Alternate Matrix for Emergency Response to Nerve Agent Event

PPE CONDITIONS OF USE	Maximum time	GA (mg/m^3)	GB (mg/m^3)	GD/GF (mg/m^3)	VX * (mg/m^3)
Percutaneous Vapor Toxicity Calculated Minimal Effect Values for 2 hour Exposure Period		**2.7**	**1.5**	**0.375**	**0.03**
IDLH LEVEL(USArmy Proposed)		**0.1**	**0.05**	**0.05**	**0.01**
AIR: Less than AEGL – 1 for stated duration times No Respirator required. **SKIN:** Level D clothing if no splash or contact hazard. General washable work clothing or disposable coverall. Washable or disposable boots and gloves recommended for general purpose protection. If skin contact with liquid a possibility, butyl rubber gloves and boots, Silver Shield gloves tested well.	10 MIN:	0.0069	0.0069	0.0035	0.00057
	30 MIN:	0.0040	0.0040	0.0020	0.00033
	1 HR:	0.0028	0.0028	0.0014	0.00017
	4 HR:	0.0014	0.0014	0.00070	0.00010
	8 HR:	0.0010	0.0010	0.00050	0.000071
AIR: Less than 25 X 8 HR AEGL- 1 (a) Powered Air Purifying Loose Fitting Facepiece, hood or helmet with CBRN approved or combination organic vapor, acid gas, particulate cartridge/filter. (b) Any Continuous Flow respirator with a Loose Fitting Facepiece, hood or helmet. **SKIN:** Level D if no splash or contact hazard. General washable work clothing or disposable coverall. Washable or disposable boots and gloves recommended for general purpose protection. If skin contact with liquid a possibility boots and gloves mandatory, other chemical clothing based on hazard assessment. Butyl rubber boots&gloves, Silver Shield gloves tested well. Chemical clothing butyl rubber, Dupont Tychem and Trelleborg Trellchem tested well.					
	30 MIN:	<0.1 (IDLH)	<0.1 (IDLH)	<0.05 (IDLH)	<0.00825
	1 HR:	<0.07	<0.07	<0.035	<0.00425
	4 HR:	<0.035	<0.035	<0.0175	<0.0025
	8 HR:	<0.025	<0.025	<0.0125	<0.00178
AIR: Less than 50 X 8 HR AEGL- 1 (a) Any Tight Fitting Air Purifying or Powered Air Purifying Full Facepiece with CBRN approved or combination organic vapor, acid gas, particulate cartridge/filter. **SKIN:** Level D if no splash or contact hazard. General washable work clothing or disposable coverall. Washable or disposable boots and gloves recommended for general purpose protection. If skin contact with liquid a possibility boots and gloves mandatory, other chemical clothing based on hazard assessment. Butyl rubber boots&gloves, Silver Shield gloves tested well. Chemical clothing butyl rubber, Dupont Tychem and Trelleborg Trellchem tested well.					
	30 MIN:	<0.1 (IDLH)	<0.1 (IDLH)	<0.05 (IDLH)	<0.01(IDLH)
	1 HR:	<0.1 (IDLH)	<0.1 (IDLH)	<0.05 (IDLH)	<0.0085
	4 HR:	<0.07	<0.07	<0.035	<0.005
	8 HR:	<0.050	<0.05	<0.025	<0.00355
AIR: Greater than 50 X 8 HR AEGL- 1 (a) Any Self Contained Breathing Apparatus with a Full Facepiece operated in a Pressure Demand Mode. (b) Any Supplied Air Respirator with a Full Facepiece operated in a Pressure Demand Mode with an Auxiliary Escape Bottle. **SKIN:** Level A/B. Level A if vapor concentration exceeds the levels listed above for percutaneous effects. Level A or B otherwise. Skin contact more likely with higher air levels. Butyl rubber boots&gloves, Silver Shield gloves tested well. Chemical clothing butyl rubber, Dupont Tychem and Trelleborg Trellchem tested well.		>0.050	>0.050	>0.025	>0.00355

Note: There are no current OSHA PEL's for exposure to nerve agents. The National Research Council and EPA have published airborne limits to various agents called Acute Exposure Guideline Levels (AEGLs) to characterize the risk to the general population during a one-time accident and emergency scenario. Other governmental organizations including the US Army and CDC have proposed more conservative exposure limits dealing with more routine work processes such as storage or transportation of agents. For emergency responders and support personnel to a nerve agent event, it seems appropriate to establish a target working exposure limit at time weighted averages less than the lowest recommended AEGL-1 level for a given exposure duration. The more conservative exposure standards may be substituted for multi-week work operations involved in a cleanup if deemed appropriate after an incident.

Note: Respiratory protection recommendations in the table above establish a time-dependent, maximum use concentrations (MUC). The MUC is calculated by multiplying the NIOSH assigned protection factor of the type of respirator and the target level. Exposures above the MUC require a more protective respirator. The US Army's IDLH level is set as the ceiling level MUC for respirators other than SCBA's.

Note: Respiratory protection specifically approved for CBRN exposures is desirable but where not available, the alternative suitable respirators are other NIOSH approved SCBAs or air purifying respirators with combination organic vapor, acid gas, particulate filters.

Note: All recommendations for personal protective equipment (PPE) should be based on site based job hazard analysis of possible hazards including skin contact, air concentrations, heat stress, etc. Recent estimation of percutaneous absorption of nerve agent vapor suggests that skin absorption through airborne exposures is highly unlikely unless levels are significantly greater than the IDLH levels listed. Skin protection at lower levels should be designed to minimize skin contact with liquid or contaminated surfaces.

Note: All PPE should be used with appropriate additional administrative controls including medical surveillance, employee training, decontamination procedures to limit the potential for unforeseen adverse effects.

Note: Monitoring equipment is summarized in Appendix B.

