DEPARTMENT OF THE ARMY
U.S. ARMY SOLDIER AND BIOLOGICAL CHEMICAL COMMAND
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REPLY TO
ATTENTION OF

August 16, 1999

Freedom of Information and Privacy Act Office

Mr. John Greenewald, Jr.

Dear Mr. Greenewald:

In response to your June 28, 1999, Freedom of Information Act (FOIA) request, I have enclosed a sanitized copy of "Toxicity of High Purity VX in the Rabbit (Percutaneous) and Mouse (Intravenous) Following the Addition of Reaction Products (U)". This document has been reviewed for release under the FOIA. This review did not result in a downgrade or declassification of the information; therefore, the document is properly classified, and is being withheld under FOIA Exemption Number One. I have enclosed a copy of the UNCLASSIFIED pages.

If you are not satisfied with the document as provided, please contact me again in writing. Upon receipt of your correspondence, I will forward your request to our Initial Denial Authority (IDA) for final review and action.

Fees incurred while processing this request have been waived.

Sincerely,

Cheryl S. Fields
Freedom of Information and
Privacy Act Officer

Enclosure

[redacted]

CHEMICAL RESEARCH, DEVELOPMENT & ENGINEERING CENTER

CRDEC-TR-166

TOXICITY OF HIGH PURITY VX IN THE RABBIT (PERCUTANEOUS) AND MOUSE (INTRAVENOUS) FOLLOWING THE ADDITION OF REACTION PRODUCTS (U)

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April 1990

U.S. ARMY ARMAMENT MUNITIONS CHEMICAL COMMAND

Aberdeen Proving Ground, Maryland 21010-5423

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13. ABSTRACT (Maximum 200 words)

(C) Neat VX was adulterated with either diisopropylamine, diisopropylaminoethanethiol, diethyl methylpyrophosphonate, or a mixture of these three in an attempt to determine if these three materials, which are reaction products of a typical binary VX reaction, are responsible for producing skin irritation in rabbits following dermal contact with binary VX. It was determined that all three materials, as well as their mixture, are capable of causing skin irritation. Based on the toxicity data derived, it appears that diethyl methylpyrophosphonate was the most effective additive, with diisopropylamine next. The least toxic additive was the mixture. Although these three materials are the major reaction products in the binary VX production, the other reaction products may also contribute to the toxic effects produced in the rabbit by the percutaneous route.

14. SUBJECT TERMS

(U) VX, LD50, PEG-200, Diisopropylaminoethanethiol, Diethyl methylpyrophosphonate, Diisopropylamine, Reaction products, n-Octylamine, ED50, E+50

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PREFACE (U)

(U) The work described in this report was authorized under Project: Bigeye Bomb, U.S. Navy MIPR No. M0001984WR41204. This work was started in April 1987 and completed in July 1987. The experimental data are recorded in laboratory notebook 85-0008.

(U) The use of trade names or manufacturers' names in this report does not constitute an official endorsement of any commercial products. This report may not be cited for purposes of advertisement.

(U) In conducting the research described in this report, the investigators adhered to the "Guide for the Care and Use of Laboratory Animals," NIH Publication No. 85-23, 1985, as promulgated by the committee on Revision of the Guide for Laboratory Animal Facilities and Care of the Institute of Laboratory Animal Resources, National Research Council. These investigations were also performed in accordance with the requirements of AR 70-18, "Laboratory Animals, Procurement, Transportation, Use, Care, and Public Affairs," and the Laboratory Animal Use and Review Committee (LAURC), U.S. Army Chemical Research, Development and Engineering Center (CRDEC), which oversees the use of laboratory animals by reviewing for approval all CRDEC research protocols requiring laboratory animals. This project was assigned LAURC protocol number 21086000A199.

(U) This report has not been approved for release to the public.

Acknowledgments (U)

(U) The authors thank John Samuel and James Buchanan of the Chemical Division, Research Directorate, for their expertise in the preparation and storage of the agent samples used in these studies. Dorothy Berg of Toxicology Division is gratefully acknowledged for her efforts in preparing the draft manuscript.

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CONTENTS (U)

LIST OF TABLES (U)

3. (U) METHODS

3.1 (U) Agent Delivery Procedures.

3.1.1 (U) Rabbits.

(U) The agent was applied to the clipped bare skin of rabbits using a micro-Hamilton 705 calibrated syringe which was attached to an Agla micrometer driven syringe holder. A blunted 27-gauge stainless-steel needle was attached to the Hamilton syringe, and agent VX was deposited as a discrete micro-droplet on the skin. Dosage of the agent was done on a microgram/kilogram basis, and a typical delivery rate with this apparatus amounted to 125 micrometer divisions per milligram of agent dispensed. This is equal to 8 μg of agent per division, with fractions of divisions used to deliver very small dose levels of neat agent.

