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Item ID Number	01478
Author	
Corporate Author	
Report/Article Title	Manuscript: Exposure Estimates for Herbicide Orange of Ranch Hand and ground troops in Vietnam
Journal/Book Title	
Year	0000
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Color	☐
Number of Images	25
Description Notes	

	TCDD = 94 mg/kg 100% canopy Penet. 10% absorption		TCDD 94 mg/kg 6% Canopy Penet 10% Abs		4 100 10		4 6 10
	2,4,5-T (mg/kg)	TCDD (mg/kg)	2,4,5-T (mg/kg)	TCDD	T	TCDD	T TCDD
Dermal Exposure	0.132	12.4	0.888	0.74	132	0.53	8 0.03
Inhal Exposure	15.	1.41	0.9	0.084	15	0.065	0.9 0.004
Total	147	13.81	8.9	0.824	147	0.595	8.9 0.034
RPAR PEL	20,000	30	20,000	30	20,000	30	20,000 30
No effect Level for Cancer		1.0 ~~13.8~~		1.0 ~~1.82~~		1.0 ~~.59~~	1.0

Deposition Rates in SVN

	Herbicide Purple				Herbicide Orange			
	TCDD = 94 mg TCDD/Kg 2,4,5-T				TCDD = 4 mg TCDD/Kg 2,4,5-T			
Italian Decon. Stds	100% Penet.		6% Penet		100% Penet.		6% Penet.	
	2,4,5-T (g/m^2)	TCDD (ug/m^2)	2,4,5-T (g/m^2)	TCDD (ug/m^2)	2,4,5-T (g/m^2)	TCDD (ug/m^2)	2,4,5-T (g/m^2)	TCDD (ug/m^2)
Homes - 0.01 ug/m^2	1.35	[illegible]	0.08	[illegible]0006	1.35	0.0054	0.08	0.0003
Outside homes - 0.75 ug/m^2								
Gardens - 5.0 ug/m^2								
	TCDD = 32.8 mg TCDD/Kg 2,4,5-T				TCDD = 30 mg TCDD/Kg 2,4,5-T			
Seveso Levels	100%		6%		100%		6%	
Zone / Range (ug/m^2)	T (g/m^2)	TCDD (ug/m^2)	T (g/m^2)	TCDD (ug/m^2)	T (g/m^2)	TCDD (ug/m^2)	T (g/m^2)	TCDD (ug/m^2)
A ND - 5,000	1.35	[illegible]	0.08	0.0026	1.35	0.0405	0.08	0.0024
B ND - 44								

Threshold values for decon adopted ~~by~~ following recommendations of the Medical - Epidemiological Commission Sept 27 & Oct 11 76

Indoor levels 0.01 ug/m²

Outdoor levels (including appurtenances of homes) 0.750ug/m²

Outdoor levels (soils in gardens & other areas) 5.0ug/m²

Ref: Regional Lombardy ~~Commission~~ Council of Sanitation

"Decontamination of Dioxin Contaminated Areas"

as approved by the Regional Council Aug 24, 1976

A. Giovanardi, 4 Dec 76.

Zone adjacent to factory 2000 $\mu g/m^2$
Giovanardi

98% of TCDD in top 4cm of soil
"Nature" Vol 265, 7 Feb 77 p 490

La Rosa
Kelly Info Ofc

Animals more susceptible
true of most pesticides

Could compare ~ Eglin & Seveso

Levels of TCDD/m^2 @ Eglin ✓
" " " / " @ Seveso ✓
" " " / " in RVN ✓
" " " / m^2 in Vietnam/Laos

Stds set by Lombardy Authorities

Zone A: 96% of all samples are $\leq 5000 \mu g/m^2$

$\bar{x}$ =

Ref	Zone	Area	Inhab	TCDD	
(1)	A	$1 \times 10^6 m^2$	700	50-1,000 $\mu g/m^2$	
(2)	B	50.6 ha	800	50-1,000	50 ppm on leaves

①	B	$2 \times 10^6 m^2$	5,000	$0.75 - 50 \mu g/m^2$
②		199 ha	4,300	$5 - 50 \mu g/m^2$
③				$43.8 \mu g/m^2$

$\bar{x} = 3.4 \mu g/m^2$

Respect (c)

② (c)

1/3:

Calculate amount of TCDD per m^2 in 2VN

Assume
HP = TCDD = 94 mg/10^6 mg
NO = " = 4 "
Application rate 12 # 2,4,5-T/A

100% penetration
6% "

100% $\frac{12\ \#\ 2,4,5\text{-}T}{A} \times \frac{1\ A}{4,047\ m^2} \times \frac{Kg}{2.2\#} \times = \frac{1.35g}{m^2}$

(.72)

6% $= \frac{0.08g}{m^2}$

TCDD / HP

100% $\frac{1.35g}{m^2} \times \frac{94\ mg}{10^6 g} = 1.27 \times 10^{-4} \frac{mg}{m^2}$