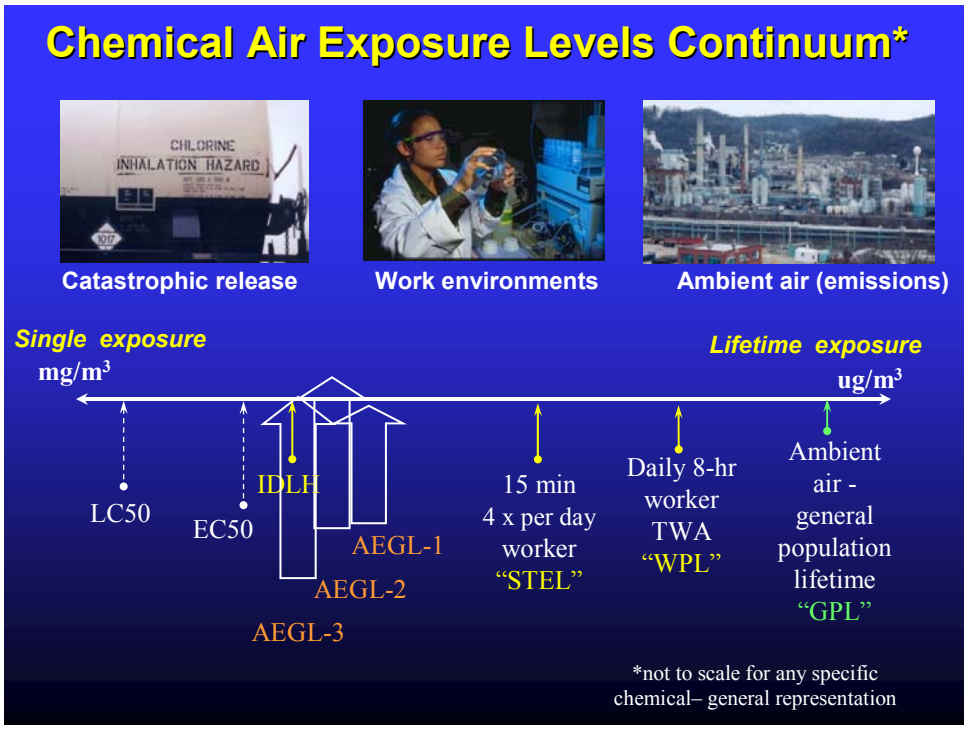
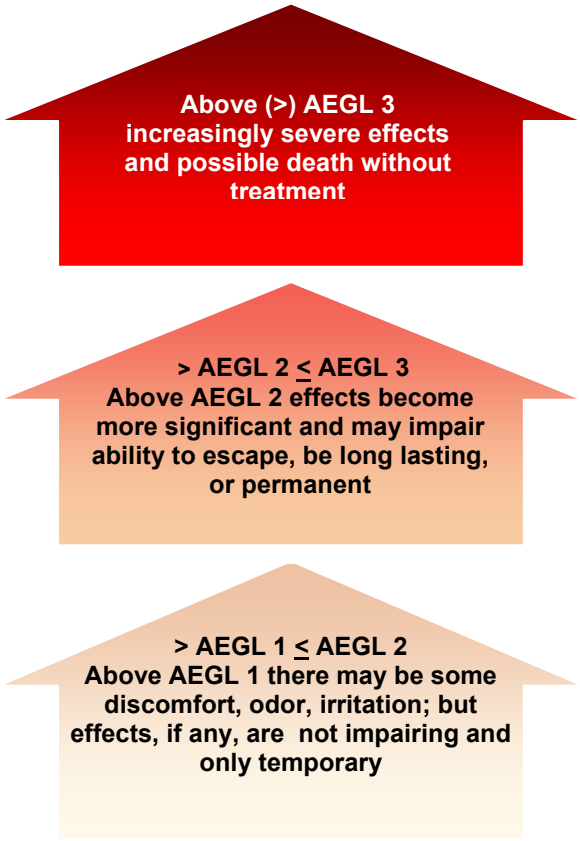

Chemical Air Exposure Levels Continuum*
CHLORINE
INHALATION HAZARD
Catastrophic release
Work environments
Ambient air (emissions)
Single exposure
mg/m3
Lifetime exposure
ug/m3
LC50
EC50
IDLH
AEGL-1
AEGL-2
AEGL-3
15 min
4 x per day
worker
"STEL"
Daily 8-hr
worker
TWA
"WPL"
Ambient
air -
general
population
lifetime
"GPL"
*not to scale for any specific
chemical– general representation

Figure 1.
Generic Description of AEGL Levels*



***Effects described are general in nature and do not reflect the specific effects associated with any particular chemical**

APPENDIX A

USACHPPM Health Effects Associated With Nerve Agent Acute Exposure Guideline Levels (AEGLs)

Background - AEGLs

Acute Exposure Guidelines Levels (AEGLs) are concentrations of a chemical in the air above which different health effects could begin to occur amongst the more sensitive (susceptible) members of the general population. AEGLs are being developed for hundreds of toxic industrial chemicals as well as chemical warfare agents. They are developed by the National Advisory Committee (NAC) for AEGLs, reviewed by the National Research Council (NRC) Committee on Toxicology, and are federal guidance for the assessment and management of short *one-time exposure incidents* (accidents or intentional terrorist attacks) involving releases of chemical gases. Unlike any other toxicity values for emergency response, AEGLs are established for multiple exposure periods ranging from minutes to hours (10 min, 30 min, 1 hr, 4 hr, 8 hr), providing critical information to planners and responders.

The NAC derives AEGLs using a procedure recommended by the NRC[1] to ensure that the following generic levels are protective (safe-sided) for the general population, including susceptible individuals such as children, persons with respiratory illness, and the elderly:

AEGL 1 - level above which non-disabling, reversible discomfort may be noted.
AEGL 2 - level above which more serious effects may occur including possible long-lasting or escape-impairing effects.
AEGL 3 - level above which exposures may become life threatening or result in death.