3.1.2 (U) Mice.

(U) Mice were dosed intravenously, in a lateral tail vein, with the diluted agent. A Hamilton 705 syringe, to which was attached a 1/2-in., 26-gauge stainless-steel needle, was used to make the injections. The diluted agent was always used when testing mice. A stock solution was made up in polyethylene glycol-200 (PEG-200) at a concentration of 10.0 mg/mL. A second dilution (working solution) was made up in physiological saline at a concentration of 0.050 mg/mL. For each VX sample tested, the dilutions were made up just prior to testing; after the test was completed, all the remaining stock and working solution were destroyed with NaOH decontamination solution.

3.2 (U) Animal Test Procedures.

3.2.1 (U) Rabbit Percutaneous LD50 Test.

(U) Rabbits were clipped free of dorsal hair 18-24 hr prior to testing. They were weighed to the nearest one-hundredth of a kilogram, and the agent dose levels were calculated on a milligram per kilogram basis. On the day of the test, each rabbit was placed into an aluminum stanchion that restrained the rabbit by means of a neck collaring slide. Adjustable neck collaring devices were used so that breathing or blood circulation would not be restricted. The rabbits were then placed into filtered chemical fume hoods, and the hoods exhaust system was adjusted to 100 $\pm$ 10 lfpm. Each rabbit's skin was carefully examined; the best skin, free of any blemish, was selected as the test site. This site was then circled in black ink, an area about 1/2-3/4 $in.^2$, and so designated as the agent exposure site. The rabbits were tested in groups of eight, and six individual dose groups (48 rabbits) were tested. The dose levels were usually 0.1 or 0.2 log interval apart with the design being to establish a 100% lethal dose, several partially lethal doses, a 0% lethal dose, and hopefully, a no-effect dose level. After the VX was applied, one person was assigned to each group of rabbits and observed them for the onset of toxic signs. A list of normally observed toxic signs would include twitching, tremors, convulsions, miosis, salivation, collapse, prostration, and death. In addition to these commonly observed signs, we noted skin irritation and signs such as vocalization, tearing, lacrimation, chewing, and nystagmus. These occasionally observed signs were recorded, but not used in any statistical

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data analysis. Following the completion of the 24-hr exposure, all rabbits had their test sites decontaminated with sodium hypochlorite (bleach), rinsed with water, and blotted dry with absorbent toweling; the dead rabbits were double-bagged for disposal by incineration. Surviving rabbits were returned to their home cages for an additional 13 days observation. At the completion of the 14-day test, all rabbits were euthanatized with an intravenous (ear vein) administration of T-61 (euthanasia solution) and incinerated.

3.2.2 (U) Mouse Intravenous LD50 Test.

(U) The mice were tested in groups of 12 (6 each sex), with logarithmically spaced doses of diluted VX. The onset of toxic signs was very rapid and signs commonly observed were recorded at the earliest onset. These signs included ataxia, tremors, convulsions, exophthalmus, salivation, Straub tail, collapse, prostration, and death. In addition to these signs, additional signs were observed but not used in any statistical analysis. These signs included subconvulsive jerking, decreased activity, low carriage, tearing, and lacrimation. Observation for toxic signs was continuous until the end of the work day (1530) and then at least twice daily for the remaining 13 days. After 14 days, all surviving mice were euthanatized by cervical dislocation and incinerated.

3.3 (U) Data Analysis.

(U) Toxic signs collected during these tests were recorded to the nearest 1/2 min and then used to determine the Et50 (effective time to 50% response), ED50 (effective dose to produce a toxic effect in 50% of the population), and LD50 (effective dose to produce death in 50% of the population). Et50 data were computed by the Bliss[7] method for Time to Mortality, and the ED50 and LD50 data were computed by the Bliss[8] method Dose Mortality Curve. Both of these programs are contained in the UNIVAC 1100/60 computer. The ED50 and LD50 response ratios were introduced into the computer, which generated the dose required to produce 1, 16, 30, 50, and 84% responses and the confidence limits on each of these dosages. In addition, the slope of the dose-response curve was calculated along with the standard error of the slope and its significance.

(U) For each individual test with rabbits, Et50, ED50, and LD50 data were generated; for mice, these same data were obtained for the males, females, and the combined population. Because only slight differences were evident in them male/female mouse data, this report will contain only the combined sex statistical data related to Et50s.

3.4 (U) Rabbit Skin Irritation Analysis.

