

**Table 2. Summary of Multi-Media Chemical Agent Toxicity and Exposure Values: Existing Information as of 8/03/04 POC V. Hauschild, USACHPPM, 410-436-5213**

Media	Standard/Guideline Name	Population	Exposure Scenario	H/HD/HT (Mustard)	GA (Tabun)	GB (Sarin)	GD/GF	VX	Lewisite	Notes/Status	
WATER	FDWS (Field Drinking Water Standards) ug/L	designed for military * but can have civilian applications	safe for for up to 7 days	200 <sup>a</sup>	20 <sup>a</sup>	20 <sup>a</sup>	20 <sup>a</sup>	20 <sup>a</sup>	200 <sup>a</sup>	The last published version of TB Med 577 ( <i>ref a</i> ) was in 1986, this has being superseded and the new values shown have been endorsed by DoD (see <i>ref b</i> ). The new version of TB Med 577 is still DRAFT (final publication expected in end 2004 (410-436-3919 for info) * See note below (next page)	
			normal/humid climate - 5 L/day ingestion rate	(140) <sup>b</sup>	(12*) <sup>b</sup>	(12*) <sup>b</sup>	(12*) <sup>b</sup>	(12*) <sup>b</sup>	(12*) <sup>b</sup>		(80) <sup>b</sup>
			dry/arid climate - 15 L/day ingestion rate	(47) <sup>b</sup>	(4*) <sup>b</sup>	(4*) <sup>b</sup>	(4*) <sup>b</sup>	(4*) <sup>b</sup>	(4*) <sup>b</sup>		(27) <sup>b</sup>
SOIL	HBESL – Residential (Health-Based Environmental Screening Levels) mg/kg	civilian general population: adults and children	daily exposure via ingestion, inhalation, and dermal contact for a lifetime	0.01 <sup>c,d,e</sup>	2.8 <sup>c,d,e</sup>	1.3 <sup>c,d,e</sup>	0.22 <sup>c,d,e</sup>	0.042 <sup>c,d,e</sup>	0.3 <sup>c,d,e</sup>	HBESLs were endorsed by Army headquarters (ESOH) in May 99 ( <i>ref c</i> ) and were derived (by Army, <i>ref d</i> ) using chronic toxicity criteria with risk assessment models and assumptions similar to EPA Reg IX preliminary remediation goals (PRGs). HBESLs are conservative screening criteria for assessing potential long-term human exposure to soil contaminated from liquid agent (ambient vapor alone would be unlikely to result in deposition or soil contamination). HBESL are also used as criteria to determine public release of decontaminated items/property ( <i>ref e</i> ). Note that many agent-certified laboratories may not be able to achieve these levels. Also note that where there is potential HD or VX soil contamination, breakdown products may also warrant evaluation (see <i>ref d, f &amp; App F</i> ).	
	HBESL – Industrial mg/kg	civilian general adult population	frequent exposures via ingestion, inhalation, and dermal contact: 250 days/year for 30 years	0.3 <sup>c,d</sup>	68 <sup>c,d</sup>	32 <sup>c,d</sup>	5.2 <sup>c,d</sup>	1.1 <sup>c,d</sup>	3.7 <sup>c,d</sup>		
WASTE	HWCL <sup>sol</sup> (solid hazardous waste control limit) mg/kg	civilian/DoD worker	possible occasional exposure at HW treatment facility	6.7 <sup>g,h</sup>	680 <sup>g,h</sup>	320 <sup>g,h</sup>	52 <sup>g,h</sup>	10 <sup>g,h</sup>	37 <sup>g,h</sup>	Waste values were derived (by Army – <i>ref g,h</i> ) using chronic toxicity criteria with a risk assessment model similar to that used by EPA Region IX. Assumptions denote specific exposure scenarios associated with waste materials and workers potentially exposed to them (assumes exposures to the general public are controlled) were used. Values were initially documented in a Department of Army proposed hazardous waste management rule presented to the State of Utah ( <i>ref h</i> ) and later in an Oct 2000 USACHPPM memo to PMCD ( <i>ref g</i> ). Values were not officially endorsed by Utah but as of June 2004 were endorsed in DA policy ( <i>ref e</i> ) for site-specific consideration/use.	
	HWCL <sup>liq</sup> (liquid hazardous waste control limit) mg/L	worker civilian/ DoD	possible occasional exposure at HW treatment facility	0.7 <sup>g,h</sup>	20 <sup>g,h</sup>	8.3 <sup>g,h</sup>	0.3 <sup>g,h</sup>	0.08 <sup>g,h</sup>	3.3 <sup>g,h</sup>		
	NHWCL <sup>e</sup> (non-hazardous waste control limit (haz waste exemption level) <sup>f</sup> ) mg/kg	worker civilian/ DoD	possible occasional exposures at a non-HW land disposal facility	0.3 <sup>g,h</sup>	68 <sup>g,h</sup>	32 <sup>g,h</sup>	5.2 <sup>g,h</sup>	1.1 <sup>g,h</sup>	3.7 <sup>g,h</sup>		
Chronic Toxicity Reference Criteria (for use in risk assessment calculations)	RfD <sub>o</sub> (Oral Reference Dose) mg/kg-day	General population: adults and children	chronic (lifetime) ingested dose at or below which no adverse health effects are expected	0.000007 <sub>i,j,k</sub>	0.00004 <sub>i,j,k</sub>	0.00002 <sub>i,j,k</sub>	0.000004 <sub>i,j,k</sub>	0.000006 <sub>i,j,k</sub>	0.0001 <sub>i,j,k</sub>	NRC/COT ( <i>ref i</i> , 1999) gave general endorsement of values; addressed in DA OTSG endorsement letter of final RfDs (Feb 2000, <i>ref j</i> ); most current documentation of basis and overall status of these values is in a peer-reviewed article ( <i>ref k</i> )	
	CSF <sub>o</sub> Oral Cancer Slope Factor (mg/kg/day) <sup>-1</sup>	General population: adults and children	represents the potency of the agent by ingestion to cause increased cancer risk	7.7 <sub>i,j,k</sub>	Not determined to be a carcinogen					In 1999 the NRC/COT ( <i>ref i</i> ) endorsed a less conservative HD CSF <sub>o</sub> of 1.6; DA OTSG (Feb 00) has currently endorsed use of the 7.7 ( <i>ref j</i> , <i>ref k</i> )	
	Inhalation Unit Risk (ug/m <sup>3</sup> ) <sup>-1</sup>	General population: adults and children	represents the potency of the agent by inhalation to cause increased cancer risk	0.0041 <sup>i</sup>						See Table 20 HD HCD, Nov 00 ( <i>ref l</i> )	

