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MINUTES OF A MEETING HELD TO DISCUSS AND EVALUATE THE TOXICITY
OF 2,4-D AND 2,4,5-T COMPOUNDS

26 April 1963

orig minutes
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for CBR Agency files

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SUBJECT: Minutes of a meeting held to discuss and evaluate the toxicity of 2,4-D and 2,4,5-T compounds with particular emphasis on use of these materials in military operations as herbicides.

TIME: 1000 hours

DATE: 26 April 1963

PLACE: Room 202, Bldg 3510 (350), Sigmond Arsenal, Maryland

ATTENDEES:

Brig Gen F. J. Delucore, Commanding General, CSR Agency, E.A., Md.
Col F.L. Bauer, Whittier, Director of Ind Sec, CML, E.A., Md.
Dr. J.P. Bennett, Whittier, Dir/Ind/Sec, CML, E.A., Md.
Dr. J.T. Thurston, Office of Secretary of Defense, Wash., D.C.
Dr. J.S. DeWitt, Recurrent Wildlife Res Center, Laurel, Md.
Dr. W.C. Shaw, US Dept of Agriculture, Beltsville, Md.
Dr. H.H. Summerson, Chief Scientist, CSR Agency, E.A., Md.
Dr. C.E. Wenzel, Fort Detrick, Frederick, Md.
Dr. J.S. Leary, US Dept of Agriculture, Beltsville, Md.
Dr. W. Barthland, Army Res Office, Arlington Hall, Va.
Dr. R.J. Cotten, An Chem Products, Inc., Joliet, Va.
Dr. V.R. Fowz, Roy Chemical Co., Beltsville, Md.
Dr. S. Silver, Scientific Director, CML, E.A., Md.
Dr. H.P. Averill, Toxicology Div, Dir/Ind/Sec, CML, E.A., Md.
Dr. John C. Anderson, Identification, Dir/Ind/I, CML, E.A., Md.
Lt Col D.C. Rice, HQ CIA Agency, E.A., Md.
Capt S.A. Santoro, CMA Ind Div, CML, E.A., Md.
Mr. Frank J. Vesel, Ch, Basic Res Bz, CML, E.A., Md.
Dr. Harold W. Barthland, Weapons Labs, Falls Church, Va.
Mrs. Martha A. Lange, Demographer, Ind Div, CML, E.A., Md.

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The meeting was called to order by the Chairman, Col Sauer, who commented that vast areas of the tropics and semitropics are covered by dense growths of trees, shrubs, etc. Dependent upon circumstances, this vegetative ground cover has in times past been a problem to health (malaria control, scrub typhus bite control), a source of ambushes, an obstruction of lines of fire, observation, transportation, etc.

The Chairman stated that those in attendance would be familiarized with the actual use of certain herbicides in Viet Nam during the past two years. He stated that the sought-for end of the meeting was a general statement about dose levels and hazards to health of man and domestic animals from 2,4-D and 2,4,5-T based on the medical literature and unpublished data of various research laboratories. The Committee was asked to evaluate the toxicity of a mixture known as "Purple". This mixture consists of 50% normal butyl 2,4-D, 30% normal butyl 2,4,5-T, and 20% isobutyl 2,4,5-T. The Chairman further stated that the Committee should also review this information in light of actual use of these materials as military herbicides in Viet Nam and comment as to whether health hazards were engendered by such operational use.

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General
herbicides

Dr.
expenditure
operators

Dr.
body splash
Viet Nam
exposures

Col.
out dose
calculations

Dr.
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where toxic

Dr.
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Jones and
Int. Med.

Dr.
ingestion
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perceptible
page 225

Dr.
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that the
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Dr.
and 2,4,
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crease
2,4-D and
hand, the
the test

General F.J. Delmore presented a
herbicides in military operations.

Dr. W.C. Shaw described the use of
expenditure and contact with the nasal
operators. His remarks are attached.

Dr. C.E. Mlasarik presented usage
body splash exposures in manufacturing
Viet Nam. He commented further that
exposures to these compounds there were

Col F.L. Bauer presented an eval
out dose to man of herbicides as they
calculations are attached as Appendix B.