(U) As stated in Section 1 during these tests, we were interested in observing if irritation would develop on clipped rabbit skin following the application of neat adulterated VX. An attempt was also made to grade any irritation observed according to the procedures outlined in the Federal Register.[9] For reference purposes, the following grading system was used to evaluate skin irritation based on two responses, erythema (redness) and edema (swelling) (Table 1).

Table 1. (U) Procedures for Scoring Rabbit Skin Irritation

Skin Reaction	Value
a. (U) Erythema and Eschar Formation:	
1. No erythema	0
2. Very slight erythema (barely perceptible)	1
3. Well-defined erythema	2
4. Moderate to severe erythema	3
5. Severe erythema (beet redness) to slight eschar formation (injuries in depth)	4
b. (U) Edema Formation:	
1. No edema	0
2. Very slight edema (barely perceptible)	1
3. Slight edema (edges of area well defined by definite raising)	2
4. Moderate edema (raised approximately 1 mm)	3
5. Severe edema (raised more than 1 mm and extending beyond the area of exposure)	4

4. (U) RESULTS

4.1 (U) Control VX Test (Rabbit Data).

(U) A control VX sample, identified as Batch 1, Suplecamp, 95.2% pure, was tested on 10 March 1987 and again on 28 April 1987 by the percutaneous bare-skin route in rabbits. These two tests were combined to provide toxicity data for the unadulterated VX. Sixteen rabbits were tested at each of six-dose levels ranging from 0.0079 to 0.050 mg/kg. Table 2 lists the results of these two tests, along with the mortality fractions resulting from the various dose levels of VX. Test 1 resulted in an LD50 of 0.0240 (0.0197-0.0292) mg/kg; for Test 2, the LD50 was 0.0300 (0.0249-0.0362) mg/kg.

Table 2. (U) Rabbit Percutaneous (Bare Skin) LD50s Following Contact with Neat High Level Purity VX

Dose (mg/kg)	24 Hr Mortality Fractions and Response Time				24-Hr LD50's (mg/kg) with 95% Confidence Limits
	Test 1 (10 March 1987)		Test 2 (28 April 1987)		
	Mortality Fractions	Response Time (min.)	Mortality Fractions	Response Time (min.)	
0.050	8/8	59.0, 67.5, 73.0, 73.0, 88.0, 133.5, 169.0, 194.5	8/8	38.0, 46.0, 55.0, 61.0 69.0, 91.5, 111.0, 112.5	Test 1 0.0240 (0.0197-0.0292) Slope = 5.96 (Significant)
0.032	6/8	77.0, 109.0, 120.0, 131.5, 174.5, 233.5	4/8	88.0, 113.5, 116.5, 135.5	
0.025	5/8	48.5, 88.0, 119.0, 150.0, 218.0	1/8	66.5	Test 2 0.0300 (0.0249-0.0362) Slope = 7.10 (Significant)
0.020	1/8	242.5	2/8	140.5, 232.0	
0.0126	1/8	285.5	0/8	-	Combined Data 0.0269 (0.0236-0.0308) Slope = 6.11 (Significant)
0.0079	0/8	-	0/8	-	

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(U) Both of these LD50s are similar in that their 95% confidence limits overlap. The dose level that appears different is the 0.025-mg/kg dose, where in Test 1, 5/8 rabbits died, and in Test 2, 1/8 rabbits died. This difference in response cannot be explained because the rabbits in the second test showed similar responses and response times up to and through the toxic sign of convulsions (Tables A-1 and A-2). In fact, at the highest dose level tested (0.050 mg/kg), the rabbits in Test 2 died at a mean time of 82.3 min, and those in Test 1 died at a mean time of 120.0 min. For comparison purposes, the combined data for these tests are provided in Table A-3, along with the LD50 value of 0.0269 (0.0236-0.0308) mg/kg in Table 2. We observed no skin irritation on these rabbits during these two tests.

(U) Following these two tests, a preliminary evaluation was conducted with rabbits in an attempt to produce skin irritation following the application of the VX additives in dilution in PEG-200.

4.2 (U) Rabbit Skin Irritation - Control Test.

(U) A control rabbit-skin irritation test was conducted in which the test additives diisopropylamine, diisopropylaminoethanethiol, and ethyl pyro were added to PEG-200 at both the 5% and 10% concentrations. In addition, a known irritant (n-Octylamine) was tested at a 10% concentration in PEG-200. The mixture of the three additives was tested at both the 15% and 30% concentrations in PEG-200. Two materials, diisopropylamine and n-Octylamine, were also tested neat to check their irritation rate (speed) and severity of the pure material. All of the mentioned test materials were tested at a total volume of 0.100 mg/kg to simulate the approximate dose under actual agent test conditions.