This Fact Sheet is designed to provide a more specific explanation of the types of health effects associated with the various AEGLs for Nerve Agents depicted in the Table on the next page. Additional information regarding the specific AEGL derivation[2-3] and application[4-6] can be obtained from the references identified below.

Background - Nerve Agents

Nerve agents consist of a group of very toxic organophosphate chemicals specifically designed for military warfare. These include the agents code-named GA (Tabun), GB (Sarin), GD (Soman), GF, and VX. Other organophosphate chemicals include commercial insecticides such as Malathion®. These chemicals all cause similar effects on the human body by disrupting how nerves communicate and control muscles, glands, and organs. Though they cause similar effects, nerve agents are more toxic than commercial insecticides – so smaller amounts can cause effects of concern. Most of the nerve agents exist as liquids but some (such as GB) volatilize into the air on their own. VX is the least likely to become airborne, but in conditions involving explosions, it could vaporize and spread in the air. There are six chemical warfare agent (CWA) stockpiles that contain nerve agents in the U.S. The stockpiles were originally developed during the Cold War, and are now undergoing destruction. However, the potential for terrorist use may still exist after the US stockpiles are destroyed. As a result, many Federal, State, and local emergency planners have identified the need for acute toxicity guidelines for nerve agent to incorporate into emergency and homeland security programs.

Health Effects Associated with Nerve Agent AEGLs

The first effect from vapor exposure to nerve agents is mild levels of miosis, a condition where contracting muscles in the eye cause the pupils to shrink. This is similar to the way the eyes react to bright light; but since the pupils of the eyes normally get bigger in darker environments, a person with miosis from chemical exposure may temporarily (hours) have some trouble seeing in darker environments. There are no distinct susceptible sub-groups to this effect (miosis), but at higher levels, miosis can become more significant, and eventually occur along with other effects such as breathing difficulties to which those with existing respiratory illness may be more susceptible. In the more likely exposure scenario of low nerve agent vapor concentrations only

the surface tissues of the unprotected eye would be affected. Miosis alone is completely reversible without treatment, and it is not associated with long-term effects on any other systems or organs of the body. Key points associated with each AEGL are summarized below:

• Nerve Agent AEGL 1 is the estimated initial concentration *above which* some members of the general population could begin to experience mild miosis and/or slight runny nose. The estimated concentration for this effect is reduced by uncertainty factors (also known as "safety factors") to provide a "margin of safety" (a factor of 10 or more) to ensure that the AEGL 1 is very protective. It is possible that no one, including more susceptible persons, would experience *any* effects at AEGL 1 concentrations. The Figure below shows how the margin of safety is incorporated into the AEGLs.

• Nerve Agent AEGL 2 is the estimated initial concentration *above which* some members of the exposed general population could begin to experience a more significant level of miosis with some runny nose, and possible shortness of breath. As with AEGL 1, the estimated concentration for this effect is reduced by safety factors to provide a margin of safety. This procedure provides a protective AEGL 2, which may result in some cases of miosis (which could last a few hours) and shortness of breath (which are likely to last only minutes after the exposure). *No long-term or permanent effects are expected to result from general public exposure at AEGL 2.*

• Nerve Agent AEGL 3 is designed to protect against severely incapacitating effects (e.g. effects which prevent persons from taking self-protective measures) to include severe nausea/vomiting, seizures and loss of consciousness. Without treatment, such severe effects could lead to death. As with the AEGL Levels 1 and 2, the estimated threshold for this effect is reduced by safety factors to provide a margin of safety. The result is a protective AEGL 3, which may result in some reversible incapacitation, but no deaths to the general public.

References:

1. National Research Council (NRC) (2001). *Standing Operating Procedures for Developing Acute Exposure Guideline Levels for Hazardous Chemicals*. Subcommittee on Acute Exposure Guideline Levels, Committee on Toxicology, National Research Council. National Academy Press, Washington, D.C.
2. Environmental Protection Agency (2001). "National Advisory Committee for Acute Exposure Guideline Levels, (AEGLs) for Hazardous Substances: Proposed AEGL Values." *Federal Register*, Vol 66 (no. 85): 21940-21964 (2 May 2001).
3. Environmental Protection Agency (2002). "National Advisory Committee for Acute Exposure Guideline Levels, (AEGLs) for Hazardous Substances: Public Meeting #26 Highlights"; 10 September 2002 * (changes made to initial *FR proposed VX values)*
4. NRC: 8th Interim Report of the Subcommittee on AEGLs, National Academy Press, Washington D.C (Dec 02) *
5. *Ready-Set-Act Fact Sheet: General Guidance Regarding AEGLs and CSEPP,* www.csepportal.net ;Jan 2003
6. *Basic Questions Regarding AEGLs in Emergency Planning and Response*, USACHPPM Jan 2003

- the official NRC publication containing the final AEGLs for nerve agents is anticipated in March/April 03 to be available at: www.nap.edu

