REPORT TO

MONSANTO CHEMICAL COMPANY

SUBACUTE DERMAL TOXICITY OF

AROCLOR 1254

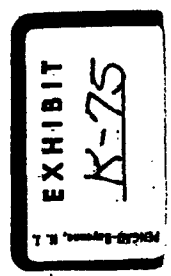
I. Introduction and Outline of Procedure

A sample identified as Aroclor 1254 was received from Monsanto Chemical Company for evaluation of 20-day subacute dermal toxicity in albino rabbits.

Skin applications of the test material, in the form of a corn oil solution, were made daily to four test groups consisting of two rabbits each (one male and one female) for a period of 20 days. These test groups corresponded to daily dermal doses of 10, 50, 100 and 200 mg/kg/day respectively.

In addition to the four test groups, a treated control group of two rabbits was also employed. The animals in this group received daily dermal applications of corn oil comparable to the volume administered to the highest test dose group.

The rabbits in all groups were housed individually over the period of investigation and observations were made with respect to body weight effects, incidence of mortality, reactions displayed and status of the



hematopoietic and urinary systems. Special emphasis was placed on observations for skin irritation produced by the test material.

Following the 20-day application period, the rabbits were kept under observation until an additional 14 days had elapsed. At the end of this period, final mortality tabulations were made and all surviving rabbits from each test and control group were sacrificed for pathologic studies. Gross autopsies were performed and a complete set of representative tissues and organs was taken from each rabbit and preserved in formalin. Microscopic examinations of selected tissues and organs were made to ascertain the presence or absence of histopathologic change as a result of dermal applications of the test material at the dose-levels employed.

The dosage schedule and other pertinent data are presented in Table I.

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— Monsanto Chemical Company

TABLE I

20-Day Subacute Dermal Toxicity - Albino Rabbits

Dosage Schedule

Group	Number of Animals	Dose* (mg/kg/day)	Number of Scheduled Consecutive Applications
T-C	2	**	20
T-I	2	10	20
T-II	2	50	20
T-III	2	100	20
T-IV	2	200	20

* Administered as a 4.0 per cent solution in corn oil.
** The treated control rabbits received doses of corn oil comparable in volume to that applied to the rabbits of the high dose group.

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II. Investigational Procedure

A. Experimental Animals

The animals employed in the 20-day subacute dermal toxicity study were adult, New Zealand strain albino rabbits. The body weights of the test animals were in the two-to-three kilogram range. A total of 10 adult rabbits were selected from a larger population after examination of each animal for general physical well-being. Each animal selected for the experiment was housed individually in a wire-bottomed stainless steel rabbit cage for the duration of the test. All rabbits were fed a standard laboratory rabbit ration* plus water ad libitum.

B. Method of Application

In preparation for the test, the back of each rabbit was shaved using electric clippers. The exposure site thus prepared on each animal constituted approximately ten per cent of the total body surface area. The animals were then returned to their stock cages, and 24 hours were allowed to elapse before the first percutaneous applications were made. This period permitted the skin to recover from the slight disturbance of the stratum corneum caused by the clipping procedure and also permitted the healing of any microscopic abrasions possibly produced during the shaving procedure.

At the end of the 24-hour recovery period, the calculated doses of the test material in the form of a 4.0 per cent (w/v) corn oil solution

* Rockland Rabbit Ration, Rockland Farms, New City, New York.

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were gently distributed (without rubbing) over the entire application sites on the test rabbits.

The animals in the treated control group were treated in the same manner as those in the test group with the exception that corn oil alone was applied to the skin.

Following the dermal applications, the animals were returned to their individual cages to await testing on the following day.

The above schedule was followed every day, including weekends, for a total of 20 consecutive days.

C. Body Weight Effects

On the morning of the first test day, the body weight of each rabbit in every group was determined and recorded. Thereafter, individual weighings were made weekly and the data recorded as an index to body weight effects. Dose calculations were made weekly to coincide with changes in body weight.

D. Mortality and Reactions

Checks for mortality and abnormal behavioral reactions were made daily during the 20-day test period as well as during the 14-day observation period. Special emphasis was placed on observations for local skin reactions in order to determine the degree of skin irritation produced by the test material.