(U) Table 3 lists the results of this test and the following is noted. PEG-200 was tested on six different skin sites and produced no observable skin irritation. Diisopropylamine was tested at both the 5% and 10% concentrations and produced a mild erythema (rating 1) on 2/6 test sites in each case. The same material tested neat produced erythema on 1/6 test sites; however, we also noticed that the neat diisopropylamine evaporated almost immediately from the test site.

(U) The application of 5% and 10% diisopropylaminoethanethiol produced mild erythema on 3/6 test sites at the 5% concentration. We observed no visible irritation from the 10% concentration. Ethyl pyro at both the 5% and 10% concentrations produced mild erythema on 2/5 test sites.

(U) A mixture of the three chemicals listed above was tested at both the 15% and 30% concentrations in PEG-200. At the 15% level, 3/6 skin sites developed a mild erythema; at the 30% concentration, 2/6 skin sites developed mild erythema.

(U) In all of the above tests, the erythema was rated at 1, and we observed no edema or swelling. As a positive control, we tested n-Octylamine at a 10% concentration in both PEG-200 and neat. With this material, the 10% concentration produced erythema within 0.5 min (area 1/4 in. by 3/4 in.) and a 3.0 rating (moderate to severe). By 24 hr, the erythema had lessened to

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a 1-2 rating and was present on 4/6 test sites. The neat n-Octylamine produced severe erythema (rating -4) and also moderate edema, which were present on 3/3 test sites. Based on these limited test data, we determined that the three additives had the potential to irritate rabbit skin and, if added to neat VX, should cause an observable irritation.

Table 3. (U) Rabbit Skin Irritation Resulting from Diluted (in PEG-200) or Neat Reaction Products

Test Material[a]	No. of Test Sites	24 Hr Skin Irritation (Number Responding)	
		Erythema	Edema
PEG-200	6	0/6	0/6
Diisopropylamine			
a) 5% -	6	2/6	0/6
b) 10% -	6	2/6	0/6
c) 100%[b]	6	1/6	0/6
Diisopropylamino-ethanethiol			
a) 5% -	6	3/6	0/6
b) 10% -	6	0/6	0/6
Ethyl pyro			
a) 5% -	5	2/5	0/5
b) 10% -	5	2/5	0/5
Mixture[c]			
a) 15% -	6	3/6	0/6
b) 30% -	6	2/6	0/6
n-Octylamine[d]			
a) 10%	6	4/6[f]	0/6[f]
b) 100%[e]	3	3/3	3/3

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[a] (U) Test material applied as a 0.100-mg droplet.

[b] (U) Neat, undiluted diisopropylamine.

[c] (U) Mixture - 15% = 5% diisopropylamine, 5% diisopropylaminoethanethiol and 5% ethyl pyro.

- 30% = 10% diisopropylamine, 10% diisopropylaminoethanethiol and 10% ethyl pyro.

[d] (U) n-Octylamine - used as a positive control.

[e] (U) Neat, undiluted n-Octylamine.

[f] (U) At 0.5-26 min after dosing, there were erythema and edema, which either partially or totally disappeared by 24 hr.

Table 8. (U) Intravenous Toxicity of High Level Purity VX in the Mouse, Test Number 1 - 10 February 1987

Dose (mg/kg)	24 Hr Mortality Fractions and Response Time				Mortality Fractions Total Population	24-Hr LD50's (mg/kg) with 95% Confidence Limits
	Males		Females			
	Mortality Fractions	Response Time (min)	Mortality Fractions	Response Time (min)		
0.020	6/6	6.0, 8.0 (3), 8.5, 9.0	6/6	4.5, 5.5, 6.0, 9.0, 8.0, 16.0	12/12	Males 0.0178 (0.0178-0.0187) Slope = 77.97 (Not Significant)
0.0178	3/6	10.5, 12.0, 20.0	4/6	7.0, 7.5, 9.0, 10.5	7/12	
0.0159	0/6	-	1/6	9.0	1/12	Females 0.0171 (0.0159-0.0184) Slope = 31.35 (Significant)
0.0126	0/6	-	0/6	-	0/12	
0.0100	0/6	-	0/6	-	0/12	Total Population 0.0174 (0.0167-0.0182) Slope = 35.84 (Significant)
0.0079	0/6	-	0/6	-	0/12	

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Table 9. (U) Intravenous Toxicity of High Level Purity VX in the Mouse, Test Number 2 - 29 April 1987