Dr. B.P. McNamara presented data
various animal species. These remarks
was also mentioned that the medical
where toxic effects possibly were act

Dr. W. Northland discussed the
possibly due to exposure to 2,4-D pub
Jones and Brown and the fourth publica
Int. Med. No. 3, 133, 1965.

Dr. H.N. McFarland commented on
ingestion of not less than 6500 mg of
one man ingested 500 mg of 2,4-D per
perceptible effects. The specific re
page 225, 1962.

Dr. J.S. Leary described the De
criteria for use of herbicides and p
were as follows: the criteria for th
that they must be, by regulation, not
flammable, available in large quantities
addition, operationally, the Department
constant control in areas where the

Dr. J. B. DeWitt stated that 2,4-D
and 2,4,5-T were added to the diets at
stages of growth. He confirmed that
chronic and acute toxicity. The only
crease in egg-laying of mallard ducks
2,4-D and/or 2,4,5-T at a dose level
hand, the quail produced a larger than
the test period.

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Dr. V.E. Lowe stated that the available toxicity data are adequate for the prediction of toxic doses. He based this on experimental evidence, as well as on field applications. He explained that there was a nuisance factor involved in that people have complained of a harsh taste in the drinking water.

Dr. R.J. Otten stated his experiences on the use of herbicides in practical field applications. He commented that his firm has a number of contracts with industrial firms making these continuous field applications over very large areas. Even though thousands of people were involved in these operations, skin sensitization was the maximum effect produced. This was noted in probably one out of a thousand persons.

Dr. McManara summarized the LD50 and LD1 data for oral, intratracheal, intraperitoneal, and percutaneous routes on several species of animals. Based upon all data presented, the Committee decided to adopt as acute toxicity standards the figures which are cited in the conclusion of this report.

The Committee adopted the following observation and conclusions:

OBSERVATIONS - Based upon the data reviewed and presented, the Committee recommended acceptance of these figures for acute toxicity of purple mixture. The Committee further noted that these were compiled from several animal species, that toxicity data were similar from species to species, and that the occasional cases of accidental poisoning and/or attempted suicide in man report even higher figures.

Oral and intraperitoneal routes

(LD50 - 300-1000 mg/kg

(LD1 - 100-333 mg/kg

Percutaneous routes

(LD50 - 1000-6000 mg/kg

(LD1 - 600-2000 mg/kg

CONCLUSIONS - The Committee stated 'in summary and after careful review of toxicological data related to 2,4-D and 2,4,5-T plus the knowledge as to the manner these materials have been used for defoliation in military situations in Southeast Asia, the Committee concluded that no health hazard is or was involved to man or domestic animals from the amounts or manner these materials were used in the aforementioned exercise'.

Additional information pertinent to this meeting are attached as Appendices D, E, and F.

APPENDIX

Is

**Minutes of a Meeting Held to Discuss and Evaluate the Toxicity
of 2,4-D and 2,4,5-T Compounds**

held

25 April 1963

APPENDIX A

Presentation by Dr. W.C. Shaw

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Appendix A

The Phenoxyacetate herbicides are used to control weeds in wheat, oats, barley, rice, asparagus, sugarcane, corn, and other crops. They are also used to control weeds and brush in swamplands and pastures, some croplands, undesirable hardwood trees in conifer forests, on utility rights-of-ways, industrial and military sites and military operations. These compounds are applied at rates of 1/15 to 150 pounds/acre depending on the vegetation to be controlled and method of application.

The herbicidal properties of these chemicals were reported in 1944 and their commercial manufacture began in about 1946. Since 1947 more than 300 million pounds have been produced and used to control vegetation on more than 400 million acres of land.

The annual production of the phenoxyacetate herbicides is estimated to exceed 50 million pounds and they are used on about 50 million acres of land each year.

These herbicides are registered by the U.S. Department of Agriculture and their use for weed control in food crops is permitted with a tolerance of 5 ppm on apples, asparagus, and other edible crops.

During the 15 years these herbicides have been used extensively in the U.S., the Dept of Agriculture records show that the Department has not received a single complaint of injury to humans, livestock, wildlife, or soils from the phenoxy herbicides. In addition, the major manufacturers of the phenoxy herbicides have certified that none of the workmen in their factories have shown any ill effects. Approximately 200 scientists conduct research with these compounds each year. Not a single case of injury, illness, or irritation of any kind has ever been reported.

