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This paper gives the rationale for supporting current neat agent equivalent dilute limits on chemical agents in DoDI 5210.65, Security Standards for Safeguarding Chemical Agents. The analysis used the results of 50 years of chemical agent research to make a risk-based determination of amounts of chemical agents requiring increased security and personnel safeguards to prevent diversion or theft of agent.

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Rationale for Definition of Dilute Chemical Agents

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7 August, 2018

BLUF: It is appropriate to define dilute chemical agent as neat agent equivalent without concentration limits, because risk from theft/diversion is determined based on total agent. Dilution of the agent can be viewed as a mitigation of risk by making theft and malicious use more difficult.

This paper, for submission to ASD(NCB), gives the rationale for supporting current neat agent equivalent dilute limits on chemical agents in DoDI 5210.65, Security Standards for Safeguarding Chemical Agents. This analysis was requested at a 2 Aug 18 meeting between ASD(NCB), DA G-3/5/7 DAMO-SSD, the DAIG Technical Inspections Division, and AMC Surety Division held at Battelle labs in West Jefferson, OH. The analysis used the results of 50 years of chemical agent research (references below) to make a risk-based determination of amounts of chemical agents requiring increased security and personnel safeguards to prevent diversion or theft of agent. It is recommended that DoDI 5210.65 require components to implement risk based security programs for all DoD chemical agents regardless of category.

This analysis was requested to determine if dilute chemical agent definitions must include a maximum concentration, as well as a maximum total amount. To answer this question, it is critical to define the purpose of the dilute chemical agent definition. The dilute chemical agent thresholds define the amount of chemical agent subject to security and personnel reliability requirements of DoDI 5210.65. Security and reliability requirements mitigate the risk of diversion or theft of chemical agent. Therefore, the importance of the definition of dilute limits is the amount of risk from diversion of agent at the dilute levels. The most conservative way to assess risk is the potential harm to people of the maximum amount of dilute agent. This calculation is only dependent on total amount of agent, and is not affected by concentration. Quantification of risk from dilute agent limits in Table 1 follow the table.

It is possible that dilution of chemical agent could be viewed as a mitigation of risk, as increasing dilution of agent would require theft of higher volumes, thus increasing the difficulty of theft. Very dilute solutions might also require concentration before becoming viable as a weapon, increasing the difficulty of deploying the agent for harm.

Table 1. Dilute Chemical Agent Limits

Agent	Maximum Neat Agent Equivalent in Dilute Solution
G-type	20 mg
V-type	10 mg
H-type	100 mg
L-type	50 mg

Risk quantification: As noted in the Ad Hoc paper, the quantities of agent in Table 1 "cannot reasonably be expected to cause a fatality, catastrophe or serious incident that could not be readily caused by other means." Risk for each chemical agent is calculated below. Acute Exposure Guideline Level 2 (AEGL 2) and LD_{50} doses used in the calculations were obtained from the CHPPM report.

G-type

GB was used for risk determination. Risk is based on inhalation. Acute Exposure Guideline Level 2 (AEGL 2) was used in determining potential risk, as below this level there are "minimal transient, non-impairing effects" (CHPPM report, p. 47). The AEGLs were developed to apply to a civilian population, and AEGL 2 is the threshold for risk determination used in the Chemical Stockpile Emergency Preparedness Program (CSEPP).

AEGL 2 for a 10 minute exposure to GB is 0.087 mg/m^3. This means that if the entire 20 mg neat equivalent of GB in a dilute vial were to volatilize, it would be below AEGL 2 in 230 m^3 of volume. For adverse effects to occur, a person would have to be in a relatively small confined space for an extended period of time. Further reducing risk, humidity would prevent complete volatilization, the agent would likely disperse, and a person could likely leave the area prior to a 10 minute exposure.

V-type

VX was used for risk determination. Risk is based on exposure to percutaneous liquid. LD_{50} for a 70 kg male has been estimated as 2-5 mg, making 2-5 LD_{50} doses per dilute vial. As noted in the Ad Hoc paper, complete contact with the skin would require an unusual or deliberate event, and the presence of clothing would reduce skin contact further.

H-type

HD was used for risk determination. Risk is based on inhalation. AEGL 2 for a 10 minute exposure to HD is 0.60 mg/m^3. This means that if the entire 100 mg neat equivalent of HD in a dilute vial were to volatilize, it would be below AEGL 2 in 167 m^3 of

volume. For adverse effects to occur, a person would have to be in a relatively small confined space for an extended period of time. Further reducing risk, humidity would prevent complete volatilization, the agent would likely disperse, and a person could likely leave the area prior to a 10 minute exposure.

L-type

L was used for risk determination. Risk is based on inhalation. AEGL 2 for a 10 minute exposure to L is 1.3 mg/m^3. This means that if the entire 50 mg neat equivalent of L in a dilute vial were to volatilize, it would be below AEGL 2 in 39 m^3 of volume. For adverse effects to occur, a person would have to be in a relatively small confined space for an extended period of time. Further reducing risk, humidity would prevent complete volatilization, the agent would likely disperse, and a person could likely leave the area prior to a 10 minute exposure.

References:

McNamara et al., Ad Hoc Position Paper on Surety Material Quantities, 3 July 1980.

Subcommittee on Chronic Reference Doses for Selected Chemical-Warfare Agents, Review of the U.S. Army's Health Risk Assessments For Oral Exposure to Six Chemical-Warfare Agents, 1999.

U.S. Army Center for Health Promotion and Preventive Medicine (CHPPM), Acute Toxicity Estimation and Operational Risk Assessment of Chemical Warfare Agent Exposures, May 2004.