Table 2. Multi-Media Chemical Agent Toxicity and Exposure Values Summary Table: Existing Information as of 8/03/04 POC V. Hauschild, USACHPPM, 410-436-5213

**NOTES:**

**HIGHLIGHTED information indicate noteworthy change/addition from previous version of this Table (other non-substantial clarifying edits not highlighted)**

( ) Numbers in parentheses are from draft documents

**GREEN** Numbers in Green are currently documented in official Army regulation/policy/or through DA Headquarter 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 black are final technical values but are not officially approved for implementation through a proponent agency

\* **Application of drinking water criteria.** It is noted that contamination of large water supplies with chemical agents is relatively unlikely due to effects of hydrolysis, dilution, and the neutralizing effects of common water treatment processes (e.g. chlorine). These values were designed for a military scenario, in which smaller containerized water supplies directly used for consumption might be intentionally contaminated with significant amounts of agent. Theoretically this situation could result in residual agent levels of concern for several days. The values here assume up to 7 days exposure at 5-15 liters/day consumption – which is an extremely high rate of drinking based on hot environments and high physical activity. Although these drinking water values were not originally developed for general population application, they would be appropriate for use as screening levels for civilian applications where ingestion rates range from 1-2 liters/day and where most releases to a water supplies would involve the hydrolysis, dilution, and treatment processes.

**REFERENCES:**

a) TB Med 577, *Sanitary Control and Surveillance of Field Water Supplies*, March 1986.

b) Memorandum, DASG-HS-PE, 16 Apr 1997, Subject: Tri-Service Field Water Standards for Nerve Agents.

c) Memorandum, Headquarters Department of the Army, Office of the Assistant Secretary for Installations, Logistics, and Environment, SUBJ: Derivation of Health-Based Environmental Screening Levels (HBESLs) for Chemical Warfare Agents, May 28 1999.

d) USACHPPM/ORNL Technical Report: *Health-Based Environmental Screening Levels for Chemical Warfare Agents*, March 99.

e) Department of the Army, Memorandum Subject: *Implementation Guidance Policy for New Airborne Exposure Limits for GB, GA, GD, GF, VX, H, HD, and HT*; signed by Mr. Raymond J. Fatz, Deputy Assistant Secretary of the Army, (Environment, Safety and Occupational Health); OASA(I&E), **June 18 2004**.

f) Munro et al.; *The Sources, Fate, and Toxicity of Chemical Warfare Agent Degradation Products*, Environmental Health Perspectives, Volume 107, Number 12, December 1999 pp 933-974

g) Memorandum, USACHPPM; MCHB-TS-EES; SUBJ: Response to State of Oregon Comments on the Utah Chemical Agent Rule (UCAR), 23 October 2000; NOTE: This response includes USACHPPM Information Paper “*Management Criteria for Chemical Warfare Agent (CWA)-Contaminated Waste and Media*” 10 October 00 as well as USACHPPM Technical Paper: “*Chemical Warfare Agent Health-Based Waste Control Limits*”, dated September 2000.

h) U.S. Army –Proposed Utah Chemical Agent Rule (UCAR), May 1999 (Volume 1, Section XI. Development of Health-Based Waste Management Concentration Levels.”

i) *Review of the U.S. Army’s Health Risk Assessments for Oral Exposure to Six Chemical-Warfare Agents*, National Research Council, National Academy Press, Wash DC, 1999; [www.nap.edu](http://www.nap.edu)

j) Memorandum, (Army OTSG) MCHB-CG-PPM, Chronic Toxicological Criteria for Chemical Warfare Compounds, 16 February 2000.

k) Opreško, D.M, et al, 2001. Chemical Warfare Agents: Current Status of Oral Reference Doses, *Reviews of Environmental Contamination and Toxicology Vol 172, pp 65-85*.

l) 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