E. Hematologic Studies and Urine Analyses

Blood studies including determinations of hemoglobin concentration, erythrocyte count, and both total and differential leukocyte

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counts, were made at the beginning of the study and at the end of the 20-day test period. Urine analyses for reducing substances and microscopic elements were also done at these time intervals. The blood studies and urine analyses were done on the individual rabbits in each group.

F. Gross and Microscopic Pathologic Studies

Arrangements were made to subject any animal which might die during the test to a gross autopsy. Also, in those instances where post-mortem changes were not advanced, sections of representative tissues and organs were scheduled to be taken for histopathologic study.

At the conclusion of the investigational period, all surviving rabbits in each group were sacrificed and gross and microscopic studies were performed. The following tissues and organs were included in the microscopic studies: heart, aorta, lung, trachea, liver, gall bladder, pancreas, esophagus, stomach, small intestine, caecum, colon, spleen, cervical and mesenteric lymph nodes, kidney, urinary bladder, testis, ovary, prostate, uterus, pituitary, adrenal gland, submaxillary salivary gland, thyroid, parathyroid, skeletal muscle, bone marrow, peripheral nerve, spinal cord, brain, and skin.

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III. Results

A. Body Weight Data

Weekly individual body weights for each test group and the control group are assembled in Table II.

TABLE II

Body Weight Data

Group	Animal Number and Sex	Individual Body Weights (Kilograms) Test Day Number: 0	7	14	20	Observation Day Number 14
T-C	1-M	2.31	2.35	2.49	2.57	2.74
	2-F	2.50	2.63	2.68	2.80	2.96
T-I	1-M	2.41	2.53	2.60	2.69	2.82
	2-F	2.72	2.85	2.89	2.95	3.16
T-II	1-M	2.10	1.70	(1.36)	-	-
	2-F	2.16	1.96	1.96	2.04	2.18
T-III	1-M	2.55	2.35	2.38	2.18	2.04
	2-F	2.72	2.80	2.26	1.84	(1.80)
T-IV	1-M	2.61	(2.01)	-	-	-
	2-F	2.53	(1.87)	-	-	-

Note: Figures in parentheses represent autopsy weights.

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B. Mortality

The mortality data are summarized in Table III. The data indicate the number dead and the total number of doses received prior to death. The female of Group III died on the second day of the 14-day observation period.

The mortality data were statistically analyzed employing the technique of Litchfield and Wilcoxon*, and the mean subacute percutaneous lethal dose (LD_{50}) was calculated together with the $LD_{0.01}$ and the $LD_{99.99}$. For the purpose of these calculations, the test period was assumed to be 34 days, i.e. a 20-day application period plus a two-week observation period. All animals that died during the interval, at each dose level, were used in establishing the per cent mortality for the dose level. The data are presented in Table IV and are graphically illustrated in Figure 1.

* J. T. Litchfield, Jr. and F. Wilcoxon, "A Simplified Method of Evaluating Dose-Effect Experiments", J. Pharm. & Exp. Ther., Vol. 96, No. 2; pp. 99-113 (1949).

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TABLE III

Summary of Mortality Data

Group	Number Tested	Number Dead	Sex	Number of Consecutive Doses Received Prior to Death
T-C	2	0	-	-
T-I	2	0	-	-
T-II	2	1	F	13
T-III	2	1	M	20
T-IV	2	1	M	5
		1	F	6

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TABLE IV

Statistical Analysis of Mortality Data

Dose mg/kg/day	Number Dead	Number Tested	Observed Per Cent Dead	Expected Per Cent Dead
10	0	2	0	0.2
50	1	2	50	26.5
100	1	2	50	66.0
200	2	2	100	92.5

Mean Subacute Dermal Lethal Dose (LD_{50}) = 75 mg/kg/day*
95 Per Cent Confidence Limits of LD_{50} = 30 to 190 mg/kg/day
Subacute Dermal $LD_{0.01}$ = 6.2 mg/kg/day
Subacute Dermal $LD_{99.99}$ = 915 mg/kg/day

* The LD_{50} specifically refers to the dose which, administered each day over a 20-day period, would be expected to kill 50 per cent of the animals so dosed within the 20-day dosing period plus an additional 14 days during which the test material is not applied.

