Medical, A2SC

October 25, 1972

AROCLOR 1242
SANTOSOL 300
MIPB
JFH to GJL, 8/24/72

C. Paton - B2SC
W. R. Richard - T3A
Q. E. Thompson - T3E
J. C. Wygant - T3E
R. E. Kelly/E. P. Wheeler/
J. T. Garrett - A2SA

J. F. Herber
T3G

Four-day static fish toxicity studies have been completed on these 3 products. Results are summarized in the attached table. From the observed mortalities, 96-hour TL_{50} values were calculated using Thompson's method of moving averages and tables prepared by Weil (Biometrics: 8, 249-263, 1952). Because of the death of an occasional fish at the low concentrations, the calculation of the TL_{50} proved to be a frustrating exercise in a few cases. In general terms, however, all 3 materials have a similar relatively low degree of toxicity to both species of fish.

George J. Levinskas

/bks

att.

File	✓	
Destroy		
CDB		
JTG	✓	✓
WEN		
MNJ		
RSK	✓	✓
BWB		
EPW	✓	✓
GJL		

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Table 1

Duration of Exposure, Average Concentration of Aroclor 1242 or 1254 and Temperature to Which the Aroclor Was Heated

(Experiments in Which Exposures Have Been Completed)

Material	Experiment No.	Duration of Exposure Hours	Concentration		Temperature of Aroclor in Well °C.
			Y/liter (or mg./cu. m.	p.p.m.	
Aroclor 1242	1	17 x 7	8.6	0.83	132 - 138
Aroclor 1242	2	82 x 7	6.8	0.66	100 - 102
Aroclor 1254	1	83 x 7	5.4	0.41	130 - 135
Controls	"	84 x 7	"	"	"

Table 1A

(Experiments in Progress)

Material	Experiment No.	Duration of Exposure Hours (1)	Concentration (2)		Temperature of Aroclor in Well °C.
			Y/liter (or mg./cu. m.	p.p.m.	
Aroclor 1242	3	102 x 7	3.1	0.30	95
Aroclor 1254	2	103 x 7	1.7	0.13	120
Controls	2	103 x 7	"	"	"

(1) As of June 30, 1971

(2) As of June 15, 1971

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Table 2

Summary of Mortality Among Experimental and Control Animals

Material	Concentration		Duration of Exposure Hours	Number of Fatalities/Number of Animals Exposed				
	Y/l.	p.p.m.		Cats	Guinea-Pigs	Mice	Rabbits	Rats
Aroclor 1242	8.60	0.83	17 x 7.0	0/1	0/6	0/10	0/4	0/10
Aroclor 1242	6.83	0.66	82 x 7.0	0/1	1/7 (1)(2)	3/12 (1)(3)	2/5 (1)	1/11(1)(4)
Aroclor 1254	5.40	0.41	83 x 7.0	0/1	2/8(1)(2)(5)	0/10 (1)(6)	3/7 (1)(7)	0/10 (1)
Controls	0	0	84 x 7.0	0/1	2/8 (1)(8)	7/14 (2)(9)	1/5 (10)	1/11(1)(11

(1) One survivor was exposed on only 65 or 66 days.
(2) One survivor was exposed on only 67 or 68 days.
(3) Two survivors were exposed on only 41 or 58 days, respectively
(4) One survivor was exposed on only 23 days.
(5) One survivor was exposed on only 71 days.
(6) Five survivors were exposed on only 74 days.
(7) One survivor was exposed on only 33 days.
(8) Two survivors were exposed on only 20 or 77 days, respectively.
(9) Three survivors were exposed on only 14, 14 and 19 days, respectively.
(10) One of the survivors was exposed on only 19 days.
(11) One of the survivors was exposed on only 44 days.