Media- AIR	Standard Name	Population	Exposure Scenario	H/HD/HT	GA (Tabun)	GB (Sarin)	GD/GF	VX	Lewisite	Notes/ Status
Airborne **Exposure Limits (AELs) mg/m^3**	**IDLH** (Immediately Danger to Life/health	civilian/ DoD worker	1 time exposure	NA 2[c]	*0.2*[a, b] 0.1[d]	*0.2*[a, b] 0.1[d]	*0.06*[a,b] 0.05[d]	*0.02*[a,b] 0.01[e]	NA NA	**--IDLH, WPL, STEL, and GPL values from Final Army technical re-evaluation reports :** --Revisions to existing criteria NOT officially established in Army policy as of 5/01 but Internal (MEDCOM) staffing of revised Army regulation (DA Pam 40-8, 40-173) underway; Goal is to finalize DA Pams by end FY02
	***STEL** (Short Term Exposure Limit)	civilian/DoD worker	occasional 15-minute exposure (4x ea day)	0.003[c] *(see note)*	0.0004[d] *(see note)*	0.0004[d] *(see note)*	0.0002[d] *(see note)*	0.00004[e] *(see note)*	NA NA	*STEL is new **proposed** standard not previously established
	WPL (Worker Population Limit)	civilian/DoD worker	8-hr, daily/ 30-yr. Time-weighted average	*0.003*[b,f,g] 0.0004[c] *(see note)*	*0.0001*[a,b,g] 0.0001[d] *(see note)*	*0.0001*[a,b,g] 0.0001[d] *(see note)*	*0.00003*[a,b,g] 0.00003[d] *(see note)*	*0.00001*[a,b,g] 0.00001[e] *(see note)*	*0.003*[a,b] --	NOTE: CDC has proposed modified (lower than new Army proposed values) for the nerve agents in the *Federal Register* (Jan 8 2002; 67 FR: 894-901) The Army non-concurred with the CDC modifications (see reference h). No final CDC position has been identified. CDC is currently evaluating the Army proposed HD values. (references c, d e).
	GPL (General Population Limit)	civilian population	24-hr/daily, lifetime time-weighted avg.	*0.0001*[b,f,g] 0.00002[c] *(see note)*	*0.000003*[a,c] 0.000003[d] *(see note)*	*0.000003*[a,c] 0.000003[d] *(see note)*	*0.000001*[a,c] 0.000001[d] *(see note)*	*0.000001*[a,b,g] 0.0000003[e] *(see note)*	*0.003*[a,] --	- No re-evaluation of Lewisite has been performed. ** NOTE: Lewisite values are all based on detection; no true IDLH exists (AR 385-61, Table 2-2, 2-3)
AEGLs **mg/m^3**	**Acute Exposure Guideline Levels**	Emergency/ Accident scenario	1 time exposure :	***HD***	***GA***	***GB***	***GD/GF***	***VX***	***L***	
	AEGL - LEVEL 1 Potential minor discomfort or noticeable effects; reversible	civilian population	10 MIN:	0.40[i]	0.0069	0.0069[j]	0.0035[j]	0.00057[j]	NA	Sulfur Mustard AEGLs have completed all stages of established review process (AEGL-NAC, *Federal Register*, and NRC). They were endorsed by National Research Council (NRC) Committee on Toxicology (COT) as of 1/01; Final values scheduled to be published by the NRC in CY 2002
			30 MIN:	0.13[i]	0.0040	0.0040[j]	0.0020[j]	0.00033[j]	"	
			1 HR:	0.067[i]	0.0028	0.0028[j]	0.0014[j]	0.00017[j]	"	
			4 HR:	0.017[i]	0.0014	0.0014[j]	0.00070[j]	0.00010[j]	"	
			8HR:	0.0083[i]	0.0010	0.0010[j]	0.00050[j]	0.000071[j]	"	
	AEGL- LEVEL 2 Level where more obvious effects begin; Potentially impacting functional abilities or ability to Escape; Potential delayed recovery		10 MIN:	0.60[i]	0.087	0.087[j]	0.044[j]	0.0072[j]	"	
			30 MIN:	0.20[i]	0.050	0.050[j]	0.025[j]	0.0042[j]	"	
			1 HR:	0.10[i]	0.035	0.035[j]	0.018[j]	0.0029[j]	"	
			4 HR:	0.025[i]	0.017	0.017[j]	0.0085[j]	0.0015[j]	"	Nerve agents (G-Agents, VX) AEGLs were proposed in Fed Register in May 01; presented as INTERIM AEGLs to the NRC-COT for final review in February 2002. On Sept 10 02 they were finalized – after changes made to VX values (raised by factor of 3, based on NRC recommendation that the relative potency of GB: VX is less than originally proposed). *These values will be published in Vol 3 of the NRC series of AEGLs (anticipated early-mid 2003)*
			8HR:	0.013[i]	0.013	0.013[j]	0.0065[j]	0.00104[j]	"	
	AEGL - LEVEL 3 Life threatening; Level of potential initial fatalities		10 MIN:	3.9[i]	0.76	0.38[j]	0.38[j]	0.029[j]	"	
			30 MIN:	2.7[i]	0.38	0.19[j]	0.19[j]	0.015[j]	"	
			1 HR:	2.1[i]	0.26	0.13[j]	0.13[j]	0.010[j]	"	
			4 HR:	0.53[i]	0.14[j]	0.070[j]	0.070[j]	0.0052[j]	"	
			8HR:	0.27[i]	0.10[j]	0.051[j]	0.051[j]	0.0038[j]	"	
MEGs mg/m^3	**Military Exposure Guidelines (Air)** ** **NOTE: refer to**	Effect level	Exposure duration	***HD***	***GA***	***GB***	***GD/GF***	***VX***	***L***	CHPPM-recommended values based on AEGLs, plus a MEG for 24-hr exposures. Considered conservative but appropriate for diverse military population with some genetically susceptible individuals, just as in
		None-minimal	1time –24 hour	(0.003[k])	(0.0003[k])	(0.0003[k])	(0.0002[k])	(0.000027[k])	NA	
		None-minimal	**See AEGL 1 durations and associated values above values**						(0.003[k])	

	AEGLs above; for durations > 24 hrs additional guidelines are provided:	Significant	**See AEGL 2 durations and associated values above values**	NA	general population – USACHPPM TG230 Jan02* will be updated by Jan 03 to reflect slight changes to AEGL-based MEGs..
		Severe	**See AEGL 3 durations and associated values above values**	(0.003 [k])	

NOTES: ( ) Numbers in parentheses are from draft documents

HIGHLIGHTED values indicate changes from previous version of this Table (12/01)

GREEN Numbers in Green are currently documented in official Army regulation/policy/or through DA Headquarters endorsement

BLUE Numbers have been developed/endorsed by non-DoD federal proponents for Army and non-Army use

RED Numbers are still officially used/endorsed by Army/other approving entity source **but** revisions are proposed/underway

BLACK Numbers are final/interim final technical values but are not yet approved for official implementation by proponent agency

