^3$$

$$15 \quad (2) \text{ IDLH}_{(30 \text{ min})} \text{ for GB (male + female workforce)} = 0.2 \text{ mg/m}^3 \div 2 = 0.1 \text{ mg/m}^3$$

16

## 17 **F-6. Derivation of GPL for nerve agent GB**

18 a. The derivation of the GPL from human data is based on the same approach as used  
19 to derive the WPL and STEL. The Mioduszewski et al, 1998, study selected McKee and  
20 Woolcott (1949) as the most appropriate study. (See Appendix A.)

21

$$22 \quad \text{GPL}_{\text{INHAL}} = \text{LOAEL} \times \frac{\text{Resp}_{\text{exptl}} \times \text{Exp}_{\text{exptl}}}{\text{Resp}_{\text{GP}} \times \text{Exp}_{\text{GP}}} \times \frac{1}{\text{UF}_S \times \text{MF}}$$

23

24 Where—

$$25 \quad (1) \text{ GPL}_{\text{INHAL}} = \text{Concentration in ambient air.}$$

- 1 (2) LOAEL = In  $\text{mg}/\text{m}^3$ .
- 2 (3)  $\text{Resp}_{\text{exptl}}$  = Experimental subject minute volume (10 L/min).
- 3 (4)  $\text{Resp}_{\text{GP}}$  = General population minute volume (13.9 L/min
- 4 over 24 hrs).
- 5 (5)  $\text{Exp}_{\text{GP}}$  = General population exposure (1,440 min/day x
- 6 7 days/week).
- 7 (6)  $\text{Exp}_{\text{exptl}}$  = Experimental exposure.
- 8 (7)  $\text{UF}_s$  = Uncertainty factors.
- 9 (8) MF = Modifying factor.

10 b. The GPL was calculated as follows:

11

12

13 
$$\text{GPL} = 0.06 \text{ mg}/\text{m}^3 \times \frac{10 \text{ L}/\text{min} \times 20 \text{ min}/\text{day} \times 4 \text{ days}/\text{wk}}{13.9 \text{ L}/\text{min} \times 1440 \text{ min}/\text{day} \times 7 \text{ days}/\text{wk}} \times \frac{1}{10 \times 1 \times 3 \times 10 \times 1 \times 1}$$

14

15 
$$\text{GPL} = 0.000001 \text{ mg}/\text{m}^3$$

16

17 Where—

- 18 (1) LOAEL = 0.06  $\text{mg}/\text{m}^3$ .
- 19 (2)  $\text{UF}_H$  = 10 (To protect sensitive subpopulations).
- 20 (3)  $\text{UF}_A$  = 1 (To extrapolate from animals to humans).
- 21 (4)  $\text{UF}_L$  = 3 (To extrapolate from a LOAEL to a No Observed
- 22 Adverse Effect Level).
- 23 (5)  $\text{UF}_S$  = 10 (To extrapolate from a short term to long-term
- 24 exposure).
- 25 (6)  $\text{UF}_D$  = 1 (To adjust for inadequacies in the database).
- 26 (7) MF = 1 (to adjust for deficiencies in the study).

1 **Table F-1**  
 2 **Comparison of Currently Recommended AEL versus Previous AEL for the Nerve**  
 3 **Agents (mg/m<sup>3</sup>)**

AEL	GB	GA	GD	GF	VX
WPL (8-hr TWA)	0.0001 <sup>a</sup>	0.0001 <sup>a</sup>	0.00003 <sup>a</sup>	0.00003	0.00001 <sup>a</sup>
STEL (15 min x 4/day)	0.0004	0.0004	0.0002	0.0002	0.00004 <sup>b</sup>
IDLH (30 min)	0.1 <del>0.2</del> <sup>c</sup>	0.1 <del>0.2</del> <sup>c</sup>	0.05 <del>0.1</del> <sup>c</sup>	0.05	0.01 <sup>b</sup> <del>0.05</del> <sup>c</sup>
GPL (24 hr/day, TWA)	0.000003 <sup>a</sup>	0.000003 <sup>a</sup>	0.000001	0.000001	0.0000003 <sup>b</sup> <del>0.000003</del> <sup>c</sup>

4 <sup>a</sup> Same as existing exposure criteria (53 FR 8504 and AR 385-61).

5 <sup>b</sup> Based on relative potency to GB.

6 <sup>c</sup>—Indicates previous AEL.

## **GLOSSARY**

### **Section I Abbreviations**

**AEL**

airborne exposure limits

**CMA**

competent medical authority

**DPE**

demilitarization protective ensemble

**EC**

effective concentration

**EKG**

electrocardiogram

**GPL**

general population limits

**IDLH**

immediately dangerous to life or health

**IM**

intramuscularly

**IV**

intravenously

**L/min**

liters per minute

**LOAEL**

lowest observed adverse effect level

**MF**

modifying factor

**mg/m<sup>3</sup>**

milligrams per cubic meter

**MH**

medical history

**MSDS**

material safety data sheet

**OH**

occupational health

**OSHA**

Occupational Safety and Health Administration

**PPE**

personal protective equipment

**PRP**

personnel reliability program

**RBC-ChE**

red blood cell cholinesterase

**STEL**

short-term exposure limits

**2-PAMC1**

pralidoxime chloride

**TWA**

time-weighted average

**UF**

uncertainty factors

**USACHPPM**

U.S. Army Center for Health Promotion and Preventive Medicine

**WPL**

worker population limits

**Section II**  
**Terms****Agent area**

A physical location where entry and exit are restricted and controlled and where GA, GB, GD, GF and VX are manufactured, processed, packaged, repackaged, demilitarized, released, handled, stored, used, and/or disposed.