Dose (mg/kg)	24 Hr Mortality Fractions and Response Time				Mortality Fractions Total Population	24-Hr LD50's (mg/kg) with 95% Confidence Limits
	Males		Females			
	Mortality Fractions	Response Time (min)	Mortality Fractions	Response Time (min)		
0.0224	6/6	5.5, 7.0 (3), 12.5, 14.5	5/6	7.5, 9.0 (2), 10.5, 16.5	11/12	Males 0.0196 (0.0184-0.0208) Slope = 42.98 (Significant)
0.0212	5/6	6.5 (2), 10.0, 12.0 (2)	6/6	8.5, 9.5, 10.5 (2) 12.0, 13.0	11/12	
0.0200	5/6	9.0, 9.5, 18.5, 19.0, 20.0	0/6	-	5/12	Females 0.0209 (0.0201-0.0216) Slope = 57.05 (Significant)
0.0178	0/6		0/6	-	0/12	
0.0158	0/6		0/6	-	0/12	Total Population 0.0202 (0.0196-0.0208) Slope = 41.68 (Significant)
0.0126	0/6		0/6	-	0/12	

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Table 10. (U) Mouse Intravenous ED50 Data (Combined Tests) Following Intoxication With High Level Purity VX

Sex	ED50 Data For Toxic Signs in Mice (Mg/Kg) - 95% Confidence Limits								
	Ataxia	Tremors	Convulsions	Exophthalmus	Salivation	Straub Tail	Collapse	Prostration	Death
Males	0.0125 (0.0119-0.0130)	0.0105 (0.0093-0.0119)	0.0171 (0.0163-0.0178)	0.0187 (0.0179-0.0195)	0.0177 (0.0170-0.0185)	0.0180 (0.0172-0.0189)	0.0187 (0.0179-0.0195)	0.0187 (0.0179-0.0195)	0.0187 (0.0179-0.0195)
Slope Significant	42.72 No	14.55 Yes	31.58 Yes	31.65 Yes	34.35 Yes	23.76 Yes	31.65 Yes	31.65 Yes	31.65 Yes
Females	0.0133 (0.0129-0.0138)	0.0124 (0.0113-0.0136)	0.0172 (0.0164-0.0181)	0.0191 (0.0181-0.0201)	0.0189 (0.0179-0.0200)	0.0178 (0.0171-0.0182)	0.0189 (0.0179-0.0199)	0.0191 (0.0180-0.0203)	0.0191 (0.0180-0.0203)
Slope Significant	55.53 No	16.64 Yes	24.54 Yes	18.99 Yes	18.13 Yes	79.45 No	79.94 Yes	16.94 Yes	16.94 Yes
Total Population	0.0129 (0.0127-0.0131)	0.0114 (0.0106-0.0123)	0.0172 (0.0166-0.0177)	0.0188 (0.0182-0.0195)	0.0183 (0.0177-0.0189)	0.0179 (0.0174-0.0185)	0.0188 (0.0182-0.0194)	0.0189 (0.0182-0.0195)	0.0189 (0.0182-0.0195)
Slope Significant	46.24 No	13.99 Yes	27.16 Yes	23.76 Yes	22.31 Yes	29.52 Yes	24.44 Yes	22.01 Yes	22.01 Yes

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APPENDIX A

RABBIT PERCUTANEOUS (BARE SKIN) Et50 AND ED50 DATA FOLLOWING CONTACT WITH VX OR VX/ADDITIVES (U)

Classified by: AR 380-86, Table 1, para 1b(2), 15 Feb 84
Declassify on: OADR

Table A-1. (U) Compound: Control VX, Batch 1, Bottle 1; Route: Percutaneous; Species: NZW Rabbit; Date Tested: 10 March 1987