*STEL is new proposed standard not previously established

** Lewisite values are all based on detection; no true IDLH exists (AR 385-61, Table 2-2, 2-3)

PINK – regarding ongoing CDC review of AELs and potential changes to "new" (in black) Army proposed values

REFERENCES:

a) DA Pamphlet 40-173: *Occupational Health Guidelines for the Evaluation and Control of Exposure to Nerve Agents GA, GB, GD, and VX*; Medical Services, 4 Dec 1990

b) AR 385-61: *The Army Chemical Agent Safety Program*; Safety; 28 February 1997

c) USACHPPM Technical Report: *Evaluation of Airborne Exposure Limits for Sulfur Mustard (HD): Occupational and General Population Exposure Criteria*, Technical Report 47-EM-3767-00, November, 2000

d) Mioduszewski et al.; *Evaluation of Airborne Exposure Limits for G-Agents: Occupational and General Population Exposure Criteria*, ERDEC-TR-489; April 1998. (and February, 2000 Errata Summary)

e) Reutter et al.; *Evaluation of Airborne Exposure Limits for VX: Occupational and General Population Exposure Criteria*; ECBC-TR-074; February 2000.

f) DA Pamphlet 40-8: *Occupational Health Guidelines for the Evaluation and Control of Exposure to Mustard Agents H, HD, and HT*; Medical Services, August 1991

g) The Centers for Disease Control (CDC) of the Department of Health and Human Services (DHHS) 1988. *Recommendations for Protecting Human Health and Safety Against Potential Adverse Effects of Long-Term Exposure to Low-Doses of Agents GA, GB, VX, Mustard Agents (H. HT, HD) and Lewisite (L)*, *Federal Register*, Vol. 53 No 50, page 8504, Tuesday, March 15, 1988.

h) March 14 2002, signed by Mr. Raymond J. Fatz, Deputy Assistant Secretary of the Army, (Environment, Safety and Occupational Health) OASA(I&E), addressed to Dr. Paul Joe, Centers for Disease Control (CDC); subject comments to Federal Register request for comments, (Jan 8 2002; 67 FR: 894-901).

i) **Final Acute Exposure Guideline Levels (AEGLs) for Sulfur Mustard (Agent HD):** the **6th Interim Report of the COT Subcommittee on AEGLs (Dec 2001)**, the COT Subcommittee formally states "The subcommittee concluded that the revised document conforms with the *Guidelines for Developing*

Community Emergency Exposure Levels for Hazardous Substances (1993) and *Standing Operating Procedures for Developing Acute Exposure Guideline Levels for Hazardous Substances* (2001), and that no further modifications to the document are required." The final values will be formally published by the National Academy Press, expected out in CY 2002.

j) **Final Acute Exposure Guideline Levels (AEGLs) for G-Agents, Final Temporary Acute Exposure Guideline Levels (AEGLs) for Nerve Agent VX**: proposed in 66 FR 21940 (May 2, 2001) and upgraded to "Interim" and without any change in June 2001. Per National Research Council (NRC) Committee on Toxicology (COT) review, and NAC-AEGL meeting # 26 , 1201 Constitution Ave, NW, Rm 1117, EPA, Washing ton DC, 10 September 2002 G-agent and VX AEGLs were finalized after making changes to interim VX AEGLs (all raised by factor of 3). This will be documented in meeting minutes (not yet available) and in the final Nerve Agent AEGL technical support document, be formally published by the National Academy Press, expected out in early CY 2003.

k) USACHPPM Technical Guide 230 Chemical Exposure Guidelines for Military Personnel, January 2001, updated errata April 02, **UPDATE VERSION with revised chemicals agent AEGLs to be published Jan/Feb 03.**

APPENDIX B

CHEMICAL DETECTION EQUIPMENT

There are various detectors available for detecting Chemical Warfare Agents and Toxic Industrial Chemicals. Systems considered for use are described in Table 1 below. Specific recommendations for each are also provided.

ITEM/ **DETECTOR TYPE**	**KEY POINTS**	**SENSITIVITY**	**COST**
JCAD CHEMSENTRY • Surface Acoustical Wave (SAW), electro chemical cell, and internal bay for additional sensor. • Real-time CWA and TIC detector • Mfg by BAE Systems: http://www.chembiosolutions.com/index.asp • SBCCOM: http://www.sbccom.apgea.army.mil/products/jcad.htm	• Intended to replace all current US military chemical point detection systems. • Detects, identifies, quantifies, and reports the presence of chemical warfare agents and certain TIC. • Can be hand-held, worn, or installed as a fixed detector. • Detects: VX, G-series nerve, H-series blister and lewisite, AC blood agent, CK blood agent, Ammonia, Arsine, Benzene, Chlorine, Diborane, Hydrogen Sulfide, Hydrogen Sulfide, and Toluene.	• Actual sensitivity data is classified. • Meets DoD detection requirements (sub IDLH).. • Can detect in parts per trillion range with pre-concentrator, which may allow detection at TWA levels.	• Approximately $10,000 for complete kit. • Cost includes training in Austin, TX. • Cost includes free software updates and tech support for 1 year.

ITEM/ **DETECTOR TYPE**	**KEY POINTS**	**SENSITIVITY**	**COST**
APD 2000 • Ion Mobility Spectrometry (IMS). • Mfg by Smiths Detection: http://www.smithsdetection.com/	• Detects and identifies chemical warfare agents, pepper spray and mace. • Integrated gamma radiation dosimeter. • Hand-held, easy to use. • Widely used by various agencies, including FBI, EPA, and Capitol Police. • Tested by SBCCOM, Aug. 2000. • Has had considerable software upgrades improving performance since SBCCOM test.	• Approximately ½ IDLH for nerve agents. • Cannot detect at TWA levels.	• Approximately $9,000.
MINICAMS • Specialized Gas Chromatograph with choice of various detectors. • Mfg by OI Corporation: http://www.oico.com/cms.htm	• Automatic, and near-real-time continuous monitor and alarm system. • Can detect all chemical warfare agents, simulants, and related compounds. • Can be calibrated with simulants. Preferable to calibrate with actual agents; would have to make arrangements with military or others to calibrate. • Portable unit, but not hand-held.	• Can detect below TWA levels for all compounds. • Can detect at general population limits for some agents.	• Approximately $35,000 to $50,000.