6% $\frac{0.08g}{m^2} \times \frac{94\ mg}{10^6 g} = 7.62 \times 10^{-6} \frac{mg}{m^2}$

2/3:

TCDD/HO

100% $\frac{1.35g}{m^2} \times \frac{4mg}{10^6 g} = 5.4 \times 10^{-6} \frac{mg}{m^2}$

6% $\frac{0.08g}{m^2} \times \frac{4mg}{10^6 g} = 3.2 \times 10^{-7} \frac{mg}{m^2}$

According to Givaudan (10 Mar 77)
the TCDD levels at Seveso were

Area A ~ 30 ug/m²
" B 4 ug/m²

According to W. Forth (Nov 77)

The TCDD levels at Seveso were initially —
Area A 6,000 ug/m²
Area B ± 50 ug/m²

The calculated TCDD surface levels in RVN were:

HP ♂ 6% 100%
7.62 ng/m² — .127 ug/m²
(0.0076 ug/m²

HO ♂ 6% 100%
0.32 ng/m² — 5.4 ng/m²
(0.0003 ug/m²) — (0.0054 ug/m²)

HP $\bar{c}$ TCDD = 33 ppm
HO $\bar{c}$ " = 30 ppm

TCDs in top 7cm

Ital std of $\frac{0.01 \text{ ug}}{m^2}$

A- 5,000 ug/m^2

B. 50 ug/m^2

M < 5 ug/m^2

W. Forthe Nov '77

Guardian 10 Mar 77

Zone	Range	Mean	
B	ND - 43.8	3.93	$\mu g/m^2$
A6	ND - 270.4	29	
A7	ND - 91.7	15	
AN	ND - 21.2	—	

5,000 $\mu g/m^2$

	Herbicide Purple				Herbicide Orange			
	TCDD = 32.8 mg TCDD/Kg 2,4,5-T				TCDD = 30 mg TCDD/Kg 2,4,5-T			
	100% Penet.		6% Penet.		100% Penet.		6% Penet.	
	2,4,5-T (ug/Kg)	TCDD (mg/Kg)	2,4,5-T (ug/Kg)	TCDD (mg/Kg)	2,4,5-T (ug/Kg)	TCDD (mg/Kg)	2,4,5-T (ug/Kg)	TCDD (mg/Kg)
Dermal	132	4.33	8	0.262	132	3.96	8	0.240
Inhalation	15	0.49	0.9	0.030	15	0.45	0.9	0.027
Totals	147	4.82	8.9	0.292	147	4.41	8.9	0.267

	Herbicide Purple				Herbicide Orange			
	TCDD = 94 mg TCDD/Kg 2,4,5-T				TCDD = 4 mg TCDD/Kg 2,4,5-T			
	100% Penet.		6% Penet.		100% Penet.		6% Penet.	
	2,4,5-T (ug/Kg)	TCDD (mg/Kg)	2,4,5-T (ug/Kg)	TCDD (mg/Kg)	2,4,5-T (ug/Kg)	TCDD (mg/Kg)	2,4,5-T (ug/Kg)	TCDD (mg/Kg)
Dermal Exposure (head, neck shoulders, hands forearms, thighs) 10% absorption	132	12.4	8	0.74	132	0.53	8	0.03
Inhalation Exposure 100% absorption	15	1.41	0.9	0.084	15	0.065	0.9	0.004
Totals	147	13.81	8.9	0.824	147	0.595	8.9	0.034

p. IV-60 Table 9

Dow / Schwartz et al 1973	Single oral dose No effect rat (male)	8 and 16 ug/kg
	Injected in Rabbit (5 rabbits)	32 ug/kg
	Oral in Dog (6 dogs)	30 – 300 ug/kg

A

Inhalation Exposure

From RPAR

0.067 mg Malathion / m^3 / 0.46#

$\frac{0.067\ mg/m^3}{0.46\#} \times 12\# = 1.748\ mg/m^3$

$1.748 \times 1/6 = 0.291\ mg/m^3$

Resp rate of $1.8\ m^3/hr$
Exposure for 2 hr

$\frac{0.291\ mg}{m^3} \times \frac{1.8\ m^3}{hr} \times 2\ hr = 1.05\ mg\ T$

TCDD @ 94 mg / Kg

$1.05\ mg\ T \times \frac{94\ mg\ TCDD}{10^6\ mg\ T} = 98.7\ mg\ TCDD$

9.8×10^{-5} mg
9.8×10^{-2} ug
98.7 ng

For 70 Kg man 100 % abs

2,4,5-T	0.015 mg/Kg
TCDD	1.41 mg/Kg

B

TCDD @ 4 mg/Kg

$(1.05)\left(\frac{4}{10^6}\right)$ = 4.6 mg TCDD

4.2×10^{6} mg
4.2×10^{0} mg

For 70 Kg Man 100% abs

2,4,5-T	0.015 mg/Kg
TCDD	0.065 mg/Kg

For 6% penetration

TCDD @ 94 mg/Kg

		70Kg
2,4,5-T	0.063 mg	0.0009 mg/Kg
TCDD	5.92 mg	0.084 mg/Kg

9×10^{-4} mg/Kg
0.0009

TCDD @ 4 mg/Kg

2,4,5-T	0.0009 mg/Kg
TCDD	0.004 mg/Kg

(A)