Dose (Mg/Kg)	Et50 Data - Onset Time (Minutes) for Toxic Signs - With 95% Confidence Limits								
	Twitches	Tremors	Miosis	Convulsions	Salivation	Exophthalmus	Collapse	Prostration	Death
0.050	8/8 13.2 (12.3-14.2)	8/8 28.6 (25.8-31.6)	8/8 57.9 (55.3-60.6)	8/8 63.3 (60.6-66.2)	8/8 77.6 (66.7-90.4)	1/8 56.5	8/8 95.9 (85.4-107.6)	8/8 112.4 (97.7-129.3)	8/8 120.0 (104.2-138.3)
0.032	8/8 15.6 (14.4-17.0)	8/8 34.9 (32.2-37.9)	8/8 91.4 (83.4-100.2)	8/8 95.9 (87.4-105.3)	7/8 86.4 (76.8-97.4)	2/8 72.0, 83.0	6/8 118.2 (101.0-138.2)	6/8 138.6 (117.6-163.2)	6/8 156.6 (135.0-181.7)
0.025	8/8 10.3 (9.7-10.9)	8/8 22.2 (19.7-25.0)	7/8 150.6 (118.2-191.7)	6/8 90.0 (74.7-108.5)	5/8 79.4 (63.2-99.8)	3/8 45.5, 111.5, 120.0	5/8 103.6 (80.4-133.7)	5/8 131.6 (99.9-173.5)	5/8 140.1 (110.0-178.5)
0.020	8/8 13.5 (11.4-16.0)	8/8 27.1 (22.6-32.5)	4/8 74.0, 98.5, 100.0, 160.5	4/8 100.5, 102.5, 103.5, 262.5	4/8 103.0, 136.5, 154.5, 240.0	1/8 199.0	2/8 158.5, 194.0	2/8 175.0, 196.0	1/8 242.5
0.0126	8/8 15.2 (13.2-17.6)	8/8 42.3 (38.4-46.5)	7/8 138.2 (128.4-148.6)	1/8 108.5	1/8 139.5	0/8 -	1/8 127.5	1/8 283.5	1/8 285.5
0.0079	8/8 20.4 (18.9-22.0)	8/8 59.3 (57.2-61.3)	1/8 141.0	0/8 -	0/8 -	0/8 -	0/8 -	0/8 -	0/8 -

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Table A-2. (U) Compound: Control VX, Batch 1, Bottle 1; Route: Percutaneous; Species: NZW Rabbit; Date Tested: 28 April 1987

Dose (Mg/Kg)	Et50 Data - Onset Time (Minutes) for Toxic Signs - With 95% Confidence Limits								
	Twitches	Tremors	Miosis	Convulsions	Salivation	Exophthalmus	Collapse	Prostration	Death
0.050	8/8 15.2 (14.4-16.1)	8/8 24.1 (22.5-25.8)	8/8 47.7 (44.1-51.6)	8/8 55.4 (51.0-60.2)	8/8 58.9 (54.8-63.3)	8/8 51.4 (47.5-55.7)	8/8 68.1 (60.8-76.3)	8/8 75.5 (66.9-85.3)	8/8 82.3 (73.7-92.0)
0.032	8/8 15.9 (15.0-16.8)	8/8 26.2 (25.3-27.1)	8/8 71.6 (67.6-75.9)	7/8 73.9 (68.5-79.8)	7/8 94.7 (86.6-103.7)	5/8 87.5 (75.5-101.4)	5/8 133.9 (114.7-156.3)	4/8 83.0, 113.0, 114.5, 121.5	4/8 88.0, 113.5, 116.5, 135.5
0.025	8/8 12.2 (11.6-12.9)	8/8 22.7 (21.9-23.6)	8/8 74.6 (67.2-82.7)	8/8 99.5 (86.3-114.7)	6/8 175.6 (151.5-203.4)	3/8 50.5, 114.5, 198.0	1/8 52.0	1/8 57.5	1/8 66.5
0.020	8/8 12.5 (11.8-13.3)	8/8 29.8 (27.9-31.8)	8/8 135.0 (119.5-152.4)	8/8 113.7 (107.6-120.2)	4/8 85.0, 130.5, 147.0, 165.5	5/8 166.3 (145.2-190.3)	2/8 111.0, 136.5	2/8 137.5, 187.0	2/8 140.5, 232.0
0.0126	8/8 19.6 (17.2-22.3)	8/8 42.2 (38.2-46.6)	7/8 137.6 (122.0-155.1)	2/8 73.5, 174.0	3/8 106.5, 174.0, 175.5	3/8 41.5, 52.0, 79.0	1/8 160.5	0/8 -	0/8 -
0.0079	8/8 23.9 (21.9-26.2)	8/8 39.2 (37.6-40.7)	2/8 165.5, 196.5	0/8 -	0/8 -	0/8 -	0/8 -	0/8 -	0/8 -

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Table A-3. (U) Compound: Control VX, Batch 1, Bottle 1; Route: Percutaneous; Species: NZW Rabbit; Date Tested: 10 March + 28 April 1987