ITEM/ **DETECTOR TYPE**	**KEY POINTS**	**SENSITIVITY**	**COST**
ANACHEMIA DETECTORS • M-8, M-9, 3-Way chemical agent liquid detector papers. • M256A1 Chemical Agent Detector Kit. • NAVD Nerve Agent Vapor Detector • C-2 Chemical Agent Detector Kit • Mfg by Anachemia Inc., Canada: http://www.anachemia.com/engnew/frame/product4.html	• Have been used for many years by the US Military • Colorimetric detector papers determine the presence of nerve or blister agents in liquid form. • M256A1 kit contains ampoules for detecting nerve, blister, and blood agents, as well as liquid detector papers. • NAVD contains colorimetric indicators for nerve agent vapors. • C-2 kit detects and identifies agent liquids and vapors.	• Can detect below IDLH levels. • Cannot detect at TWA levels. • Generally used as a qualitative indicator	• Detector paper booklets: $5 to $15 each. • NAVD: $5 • M256A1: $150 • C-2: $550
DRAGER CIVIL DEFENSE SIMULTEST (CDS) /HAZMAT KIT • Detector tube hazmat response kit. • Mfg by Draeger Safety: http://www.draeger.com/us/ST/Ag.jsp	• Screening kit; detects and identifies wide range of chemical warfare agents and various toxic TICs. • Colorimetric tubes placed in parallel sets for simultaneous detection of the various chemicals. • A mechanical hand pump is used to draw air through the tubes. • Standard, widely-used kit used for screening by hazmat and other responding groups.	• Primarily detection around IDLH levels.	• Approximately $1700
JCAD CHEMSENTRY • See information in CWA section above.			

ITEM/ **DETECTOR TYPE**	**KEY POINTS**	**SENSITIVITY**	**COST**
DRAGER CIVIL DEFENSE SIMULTEST (CDS)/HAZMAT KIT • See information in CWA section above.			
DRAGER DETECTOR TUBES • Short-term conventional gas detector tubes. • Mfg by Draeger Safety: http://www.draeger.com/us/ST/Ag.jsp	• Several tubes are available, covering approximately 50 chemicals on the list of TICs. • Fast and easy to use.	• Below IDLH and TWA levels.	• $50-$100 per pack of 10 tubes
DRAGER PAC III • Single-gas detector using exchangeable electrochemical sensors. • Mfg by Draeger Safety: http://www.draeger.com/us/ST/Ag.jsp	• Several sensors are available, enabling detection and alarm for approximately 20 of the chemicals on the list of TICs. • Small, lightweight, can be hand-held or worn.	• Below IDLH and TWA levels.	• Approximately $400 for unit, $200 for each sensor
DRAGER MINIWARN • Four-gas detector using exchangeable electrochemical sensors. • Mfg by Draeger Safety: http://www.draeger.com/us/ST/Ag.jsp	• Simultaneous measurement of 1-4 gases. • Three exchangeable electrochemical sensors and one Oxygen/LEL sensor. • Several sensors are available, enabling detection and alarm for approximately 20 of the chemicals on the list of TICs. • Uses same sensors as the Pac III. • Small, lightweight, can be hand-held or worn.	• Below IDLH and TWA levels.	• Approximately $2000 for unit, $200 for each sensor

ITEM/ **DETECTOR TYPE**	**KEY POINTS**	**SENSITIVITY**	**COST**
PHOTOVAC 2020PRO PID • Photoionization detector (PID). • Mfg. by Photovac Inc.: http://www.photovac.com • Other brands of PIDs also merit consideration, such as HNU http://www.hnu.com/ and Rae Systems http://www.raesystems.com/	• Non-specific screening detector for VOCs. • Able to detect many TICs. • Hand-held.	• Below IDLH and TWA levels.	• Approximately $3400
MIL-RAM TOX-ARRAY 1000 • Single-gas detector using electrochemical sensors • Mfg. by MIL-RAM http://www.mil-ram.com/products/ta_1000.html	• Several sensors are available, enabling detection and alarm for approximately 7 of the chemicals on the list of TICs (not covered by Drager).	• Below IDLH and TWA levels.	• $2500

Appendix B Continued

Personal Protective Equipment

There are various PPE ensembles available for protection against chemical warfare agents and toxic industrial chemicals. PPE considered for use is described in Table 2 below. Specific recommendations for each are also provided.

ITEM	**KEY POINTS**	**COST**
SCBA RESPIRATORS • Scott Models: TC-13F- 76CBRN Air-Pak 4.5 (30 minute) TC-13F-212CBRN Air-Pak 4.5 (45 minute) TC-13F- 96CBRN Air-Pak 4.5 (60 minute www.scotthealthsafety.com • Interspiro Models: TC-13F-133CBRN Spiromatic 4530 and Spiromatic S3 4530 (30 minute) TC-13F-213CBRN Spiromatic 6630 and Spiromatic S3 6630 (45 minute) TC-13F-197CBRN Spiromatic 9030 and Spiromatic S3 9030 (60 minute) TC-13F-375CBRN Spirotek S3 4530 (30 minute) TC-13F-420CBRN Spirotek S3 6630 (45 minute) TC-13F-421CBRN Spirotek S3 9030 (60 minute) www.interspiro-us.com	• These are currently the only CBRN approved SCBAs. • Must be disposed of if contaminated with liquid chemical warfare agents (according to NIOSH). • Existing SCBAs inventories can be used for TICs	• $3000-$4000