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Table 3

The Average Initial and Final Weights and Changes in Weight of Experimental and Control Animals

	Survivors					Animals That Died				
cies	n	Average Initial Weight kg.	Average Weight at Termination of Experiment kg.	Average Change in Weight During Exposure(1) kg.	Average Change in Weight Expressed as Percentage of Initial Weight(1)	n	Average Initial Weight kg.	Average Weight at Termination of Experiment kg.	Average Change in Weight During Exposure(1) kg.	Average Change in Weight Expressed as Percentage of Initial Weight(1)
Group Exposed to 8.6% of Aroclor 1242/Water (Exp. No. 1)										
	1	2.863	3.095	+0.232	+8.1	0	-	-	-	-
nea pig	6	0.649	0.640	-0.008	-2.0	0	-	-	-	-
e	10	0.024	0.026	+0.002	+9.1	0	-	-	-	-
bits	4	3.901	4.193	+0.291	+7.7	0	-	-	-	-
s	10	0.238	0.243	+0.005	+2.1	0	-	-	-	-
Group Exposed to 6.8% of Aroclor 1242/Water (Exp. No. 2)										
t	1	2.271	2.775	+0.504	+22.2	0	-	-	-	-
inea pig	6	0.404	0.629	+0.225	+56.4	1	0.385	0.321	-0.064	-16.6
e	9	0.021	0.026	+0.004	+21.2	3	0.020	0.019	-0.001	-7.1
bits	3	2.587	3.898	+1.311	+50.5	2	2.672	2.968	+0.297	+11.4
te	10	0.212	0.250	+0.038	+17.6	1	0.213	0.200	-0.013	-6.1

Table 3 (Page 2)

	Survivors					Animals That Died				
ecies	n	Average Initial Weight kg.	Average Weight at Termination of Experiment kg.	Average Change in Weight During Exposure(1) kg.	Average Change in Weight Expressed as Percentage of Initial Weight(1)	n	Average Initial Weight kg.	Average Weight at Termination of Experiment kg.	Average Change in Weight During Exposure(1) kg.	Average Change in Weight Expressed as Percentage of Initial Weight
				Group Exposed to [illegible] of Aroclor 1254/liter						
t	1	2.320	2.833	+0.[illegible]	+22.1	0	-	-	-	-
inea gs	6	0.409	0.571	+0.[illegible]	+40.7	[illegible]	0.[illegible]	0.[illegible]	-0.12[illegible]	-
ce	10	0.021	0.027	+0.00[illegible]	+2[illegible]	0	-	-	-	-
bbits	4	2.722	3.806	+[illegible]	+39.7	[illegible]	2.[illegible]	2.15[illegible]	-0.[illegible]	-
ts	10	0.227	0.242	+0.[illegible]	+[illegible]	0	-	-	-	-
				Group Exposed to Conditioned Air						
t	1	2.388	2.545	[illegible]	+[illegible]	0	-	-	-	-
inea gs	6	0.418	0.645	+0.[illegible]	+[illegible]	[illegible]	0.[illegible]	0.[illegible]	+0.030	[illegible]
ce	7	0.022	0.024	+0.[illegible]	+17.4	[illegible]	0.[illegible]	0.020	+0.001	-
bbits	4	2.764	4.[illegible]	+1.2[illegible]	+44.5	1	3.[illegible]	3.[illegible]	+0.470	+1[illegible]
ts	10	0.211	0.245	+0.034	+16.4	1	0.212	0.139	-0.073	+34.[illegible]

(1) $\left(\sum\left(\frac{\text{Final Weight} - \text{Initial Weight} \times 100\%}{\text{Initial Weight}}\right)\right)$

n

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Table 4

Summary of the Ratio of the Weight of the Liver or the Weight of the Kidneys to the Body Weight of Animals Exposed to the Vapor of Aroclor 1242 or Aroclor 1254