Dose (Mg/Kg)	Et50 Data - Onset Time (Minutes) for Toxic Signs - With 95% Confidence Limits								
	Twitches	Tremors	Miosis	Convulsions	Salivation	Exophthalmus	Collapse	Prostration	Death
0.050	16/16 14.4 (14.0-14.9)	16/16 27.1 (25.9-28.2)	16/16 54.1 (52.4-55.9)	16/16 60.5 (58.7-62.4)	16/16 69.1 (64.9-73.7)	9/16 52.8 (49.4-56.4)	16/16 83.5 (78.6-88.8)	16/16 95.5 (89.0-102.5)	16/16 102.9 (96.1-110.2)
0.032	16/16 16.0 (15.4-16.5)	16/16 31.0 (29.8-32.3)	16/16 82.9 (79.5-86.4)	15/16 86.8 (82.7-91.1)	14/16 92.0 (87.5-96.7)	7/16 60.5, 61.0, 71.5, 72.0, 83.0, 93.0, 117.5	11/16 128.2 (119.2-137.8)	10/16 131.0 (121.0-141.8)	10/16 143.7 (132.9-155.4)
0.025	16/16 11.4 (11.1-11.8)	16/16 23.0 (22.1-24.0)	15/16 110.9 (99.8-123.2)	14/16 97.3 (90.1-105.1)	11/16 144.9 (127.8-164.2)	6/16 45.5, 50.5, 111.5, 114.5, 120.0, 198.0	6/16 42.5, 44.5, 52.0, 108.5, 130.0, 141.0	6/16 46.0 57.5, 65.5, 112.5, 147.0, 216.0	6/16 48.5, 66.5, 88.0, 119.0, 150.0, 218.0
0.020	16/16 13.3 (12.5-14.2)	16/16 29.8 (28.0-31.7)	12/16 131.1 (121.8-141.2)	12/16 127.4 (118.1-137.4)	8/16 85.0,103.0, 130.5, 136.5, 147.0, 154.5, 165.5, 240.0	6/16 88.0, 130.5, 146.5, 146.5, 192.5, 199.0, 200.0	4/16 111.0, 136.5, 158.5, 194.0	4/16 137.5, 175.0, 187.0, 196.0	3/16 140.5, 232.0, 242.5
0.0126	16/16 17.9 (16.8-19.2)	16/16 42.8 (40.8-44.8)	14/16 140.3 (134.1-146.8)	3/16 73.5, 108.5, 174.0	4/16 106.5, 139.5, 174.0, 175.5	3/16 41.5, 52.0, 79.0	2/16 127.5, 160.5	1/16 283.5	1/16 285.5
0.079	16/16 22.6 (21.7-23.6)	16/16 51.6 (49.8-53.4)	3/16 141.0, 165.5, 196.5	0/16 -	0/16 -	0/16 -	0/16 -	0/16 -	0/16 -

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Table B-1. (U) Compound: Control VX, Batch 1, Bottle 1; Route: Intravenous; Species: ICR Mouse; Date Tested: 10 February 1987

Dose (Mg/Kg)	Et50 Data - Onset Time (Minutes) for Toxic Signs - With 95% Confidence Limits								
	Ataxia	Tremors	Convulsions	Exophthalmus	Salivation	Straub Tail	Collapse	Prostration	Death
0.0200	12/12 1.8 (1.7-1.9)	12/12 1.7 (1.6-1.8)	12/12 5.0 (4.7-5.4)	11/12 7.7 (7.0-8.4)	12/12 7.0 (6.5-7.6)	12/12 5.7 (5.4-6.0)	12/12 7.8 (7.2-8.4)	12/12 8.1 (7.5-8.7)	12/12 8.9 (8.3-9.5)
0.0178	12/12 2.4 (2.3-2.5)	12/12 2.4 (2.3-2.5)	12/12 7.7 (7.2-8.2)	7/12 11.3 (9.7-13.1)	11/12 13.3 (11.8-14.9)	10/12 9.8 (8.5-11.2)	7/12 9.8 (8.2-11.6)	7/12 10.1 (8.6-12.0)	7/12 12.0 (10.6-13.7)
0.0158	12/12 3.0 (2.8-3.2)	12/12 2.8 (2.7-3.0)	4/12 7.5, 8.0, 10.5, 10.5	1/12 8.5	2/12 14.5, 16.5	0/12 -	1/12 8.0	1/12 8.5	1/12 9.0
0.0126	6/12 3.5, 4.5, 5.0 6.0, 7.5, 9.0	11/12 4.8 (4.4-5.2)	0/12 -	0/12 -	0/12 -	0/12 -	0/12 -	0/12 -	0/12 -
0.0100	0/12 -	4/12 6.5, 10.0, 12.5, 13.0	0/12 -	0/12 -	0/12 -	0/12 -	0/12 -	0/12 -	0/12 -
0.0079	0/11 -	0/11 -	0/11 -	0/11 -	0/11 -	0/11 -	0/11 -	0/11 -	0/11 -

Table B-2. (U) Compound: Control VX, Batch 1, Bottle 1; Route: Intravenous; Species: ICR Mouse; Date Tested: 29 April 1987