ITEM	**KEY POINTS**	**COST**
PAPR RESPIRATORS • SEA SE400 Fan supplied, positive pressure, breath responsive, demand respirator (FPBR). www.sea.com.au • 3M Breathe Easy 10 Butyl Rubber Hood/Tight Fitting PAPR System www.3m.com	• These are currently NO CBRN approved PAPRs and there will be none for some time. • Both models have specific cartridges for CWAs/TICs • SEA PAPR is not intrinsically safe. • Must be disposed of if contaminated with liquid chemical warfare agents (according to NIOSH) • SEA SE400 has optional pressurization hose which can be used to pressurize Level C suit (pressurization hose is NOT NIOSH approved yet, but it provides superior vapor protection inside suit).	• SEA SE400: $2000 • 3M Breathe Easy: $1000
APR RESPIRATORS (FULL FACE) • No specific manufacturer/model recommendations. • Full Face APR with an acid gas/organic vapor/HEPA combo cartridge should be adequate up to the APF of the respirator	• These are currently NO CBRN approved full-face APRs. NIOSH expects to have approved respirators in a few weeks • Must be disposed of if contaminated with liquid chemical warfare agents (according to NIOSH) • CBRN respirators may be manufactured with natural rubber, which could decrease fit performances as compared to silicone.	• $100-$300

ITEM	**KEY POINTS**	**COST**

LEVEL A SUITS
• There are a number of Level A suits that have had manufacturer testing for CWA/TIC. Some suits have also been 3rd party tested by Soldier and Biological Chemical Command (SBCCOM). Reports of this testing can be found at:
  • http://hld.sbccom.army.mil/ip/levela_executive_report_download.htm
  • http://hld.sbccom.army.mil/ip/phase2_levela_suits_summary_report_download.htm
• Dupont Tychem and Trelleborg Trellchem suits appear to have good test results and depending on the application could be considered for OSHA use.
  • http://personalprotection.dupont.com/
  • http://www.trelleborg.com
	• There is some difference in breakthrough times for HD vs. GB for some suits.
	• Kappler is now owned/manufactured by Dupont
	• Research possibility of using disposable Level A suits.
		• $750 - $2000 per suit

ITEM	**KEY POINTS**	**COST**

LEVEL B/C SUITS
• There are a number of Level B suits that have had manufacturer testing for CWA/TIC. Some suits have also been 3rd party tested by Soldier and Biological Chemical Command (SBCCOM). Reports of this testing can be found at:
  • http://hld.sbccom.army.mil/ip/levelb_summary_report_download.htm
  • http://hld.sbccom.army.mil/ip/phase2_levelb_suits_summary_report_download.htm
 	
• Dupont Tychem and Trelleborg Trellchem suits appear to have good test results and depending on the application could be considered for OSHA use.
 	
  • http://personalprotection.dupont.com/
 	
  • http://www.trelleborg.com
	• There is some difference in breakthrough times for HD vs. GB for some suits.
	• Kappler is now owned/manufactured by Dupont
	• Tychem F is a good lightweight CWA suit.
	• The SEA SE 400 PAPR ensemble in the suit pressurization mode requires use of a specific SEA Level C suit to accommodate the respirator location inside the suit.
	.
		• $150 - $350 per suit

ITEM	**KEY POINTS**	**COST**

GLOVES
• There are a number of gloves that have had manufacturer testing for CWA/Toxic TICs. Some gloves have also been 3rd party tested by Soldier and Biological Chemical Command (SBCCOM). Reports of this testing can be found at:
  • http://hld.sbccom.army.mil/ip/protective_gloves_summary_report_download.htm
  • http://hld.sbccom.army.mil/ip/protective_gloves_phase2_ca_download.htm
• Best choices for CWA based upon breakthrough time appear to be butyl rubber, Silver Shield, and 4H
	• For use with Level B/C ensembles.
	• SEA SE 400 specific suit has integrated Silver Shield gloves.
	• Other glove options exist for TICs.
		• $4/pair for Silver Shield and 4H
		• $30/pair for Butyl Rubber

BOOTS • There are a number of boots that have had manufacturer testing for CWA/TIC. Some gloves have also been 3rd party tested by Soldier and Biological Chemical Command (SBCCOM). Reports of this testing can be found at: • http://hld.sbccom.army.mil/ip/protective_boots_summary_report_download.htm • Best choices for CWA appear to be Tingley Hazproof, Lacrosse, and Bata.	• For use with Level B/C ensembles. • Other boot options exist for TICs. • A number of over-boot options also exist. • Boots can be decontaminated and reused for multiple entries depending upon the extent of contamination.	• $50-$100/pair

Appendix B Continued

Software

There are various software programs available to assist with preparation and response to releases of chemical warfare agents and toxic TICs. Several of these software programs are described in Table 3 below. Specific recommendations for each are also provided.

Table 3
Software for Chemical Warfare Agents and Toxic Industrial Chemicals

ITEM	**KEY POINTS**	**COST**	**RECOMMENDATIONS**
SOFTWARE			
PEAC-CWA • Palmtop Emergency Action for Chemicals (PEAC) decision-making software designed for PC and handheld computers. • Manufactured by AristaTek, Inc. http://www.aristatek.com/ • Sponsored by the federal Technical Support Working Group (TSWG) http://www.tswg.gov/tswg/cbrnc/PEACPress.htm	• PEAC-CWA system contains comprehensive information on chemical properties, PPE, exposure limits, etc. from a number of sources, including NIOSH, EPA, AIHA, and DOT for over 10,000 chemicals (including CWAs), biological agents, radioactive isotopes, and explosives. • User-friendly; chemical and synonym searchable.	• $1495 for Pocket PC Version (additional copies are 1% discounted up to 15% max) • $1295 for PC version (additional copies are $650 (2-4), $390 (5-9), $325 (10-19), $260 (20-29). • 1st year upgrades included. After 1st year, upgrades are $200 per copy.	• Procure copies for HRT • Procure copies for Regions