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APPENDIX B

An Evaluation of Possible Skin Fall-Out Dose to Man

Presented by

Col P. L. Bauer

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Appendix B

Body Area - a 50 kg, 157 centimeter tall (110 lbs. 62 in) human has a total body area of 1.5 meters or 15.2 sq ft. For purpose of computation, it is assumed that a maximum of 1/2 of the body area can be made available to fall-out, i.e., 6 sq. ft.

Based upon well documented studies, the fall-out ratio between VX on the ground and on a human in various positions averages 1:0.75. Therefore, the theoretical maximum fall-out and deposition on a human body would be 6 sq ft x 250 mg per sq ft = 1500 x 0.75 (VX correction) = 1500 mg total body.

$$1500 \text{ mg} / 50 \text{ kg} = 30 \text{ mg/kg body weight}$$

It is also known from VX experiments that 1-2 layers of clothing provide 4 to 10-fold protection against fall-out skin deposition. If the human subject was assumed to be 50% covered by any form of clothing, then maximum theoretical body deposition is 15 mg/kg body weight.

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APPENDIX C

Toxicity of Herbicides in Various Animal Species

Presented By

Dr. B. P. Mahanara

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Appendix C

Considerable data can be found in the literature on phenoxyacetates. However, most of this information concerns the parent acids or salts. Although our interests are in the butyl esters of 2,4,5 and 2,4,5-T, the information on the parent acids and salts are pertinent because there are definite relationships between the parent compounds and the esters.

The data in Table 1 indicate a low order of toxicity for all of the compounds mentioned in the various animal species for the routes of administration shown. There are no significant differences in the toxicities of the various types of compounds by the intraperitoneal and intragastric routes of administration. By these routes of administration the toxicity of 'purple' is similar to that of the other compounds mentioned. By percutaneous application, 'purple' is less toxic than by the intraperitoneal, intragastric or intratracheal administration routes.

The information on the toxicity of the parent phenoxyacetates in dogs is sparse. These data indicate that dogs are more sensitive than other species to the toxic effects of phenoxyacetates. However, in dogs 'purple' appears to be less toxic than the parent compounds.

The data shown in Table 1 refers to the LD50 values. Table 2 gives the predicted dose (mg/kg) of the parent phenoxyacetates which might cause death in 1%, 0.1% and 0.01% of a population. Doses which might produce one death in a population of 10,000 are considerably higher than the maximum dose (50 mg/kg) which could have been delivered in the Viet Nam operations. It would be expected that the lethal dose for 'purple' would be similar to those shown in Table 2.

A summary of the available data from toxicity studies now in progress are shown in Table 3. These data indicate that 'purple' will be no more toxic than predictions from information contained in Tables 1 and 2. This suggests that it is very unlikely that 'purple' would produce any fatalities as used in the operations in Viet Nam.

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Appendix C - Table 1

TOXICITY OF PHENOXYACETATES

Species	Route	LD50 mg/kg					Purple (4)
		2,4-D		Mixed Butyl Esters	2,4,5-T		
		Acid	Salt		Acid	Mixed Butyl Esters	
Rat	ip		512(2)-569(2)				436
	ig	375(1)	666(2)-105(1)	620(1)	527(1)	481(1)	440
	it						545
	pc						6000
	pce						>12500
Rabbit	iv		400 (2)				
	ip						1130
	ig		600(2)	424(1)		712(1)	2650
	it						550
	pc						1350
Dog	ip						353
	ig		100(3)		100(3)		-
	it						305
	pc						>1250
Mouse	ip		369(2)-426(2)				
	ig	300(1)	375(1)	713(1)	309(1)	940(1)	
Guinea P	ip		567(2)-600(2)				
	ig	459(1)	551(1)-1000(2)	040(1)	331(1)	750(1)	
Chicks	ig	541(1)		2000(1)	310(1)		

(1) Howe & Kynas, Am J. Vet Med, Vol XV, No. 57, p 622, 1954.

(2) Hill & Carlisle, J Ind Hyg & Tox, 29:85, 1947.

(3) Brill & Hiratake, Arch Ind Hyg & Occup Med, 7:61, 1953.

(4) CRDL