Dose (Mg/Kg)	ET50 Data - Onset Time (Minutes) for Toxic Signs - With 95% Confidence Limits								
	Ataxia	Tremors	Convulsions	Exophthalmus	Salivation	Straub Tail	Collapse	Prostration	Death
0.0224	12/12 1.2 (1.2-1.3)	12/12 2.0 (1.9-2.1)	12/12 6.8 (6.2-7.5)	12/12 9.7 (8.8-10.6)	12/12 7.9 (7.6-8.3)	12/12 5.7 (5.1-6.5)	12/12 10.2 (9.3-11.2)	11/12 9.4 (8.7-10.1)	11/12 10.8 (10.0-11.6)
0.0212	12/12 2.2 (2.0-2.3)	12/12 2.2 (2.0-2.4)	12/12 5.4 (5.0-5.8)	11/12 8.3 (7.8-8.7)	12/12 10.9 (10.4-11.5)	11/12 5.9 (5.5-6.5)	11/12 9.9 (9.3-10.4)	11/12 10.4 (9.9-10.9)	11/12 11.0 (10.6-11.5)
0.0200	12/12 1.7 (1.6-1.7)	12/12 2.2 (2.1-2.3)	11/12 7.9 (7.5-8.4)	5/12 5.0, 6.0, 7.0, 8.0, 8.5	6/12 5.5, 6.0, 8.5, 10.0, 11.5, 25.0	12/12 10.2 (8.9-11.7)	5/12 8.0, 8.0, 15.0 17.5, 18.5	5/12 8.0, 8.5, 18.0 18.5, 18.5	5/12 9.0, 9.5, 18.5 19.0, 20.0
0.0178	12/12 2.2 (2.1-2.3)	12/12 2.8 (2.7-2.9)	4/12 8.0, 9.0, 13.0, 14.0	0/12 -	1/12 9.0	3/12 9.0, 14.0, 16.0	0/12 -	0/12 -	0/12 -
0.0158	12/12 3.2 (3.2-3.3)	12/12 4.7 (4.3-5.2)	0/12 -	0/12 -	0/12 -	0/12 -	0/12 -	0/12 -	0/12 -
0.0126	2/12 3.5, 8.0	4/12 4.5, 5.5, 10.0, 10.5	0/12 -	0/12 -	0/12 -	0/12 -	0/12 -	0/12 -	0/12 -

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REPLY TO
ATTENTION OF

July 8, 1999

Freedom of Information and Privacy Act Office

Mr. John Greenewald, Jr.

Dear Mr. Greenewald:

Reference is made to your June 28, 1999, Freedom of Information Act (FOIA) request that was received in my office on July 6, 1999, for processing.

I have located a copy of the document entitled, "Toxicity of High Purity VX in the Rabbit (Percutaneous) and Mouse (Intravenous) Following the Addition of Reaction Products", April 1990. This document is classified "CONFIDENTIAL" and must be reviewed for possible downgrading and release to you under the FOIA. I have initiated a declassification review of this document, and given the reviewer a suspense date of July 19, 1999, to review the document and return it back to me.

Upon completion of this review, I will notify you promptly of our decision to release, redact or withhold this document.

Please allow me until July 25, 1999, to respond back to you on this request.

Your request is identified as FOIA FILE #99-084. If you have any questions, I can be reached at (410) 436-1288.

Sincerely,

Cheryl S. Fields
Freedom of Information and
Privacy Act Officer

DEPARTMENT OF THE ARMY
U.S. ARMY SOLDIER AND BIOLOGICAL CHEMICAL COMMAND
5183 BLACKHAWK ROAD
ABERDEEN PROVING GROUND, MARYLAND 21010-5423

REPLY TO
ATTENTION OF

August 4, 1999

Freedom of Information and Privacy Act Office

Mr. John Greenewald, Jr.

Dear Mr. Greenewald:

Reference is made to your June 28, 999, Freedom of Information Act (FOIA) request, and to my interim response dated July 8, 1999.

The document that you requested, "Toxicity of High Purity of VX in the Rabbit (Percutaneous) and Mouse (Intravenous) Following the Addition of Reaction Products", has been reviewed by our technical staff. The document is properly marked CONFIDENTIAL and downgrading is not recommended. I have sent the UNCLASSIFIED pages to our Legal staff for review and possible release to you under the FOIA. I gave Legal a suspense date of August 16, 1999, to complete their review.

I will contact you again as soon as I receive a response from our Legal staff.

Thank you for your patience while we continue to process your request.

Sincerely yours,

Cheryl S. Fields
Freedom of Information and
Privacy Act Officer