**Agent GA**

The chemical dimethylphosphoramidocyanidate, chemical abstracts service 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, chemical abstracts service 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, chemical abstracts service 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.

**Agent GF**

The chemical cyclohexyl, methylphosphonofluoridate, chemical abstracts service 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 operating area**

That portion of a work location where workers are actively conducting nerve agent operations.

**Agent VX**

The chemical phosphonothioic acid, methyl-S-(2-(bis(1-methylethyl)amino)ethyl) 0-ethyl ester, chemical abstracts service 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.

**Agent worker**

An individual assigned to exposure category A, B, C, or D.

**Airborne exposure limits**

Allowable concentrations in the air for workplace and general population exposures.

These limits include WPL, STEL, IDLH values, and GPL.

**Ceiling value**

Normally refers to the maximum exposure concentration at any time, for any duration. Practically, it may be an average value over the minimum time required to detect the specified concentration. The IDLH values for nerve agents are considered a ceiling value for the purpose of requiring the use of a self-contained breathing apparatus.

**Certifying official**

For military and DA civilian personnel, the immediate commander (or, if civil service, the director) who is responsible for the operation or security, or both, of chemical weapons or materiel. If the commander or director is a colonel or a GM/GS-15, or above, he or she may delegate subordinates to act as organization certifying officials. Such designees should be supervisors who can feasibly cause sufficient personal contact to be maintained with personnel to continually evaluate them. For DA contractor personnel, the Army Contracting Officer's Representative is usually designated in the contract as the certifying official. The certifying official certifies that personnel being considered for assignment to chemical surety duties meet the qualification requirements of the chemical PRP.

**Exposed worker**

An individual (working in a nerve agent operating area) who exhibits clinical signs or symptoms of nerve agent intoxication. In addition, a worker is presumed to have been in the presence exposed to of nerve agents (even if asymptomatic) if he or she has—

- a. An acute depression in ChE activity of 10 percent or greater from baseline while working in a nerve agent operating area.
- b. No immediate history of contact with other ChE-inhibiting substances or a corresponding reduction in red cell mass.
- c. Urine assays (see paragraph B-15e) that confirm the presence of phosphonic acid metabolites specific for nerve agents, as described in TB MED 296.

**Exposure potential**

Workplace conditions in which nerve agents may be present in a liquid or vapor form, in varying quantities and concentrations, due to the nature of industrial, training or laboratory operations.

**Potentially exposed worker**

An individual who works in an agent operating area where levels of nerve agent—

- a. Exceed the protective capability of the PPE.
- b. Are detectable at or above the applicable airborne exposure limit, and a breach or failure in PPE or engineering controls has occurred.

## Written Recommendation for Use of Respiratory Protective Devices

I have completed a medical evaluation of \_\_\_\_\_  
for the use of the respiratory device(s) listed on DA Form XX2 and in compliance with 29 CFR 1910.134 effective April 8, 1998. Based upon my evaluation, I find that this individual (click) able to wear these device(s) in a safe and healthful manner. I (click) identified the following limitations on the use of these respirator:

In my judgement, this individual (click) require a follow-up medical examination to make a final determination as the 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 (click) ability to safely us this respiratory protective device as intended.

SIGNATURE	TITLE OF HEALTHCARE PRACTITIONER	16. DATE
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**MEDICAL CLEARANCE FOR RESPIRATOR USE**

1. DATE

11 Feb 03

PRIVACY ACT STATEMENT    AUTHORITY:  
 PRINCIPAL PURPOSE:  
 ROUTINE USAGE:  
 DISCLOSURE:

2. NAME

5. SSN (*digits only*):

3. JOB TITLE

6. SEX:

4. EMPLOYER

7. HEIGHT (*digits only*):8. WEIGHT (*digits only*):9. DOB (*ddmmyy*):10. TYPE OF RESPIRATOR USED  
(selected all that apply)11. LEVEL OF WORK EFFORT  
(select one)

12. EXTENT OF USAGE

14. SPECIAL WORK  
CONSIDERATION (that is,  
high places, temperatures, or  
protective clothing) Full-face negative pressure  
air purifying Light Daily Powered air purifying  
respirator Moderate Occasionally Emergency escape device Heavy Rarely- or in  
emergency  
escape  
purposes Other (list)  
\_\_\_\_\_ Strenuous