Aroclor	Organ	Species of Animal	n	Average Organ Weight g.	Average Organ/Body Weight 100 g.	Ratio of Weight of Organ to Body Weight g./100 g.	t	P
1242	Liver	Rat	9	11.2	2.40	4.64	1.2451	0.20-0.30
1242	Liver	Guinea Pig	6	29.6	6.40	4.64	0.4291	0.50
1242	Liver	Rabbit	3	122.0	40.23	3.04	1.3085	0.10-0.20
1254	Liver	Rat	10	12.8	2.39	5.34	3.3992	0.01
1254	Liver	Guinea Pig	6	25.9	5.81	4.51	0.0000	0.50
1254	Liver	Rabbit	4	120.0	35.37	3.53	1.0122 (1)	0.50
1242	Kidney	Rat	9	1.35	2.40	0.773	0.5842	0.50
1242	Kidney	Guinea Pig	6	3.0	6.40	0.505	0.7257	0.40-0.50
1242	Kidney	Rabbit	3	18.6	40.23	0.468	0.4177	0.50
1254	Kidney	Rat	10	2.1	2.39	0.770	0.4199 (1)	0.50
1254	Kidney	Guinea Pig	6	4.6	5.81	0.808	0.9411	0.50
1254	Kidney	Rabbit	4	15.8	35.37	0.464	0.3163	0.50

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Table 4 - Page 2

Control	Organ	Species of Animal	n	Average ORGAN Weight Gm.	Average ORGAN Weight 100 Gm.	Ratio of Weight of Organ to Body Weight Gm./100 Gm.	t	P
"	Liver	Rat	10	9.9	2.63	4.15	-	-
"	Liver	Guinea Pig	6	30.3	2.66	4.51	-	-
"	Liver	Rabbit	4	102.3	37.93	2.61	-	-
"	Kidney	Rat	10	2.6	2.43	0.807	-	-
"	Kidney	Guinea Pig	6	4.8	6.65	0.731	-	-
"	Kidney	Rabbit	4	19.5	59.33	0.504	-	-

$$\pi \bar{x}_1 = \bar{x}_2 \sqrt{\frac{(n_1 s_1^2) + (n_2 s_2^2)}{(n_1 + n_2)(n_1 + n_2 - 2)}} \quad ; df = n_1 + n_2 - 2$$

(1) When the variances were significantly different, the calculated "t" was obtained by the following formula:

$$s = s_x^2/df + s_{\bar{x}}^2/n - 2; \; s_{\bar{x}}^2 = s^2/n; \; s_{\bar{x}} = \sqrt{s_{\bar{x}_1} + s_{\bar{x}_2}}$$

$$t\,(cal.) = \bar{x}_1 - \bar{x}_2/s_{\bar{x}}$$

The tabular "t" was obtained by the following formula:

$$t\,(tab.) = (t_1)(s_{\bar{x}_1}^2) + (s_{\bar{x}_2}^2)(t_2)/s_{\bar{x}_1}^2 + s_{\bar{x}_2}^2$$

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TABLE 5 (page 1)

The Effect Upon the Apparent Prothrombin Content (Method of Kato) of the Blood of Cats and Rabbits Exposed to the Vapor of Aroclor 1242 or Aroclor 1254 in Air for 7 Hours per Day, 5 Days per Week Over a Period of Several Months

Relation of Prothrombin Time of Control and Exposed Animals Expressed Arbitrarily as Clotting Time of Blood 100 x Clotting Time of Blood of Control Animals / Clotting Time of Blood of Exposed Animals						Time of Sampling in Relation to Time of Exposure	
						Days Before First Exposure	Serial Number of Periods of Exposure After Which Blood Was Drawn
EVALATION NO. 2 A OCLOR 1242 - 5.35Y/l.							
Cat A445	Rabbits				Average		
	I 370	I 371	I 372	I 373			
100.0	87.5	85.3	85.3	89.9	89.6	3	
90.3	95.2	95.2	89.9	96.1	93.6	2	
113.6	105.6	95.0	105.6	105.6	105.1		10
101.5	95.9	95.9	99.3	102.7	99.0		30
97.4	96.4	100.0	100.0	96.4	98.0		45
116.2	97.3	107.5	100.0	96.3	105.7		59
	105.1	93.9		100.4	101.5		82
		100.0			100.0		(1)

(1) Determination performed 15 days after 82nd exposure.