Dermal exposure
(head, neck, shoulders, forearms, hands & thighs)
According to RPAR

$$\frac{3.556\ mg\ malathion}{0.46\ \#/gal\cdot Acre} \times 3\ gal/Acre \times \frac{4\ \#\ T}{gal}$$

= 92.7 mg 2,4,5-T

TCDD @ 94 mg TCDD/Kg T

$$92.7\ mg\ T \times \frac{94\ mg\ TCDD}{Kg\ T} \times \frac{Kg}{10^6\ mg}$$

= 0.009 mg TCDD

Assuming 10% absorption — 70 Kg Man

2,4,5-T	=	9.27 mg	0.132 mg/Kg
TCDD	=	0.87 ug	12.4 ng/Kg

TCDD @ 4 mg TCDD/Kg T

$$92.7\ mg\ T \times \frac{4\ mg\ TCDD}{Kg\ T} \times \frac{Kg}{10^6\ mg}$$

= 0.37 ug TCDD — 70 Kg Man

10% abs =
TCDD = 0.037 ug — 0.53 ng/Kg

Assuming only 6% penetration:

~~TCDD @ 94 mg TCDD/Kg~~

2,4,5-T

92.7 mg 2,4,5-T (0.06) = 5.56 mg T

TCDD = 5.56 mg T $\times \frac{94 \text{ mg TCDD}}{10^6 \text{ mg}}$ = 0.52 Mg TCDD

5.22×10^{-4} mg .52 Mg

10% absorption:

			70 Kg
2,4,5-T	=	0.56 mg T	0.008 mg/Kg
TCDD	=	52 ng TCDD	0.74 mg/Kg

TCDD @ 4 mg/10^6 mg

0.56 mg T $\times \frac{4 \text{ mg TCDD}}{10^6 \text{ mg T}}$ =

TCDD = 2.24 mg TCDD 0.03 mg/Kg

p62 Early Care of Injured patient

				Total
1/2				
3 1/2	Head		7	7
1	Neck	9	2	2
3	Shoulders	15	6	6
2	Upper Arms	23	4(2)	8
1 1/2	Forearms	29	3(2)	6
1 1/2	Hands	35	3(2)	6
10	Trunk	55	20	20
2 1/2	Buttocks	60	5	5
4 3/4	Thighs	79	9 1/2(2)	19
3 1/2	Calf's	93	7(2)	14
~~1 3/4~~	Feet			
1 3/4	Genital	98	2 1/2(2)	5
1 3/4			0 1/2	5
				102

head -	7
Shoulders -	6
Neck -	2
Forearms -	6
Thighs (front)	10
	31% of body surface

Forearms	6
Hands	6
Thighs (front)	10
Calfs (front)	7
Feet Top	3
	32%

11,261,429

Herbs Total 11,304,869

ORANGE

white 5,246,502

HERBS 5,246,612

Blue MAS 1,124,307

1,127,367

Combat Tactical Zone

	Orange	~~White~~ Blue	white
Region I	2,250,000	298,000	363000
Region II	2,519,000	473,000	729,000
Region III Saigon	5,309,000	294,000	~~5,718,000~~ 3,719,000
Region IV	1,227,000	62,000	~~435,000~~
	11,305,000	1,127,000	5,246,000

HERBS TAPE

13 Dec. 79

GHO Thoughts

1. Marines make a readily identifiable group —

2. However, assessment of exposure is extremely difficult if not impossible.

   a. assume: marine unit of 1200 men was on-site at time of spray

   b. assume: all were down wind and that significant drift of spray occured

   c. assume: all 1200 men were at same location

   d. assume: enough spray drifted to penetrate a thick triple canopy jungle

[redacted]

3. Categorization system as proposed will misclassify as "exposed" many who were not truly exposed

4. This will introduce bias and dilute a true effect if one existed

5. Due to photo degradation and the infrequency of drift heavy enough to penetrate thick foliage to ground level, the [redacted] most likely group to study is those [redacted] 5,900 marines within 0.5 km on day 1

and those 16,500 within 1.5 km or day 1

6. Selection of a control group is not addressed.

7. The best approach is to await the RFA II mortality and/or morbidity study data before embarking on a study of this group

8. Perhaps an interim approach would be to do the Hopkins Mortality study on the total group of identified marines, taking time/photodegradation and distance into effect

9. This would not alleviate the problems of exposure misclassification/assumptions or control group selection!