13. LENGTH OF TIME OF ANTICIPATED EFFORT IN HOURS

15. SIGNATURE

16. DATE

DA FORM XX2, OCT 02

## POTENTIAL EXPOSURE EVALUATION DATA SHEET AND CLINICAL RECORD

SECTION I			SECTION II							
1a. Last Name	1b. First Name	1c. MI	1. Date	2. Time	3. PRP Notification <input type="checkbox"/>					
2. Symptomatic? <input type="checkbox"/> NO <input type="checkbox"/> YES <i>(describe)</i>			4. Vital Signs		6. Review of Systems					
3. Chemical Agent Exposure Information <i>(select all that apply)</i> a. AGENT: <input type="radio"/> GB <input type="radio"/> VX <input type="radio"/> HD b. PHYSICAL STATE: <input type="radio"/> Vapor <input type="radio"/> Liquid c. POTENTIAL ROUTE: <input type="radio"/> Eye <input type="radio"/> Inhalation <input type="radio"/> Skin			Body Temp _____		NO	YES				
			Blood Pressure _____		<input type="checkbox"/>	<input type="checkbox"/>	Runny Nose <input type="checkbox"/>	<input type="checkbox"/>		
4. Level of PPE worn: <i>(select all that apply)</i> <input type="radio"/> Level A <input type="radio"/> Level B <input type="radio"/> Tapes <input type="radio"/> Mask <input type="radio"/> Gloves <input type="radio"/> Boots <input type="radio"/> Apron <input type="radio"/> Slung mask <input type="radio"/> Overalls <input type="radio"/> Impregs <input type="radio"/> Other: _____			Pulse Rate _____		<input type="checkbox"/>	<input type="checkbox"/>	Dim Vision <input type="checkbox"/>	<input type="checkbox"/>	Dyspnea <input type="checkbox"/>	<input type="checkbox"/>
			Respiratory Rate _____		<input type="checkbox"/>	<input type="checkbox"/>	Blurred Vision <input type="checkbox"/>	<input type="checkbox"/>	Chest Tightness <input type="checkbox"/>	<input type="checkbox"/>
5. Exposure Time: a. Estimated time of exposure: _____ b. Duration of exposure/potential exposure: _____ c. Time elapsed since initial event: _____			Body Weight _____		<input type="checkbox"/>	<input type="checkbox"/>	Headache <input type="checkbox"/>	<input type="checkbox"/>	Wheezing <input type="checkbox"/>	<input type="checkbox"/>
			5. Potential Agent <input type="checkbox"/> GB <input type="checkbox"/> VX <input type="checkbox"/> Other		<input type="checkbox"/>	<input type="checkbox"/>	Nausea <input type="checkbox"/>	<input type="checkbox"/>	Sweating <input type="checkbox"/>	<input type="checkbox"/>
6. Estimated concentration of agent in workplace where exposure occurred <i>(if known)</i> : _____ mg/m3 or _____ X TWA			7. Chief complaint/exposure history:							
			8. Physical Exam							
7. Was the detection of agent confirmed by a second means of detection? <input type="checkbox"/> YES <input type="checkbox"/> NO <input type="checkbox"/> PENDING			EYE:		NO	YES (DESCRIBE)				
			Lacrimation <input type="checkbox"/>	<input type="checkbox"/>		_____				
8. Has the exposed or potentially exposed work: a. Changed and removed clothing? <input type="checkbox"/> YES <input type="checkbox"/> NO b. Been showered or decontaminated? <input type="checkbox"/> YES <input type="checkbox"/> NO c. Received any treatment? <input type="checkbox"/> YES <input type="checkbox"/> NO			Conjunctival Redness <input type="checkbox"/>	<input type="checkbox"/>		_____				
			Blepharospasm <input type="checkbox"/>	<input type="checkbox"/>		_____				
9. If treatment has been received, please describe:			Adnormal Pupil Reactivity <input type="checkbox"/>	<input type="checkbox"/>		_____				
			Pupil Size _____							
10. Information received from:			RESPIRATORY:							
			Stridor <input type="checkbox"/>	<input type="checkbox"/>		_____				
11. Name of clinic personnel recording data:			Wheezes <input type="checkbox"/>	<input type="checkbox"/>		_____				
			Rhonchi <input type="checkbox"/>	<input type="checkbox"/>		_____				
12. Date data was recorded			Rhinorrhoea <input type="checkbox"/>	<input type="checkbox"/>		_____				
			Bronchorrhoea <input type="checkbox"/>	<input type="checkbox"/>		_____				
13. Time data was recorded			Salivation <input type="checkbox"/>	<input type="checkbox"/>		_____				
			SKIN:							
14. Plan.			Sweating <input type="checkbox"/>	<input type="checkbox"/>		_____				
			NEUROMUSCULAR:							
15. CMA Signature			Fasciculations <input type="checkbox"/>	<input type="checkbox"/>		_____				
			Twitching <input type="checkbox"/>	<input type="checkbox"/>		_____				
16. Date			Weakness <input type="checkbox"/>	<input type="checkbox"/>		_____				
			9. Other findings:							
17. CMA Stamp			10. Baseline ChE:		11. Current ChE:					
			12. Date/Time:							
11/02/03			13. Impression.							
			14. Plan.							