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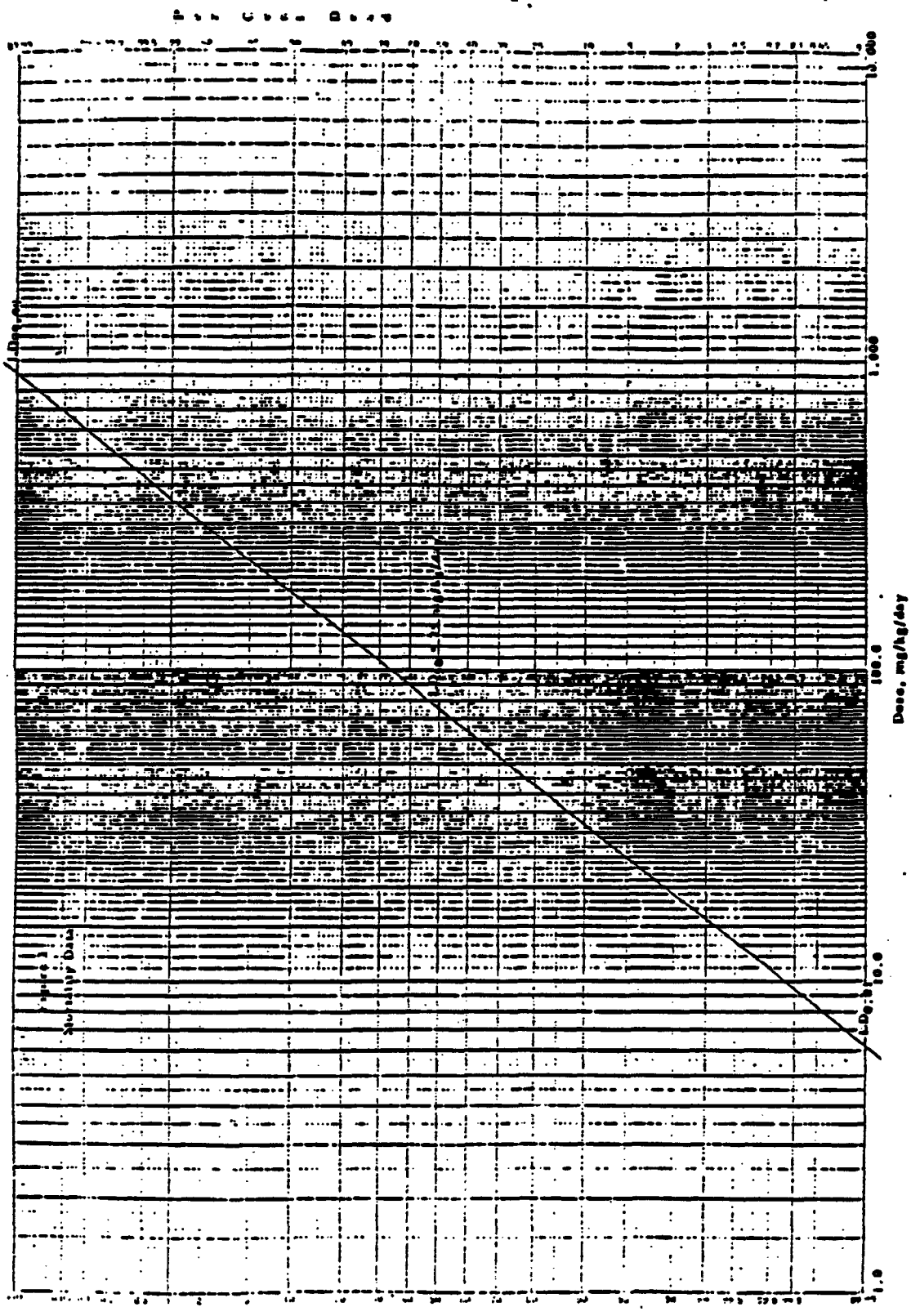

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C. Reactions

1. Behavioral Reactions

No untoward behavioral reactions were noted among the animals receiving doses of 10 mg/kg/day.