TABLE 5 (page 2)

The Effect Upon the Apparent Prothrombin Content (Method of Kato) of the Blood of Cats and Rabbits Exposed to the Vapor of Aroclor 1242 or Aroclor 1254 in Air for 7 Hours per Day, 5 Days per Week Over a Period of Several Months

Relation of Prothrombin Time of Control and Exposed Animals Expressed Arbitrarily as Clotting Time of Blood 100 x Clotting Time of Blood of Control Animals / Clotting Time of Blood of Exposed Animals									Time of Sampling in Relation to Time of Exposure	
									Days Before First Exposure	Serial Number of Periods of Exposure After Which Blood Was Drawn
INHALATION NO. 1 ARCLOR 1254 - 5.40 Y/1.										
Cat A444	Rabbits							Average		
	I 362	I 363	I 364	I 455	I 587	I 718	I 807			
100.0	97.8	92.3	97.8	97.8				97.1	3	
100.0	101.2	93.2	89.9	95.2				96.9	2	
							81.8	81.8		9
98.5	89.1	89.1	95.0	78.1				90.0		10
					102.7	96.4		99.6		15
113.6	95.9	102.7	95.9					102.0		30
							112.1	112.1		32
101.5	90.0	96.4	100.0					97.0		45
92.5	93.5	97.8	97.8					95.4		59
90.0		100.4						95.2		83
			100.0					100.0		(2)

(2) Determination performed 14 days after 83rd exposure.

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Table 6

The Average Number of Erythrocytes and Leucocytes and the Average Hemoglobin Content in the Peripheral Blood of Experimental and Control Animals

Species of Animals	Erythrocytes: Thousands per mm^3			Leucocytes: per mm^3			Hemoglobin: g./100 ml.		
	Average $\bar{x}$	n	Sx^2	Average $\bar{x}$	n	Sx^2	Average $\bar{x}$	n	Sx^2
Inhalation No. 2 Aroclor 1242 - 6.83Y/l.: 7 hours/day									
Guinea-Pigs	5,701	7	366,216	(1) 10,112	7	80,505,475	(2) 14.4	7	5.6
Rabbits	6,088	5	518,558	9,755	5	24,026,678	12.1	5	0.6
Inhalation No. 1 Aroclor 1254 - 5.40Y/l.: 7 hours/day									
Guinea-Pigs	5,886	8	303,154	12,927	8	60,773,403	(2) 14.5	8	1.8
Rabbits	(2)6,488	6	424,486	10,811	6	11,353,241	13.2	6	7.6
Controls Exposed to Conditioned Air									
Guinea-Pigs	5,729	7	911,602	12,124	7	58,659,183	13.9	7	1.9
Rabbits	5,909	5	412,093	11,590	5	24,344,656	12.2	5	1.5

$Sx^2 = \Sigma x^2 - \frac{(\Sigma x)^2}{n}$

(1) Value significantly less than that obtained on controls.
(2) Value significantly greater than that obtained on controls.

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Table 7

| | | |

Table 8

Rate of Animals Exposed to Lower Concentrations of Aroclor 1242 or 1254

Av. conc. 1st 100 runs (Aroclor 1242, 2.1 /1 (0.22 p.p.m.);
Aroclor 1254, 1.7 /1 (0.1[illegible] p.p.m.).)

Species of Animals	Number That Died/Number Exposed								
	Original Groups			Replacements			Total		
	Aroclor 1242	Aroclor 1254	A.C. Controls	Aroclor 1242	Aroclor 1254	A.C. Controls	Aroclor 1[illegible] exp.	Aroclor 1[illegible] exp.	[illegible]
ats	0/1	0/1	[illegible]	-	-	-	[illegible]	0/1	0/[illegible]
inea-Pigs	0/[illegible]	2/[illegible]	[illegible]	-	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
ice	2/10	4/10	1/10	[illegible]	1/[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
abbits	1/4	0/4	[illegible]	[illegible]	-	[illegible]	[illegible]	0/[illegible]	[illegible]
ats	1/10	0/10	[illegible]	[illegible]	-	[illegible]	[illegible]	[illegible]	[illegible]

oclor 1242 - 102nd run on [illegible], [illegible].

roclor 1254 and A.C. Controls - [illegible] run on June [illegible], [illegible].