Table 3
Software for Chemical Warfare Agents and Toxic Industrial Chemicals

ITEM	**KEY POINTS**	**COST**	**RECOMMENDATIONS**
CAMEO • CAMEO ® is a system of software applications used widely to plan for and respond to chemical emergencies. It is one of the tools developed by EPA's Chemical Emergency Preparedness and Prevention Office (CEPPO) and the National Oceanic and Atmospheric Administration Office of Response and Restoration (NOAA), to assist front-line chemical emergency planners and responders. • Available from EPA: http://www.epa.gov/ceppo/cameo/what.htm	• The original application, called CAMEO, contains a chemical database of over 6,000 hazardous chemicals, 80,000 synonyms, and product trade names. CAMEO provides a powerful search engine that allows users to find chemicals instantly. Each one is linked to chemical-specific information on fire and explosive hazards, health hazards, firefighting techniques, cleanup procedures, and protective clothing. CAMEO also contains basic information on facilities that store chemicals, on the inventory of chemicals at the facility (Tier II) and on emergency planning resources. Additionally, there are templates where users can store EPCRA information. CAMEO connects the planner or emergency responder with critical information to identify unknown substances during an incident. • The software suite also includes a mapping application and an atmospheric dispersion model	• Free	• Evaluate for potential use by HRT and/or Regions

Table 3
Software for Chemical Warfare Agents and Toxic Industrial Chemicals

ITEM	**KEY POINTS**	**COST**	**RECOMMENDATIONS**
RMP INFO • RMP*Info, initially posted to the Internet on June 30, 1999, contains the risk management plans reported by facilities that are subject to the Clean Air Act, Section 112(r). However, in compliance with the Chemical Safety Information, Site Security and Fuels Regulatory Relief Act (August 5, 1999), which exempts the offsite consequence analysis (OCA) data sections from disclosure under the Freedom of Information Act (FOIA) and limits its public availability for at least one year, RMP*Info does not contain the OCA data sections.	• Database that contains facility specific information similar to that required by the PSM Standard 1910.119 • The information in the database would be useful in identifying chemical facilities, quantities, etc. for local and regional offices to assist them in their response preparation efforts. • Note: the database only covers certain chemicals above threshold quantities.	• Currently unavailable to public	• Investigate the possibility of obtaining copies of RMP info from EPA

Appendix B Continued

Training

There are various training materials and resources available to assist with preparation and response to releases of chemical warfare agents and Toxic Industrial Chemicals. Several of these training resources are described in Table 4 below. Specific recommendations for each are also provided.

COURSE	**KEY POINTS**	***COST***

DOJ-OFFICE OF DOMESTIC PREPAREDNESS
• The DOJ - Office of Domestic Preparedness sponsors an extensive list of training opportunities regarding planning for, and responding to terrorist incidents. The following training providers are a sample of the training capabilities.
  • Center for Domestic Preparedness provides training primarily to state and local emergency responders at the former US Army Chemical School, Fort McClellan. Hands on, live chemical agent training helps responders gain high levels of confidence in equipment, procedures, and individual capabilities. CWA HAZMAT Technician and CWA Incident Command courses are offered. Contact the CDP at (256) 847-2132.
  • Texas A&M University (National Emergency Response and Rescue Training Center) delivers an extensive set of courses to for personal involved in all facets of response to CWA incidents.
	• Further information can be obtained at http://www.ojp.usdoj.gov/odp/ta/training.htm. The comprehensive catalogue available at http://www.ojp.usdoj.gov/odp/docs/coursecatalog.pdf is downloadable in PDF format. It contains course, provider, and contact information for all sponsored courses.	• Varies by course.

COURSE	KEY POINTS	*COST*
Applicable onsite courses include CWA Threat and Risk Assessment, CWA Incident Management/Unified Command, Emergency Response to Terrorism Basic Concepts • An interactive, online Terrorism Awareness for Emergency Responders course is designed for a large, multi-discipline audience. The 3-4 hour course consists of modules similar to the new web -based training OTI is developing. All training and course material are free to eligible participants. Contact Steve Hightower of TEEX at 877-438-8877 for specific, online course information. View information on TEEX at http://www.teexCWAcampus.com • National Terrorism Preparedness Institute located at St. Petersburg Junior College, delivers a satellite-based training program titled CoMNET (Consequence Management News, Equipment, and Training). CoMNET is a news magazine style show providing CWA-related awareness information. This program is a joint effort between ODP, the Combating Terrorism Technology Support Office, TSWG, and the Consequence Management Program Integration Office within DOD. No contact information		

COURSE	KEY POINTS	*COST*
provided. • Pine Bluff Arsenal is responsible for the day-to-day management of the Domestic Preparedness Equipment Technical Assistance Program. DPETAP provides emergency response personnel with on-site technical assistance and training on the calibration, use, and maintenance of radiological, chemical, and biological detection equipment. Contact Gwendt@genphysics.com for information.		
FEMA EMERGENCY MANAGEMENT INSTITUE • EMI staff provide training to enhance U.S. emergency management performance through a nationwide program of resident, field, and distance learning activities. 8,000 students attend resident courses at EMI each year while thousands of others participate in field training sponsored by EMI and conducted by State emergency management agencies. Hundreds of thousands more use EMI web-satellite television-, and text-based distance learning programs. EMI instruction focuses on the four phases of emergency management: mitigation, preparedness, response, and recovery, and covers areas such as natural hazards (earthquakes, hurricanes, floods), man-made hazards (terrorism, hazardous materials, radiological emergency	• Further information can be obtained at http://training.fema.gov/EMIWeb/	• Varies by course.

COURSE	**KEY POINTS**	***COST***
preparedness), and also includes professional development, leadership, instructional methodology, exercise design, and public information. All EMI training is developed in partnership with State and local emergency management agencies		
CHEMICAL STOCKPILE EMERGENCY PREPAREDNESS PROGRAM (CSEPP) • Various CWA training courses and materials are available through CSEPP.	• Further information can be obtained at: http://cseppweb-emc.ornl.gov/CSEPPTraining.html •	• Varies by course