Generalized inactivity, weakness, lassitude, and loss of appetite were exhibited by rabbits receiving doses of 50, 100, and 200 mg/kg/day respectively. These symptoms progressed in intensity and eventually ended in profound prostration in moribund rabbits in these dose groups. The surviving female in the 50 mg/kg/day dose group appeared normal by the end of the 14-day observation period. However, the surviving male in the 100 mg/kg/day dose group continued to show slight generalized inactivity and slight loss of appetite at the end of the observation period.

2. Local Skin Reactions

The skin at the application site of animals in the 10, 50, and 100 mg/kg/day dose groups became scaly after the eleventh application of the test material. Slight wrinkling and fissuring were noted after eighteen applications. During the 14-day observation period, desquamation occurred and by the end of this period the skin of the surviving animals appeared normal. Animals receiving doses of 200 mg/kg/day died before any significant untoward local skin reactions could be noted.

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D. Hematologic Studies and Urine Analyses

Values for hematologic data and the results of urine analyses obtained on surviving test animals at the completion of the dosing period did not differ significantly either from those recorded initially or from the corresponding data secured from the treated control animals.

E. Pathology

1. Gross Pathologic Findings

Complete necropsies were performed upon all animals that died during the test and upon all animals sacrificed at the end of the observation period. No significant gross pathologic findings were noted among animals in the 10 mg/kg/day dose group. Animals receiving doses of 50, 100 and 200 mg/kg/day respectively showed liver discoloration (lighter in color) but otherwise no hepatic alterations were seen upon gross examination. All other tissues and organs examined from these animals were comparable to those of treated control animals.

2. Microscopic Pathologic Findings

Microscopic examinations were conducted upon the tissues and organs taken from all sacrificed animals. Animals that died during the test exhibited advanced post-mortem changes. Consequently their tissues and organs were not examined microscopically.

No significant histopathologic alterations were noted in any of the tissues and organs of animals receiving doses of 10 mg/kg/day.

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Moderate hepatic necrosis was noted among surviving rabbits in the 50 and 100 mg/kg/day dose groups. This hepatic change was considered to be a direct effect of percutaneous absorption of the test material. All other tissues and organs examined from these animals were comparable to those of the treated control animals.

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IV. Summary

A. Body Weights

Examination of the body weight data revealed moderate to severe adverse effects among rabbits of Test Groups II, III, and IV (50, 100 and 200 mg/kg/day respectively). The effects were especially pronounced in the moribund animals of these groups. The body weight data of animals receiving 10 mg/kg/day compared well with that of the treated control group.

B. Mortality and Reactions

The 20-day subacute dermal mean lethal dose (LD_{50}) of Aroclor 1254 for the albino rabbit was found to be 75 mg/kg/day.

Generalized inactivity, weakness, lassitude, and loss of appetite were exhibited by rabbits receiving doses of 50, 100 and 200 mg/kg/day respectively. No untoward reactions were noted among animals in the 10 mg/kg/day dose group.

Local skin reactions included scaling, wrinkling, and fissuring among animals receiving doses of 10, 50, and 100 mg/kg/day respectively. These reactions occurred during the second half of the 20-day test period. During the 14-day observation period desquamation occurred and by the end of this period the skin of the surviving animals appeared normal. Animals receiving doses of 200 mg/kg/day died before any significant local skin reactions could be noted.

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C. Hematologic Studies and Urine Analyses

Hematologic data and results of the urine analyses for test group animals compared well with those of the treated control group animals.

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D. Pathology

1. Gross Pathologic Findings

No significant gross pathologic findings were noted among the 10 mg/kg/day dose group. Animals receiving doses of 50, 100, and 200 mg/kg/day respectively revealed liver discoloration (lighter in color). All other tissues and organs examined from these animals were comparable to those of treated control animals.

2. Microscopic Pathologic Findings

No significant histopathologic tissue alterations were noted among animals receiving doses of 10 mg/kg/day. The surviving animals receiving doses of 50 amd 100 mg/kg/day respectively revealed moderate hepatic necrosis. This finding was considered to be a direct effect of percutaneous absorption of the test material. All other tissues and organs examined from these animals were comparable to those seen in treated control animals.

Respectfully submitted,

INDUSTRIAL BIO-TEST LABORATORIES, INC.

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