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Table 9

Average Gain in Weight of Animals Exposed to Lower Concentrations of Aroclor 1242 or Aroclor 1254

(given for animals that survived all exposures; findings as of 6/14/54)

Species of Animal	n	Average Weight at Start g.	Average Weight on 6/14/54 g.	Average Gain g.	Average Increase Expressed as Percentage of Initial Weight
Aroclor 1242					
Cat	1	1,720	3,333	1,613	92.7
Guinea Pigs	6	507.5	762.0	254.5	50.1
Mice	8	23.9	27.8	3.9	16.3
Rabbits	3	2,723	1,222	1,249	44.4
Rats	9	224	279	65	30.4
Aroclor 1254					
Cat	1	2,858	3,425	567	19.8
Guinea Pigs	4	497.3	687.5	220.2	41.1
Mice	5	24.3	27.8	3.5	31.1
Rabbits	4	2,957.5	4,397.0	1,439.5	45.7
Rats	10	222.1	278.1	56.0	25.2
A. C. Controls					
Cat	1	3,329	2,965	-364	-11.5 (*)
Guinea Pigs	5	500.4	772.4	272.0	54.4
Mice	9	25.1	29.0	2.9	11.1
Rabbits	2	2,837.5	3,875.0	1,037.5	37.5
Rats	9	217.3	273.8	56.5	25.7

* on 6/19 Cat weighed 3,180 g.

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Table 10

Comparison of Toxicity of Products of Thermal Decomposition of Aroclor 1248 and a Paraffinic Hydrocarbon Hydraulic Fluid

(Air-Flow Through Furnace; Liters Per Minute: Paraffin 30, Aroclor 20)

Material	Rate of Delivery into Furnace				Temperature of Inconel °F.	Experiment No.	Duration of Exposure Hours	Number of Animals That Died / Number of Animals Exposed				
	mg./min.	mg./l.	ml./min.	ml/l.				Guinea Pigs	Mice	Rabbits	Rats	Total
Aroclor 1248	176	8.8	0.122	0.0061	1050	7	7	2/2	3/5	1/3	2/2	8/12
Paraffin	181	9.0	0.208	0.0069	1050	8	7	0/2	0/5	3/4	2/4	5/15
Paraffin	123	4.1	0.141	0.0057	800	9	7	1/2	3/5	4/4	4/4	12/15
Aroclor 1248	174	8.7	0.121	0.0065	1050	9	3.5	2/2	4/5	2/3	0/2	8/
Aroclor 1248	84	4.2	0.058	0.0029	1050	12	3.5	2/2	0/5	1/3	0/2	3/12
Paraffin	116	3.9	0.133	0.0044	1050	19	3.5	0/2	0/5	3/4	2/4	5/15
Paraffin	118	3.9	0.135	0.0045	800	10	3.5	0/2	0/5	0/4 (1)	2/4	2/15
Paraffin	70	2.3	0.080	0.0027	800	15	3.5	0/2	2/5	4/4	1/4	7/15
Aroclor 1248	173	8.7	0.120	0.0060	1050	10	1.0	2/2	0/5	1/2	0/2	3/11
Aroclor 1248	98	4.9	0.068	0.0034	1050	13	1.0	2/2	1/4	0/3	0/2	3/11
Paraffin	109	3.6	0.125	0.0042	1050	20	1.0	0/2	0/5	0/4	0/4	0/15
Paraffin	214	7.1	0.247	0.0082	800	7	1.0	0/2	0/5	2/4	2/4	4/15
Paraffin	114	3.8	0.131	0.0044	800	16	1.0	0/2	0/5	1/4	0/4	1/15

(1) From remaining data (see Figure 8, report of June 15, 1954 on Paraffinic Hydrocarbon Hydraulic Fluid) we would anticipate that if this experiment were repeated that fatalities would occur among rabbits.