



Halocarbon

PRODUCTS CORPORATION

887 KINDERKAMACK ROAD • RIVER EDGE, NEW JERSEY 07661

TELEPHONE: 201-262-8899 FAX: 201-262-0019

MAILING ADDRESS: RIVER EDGE, NEW JERSEY 07661

FYI-0494-000966

April 7, 1994



FYI-94-000966
INIT 04/12/94

CERTIFIED MAIL

REC'D
OFFICE OF POLLUTION
PREVENTION AND TOXICS
91 APR 12 AM 8:53

Document Processing Center (TS-790)
Attn: Section 8(e) Coordinator
Office of Toxic Substances
U.S. Environmental Protection Agency
401 "M" Street, S.W.
Washington, D.C. 20460



84940000066

ORIGINAL

SECTION 8(e) NOTICE

Re: 2-Chloro-1,1,1,4,4,4-hexafluorobutene-2 (CAS 400-44-2) [Also called Compound 1 in the reports]

Dear Sir/Madame:

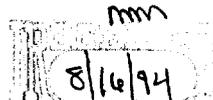
The following notice is submitted to you in accordance with paragraph V, F in the Agreement between Halocarbon Products Corporation (the Company) and the EPA, "Consent Agreement re Docket No. TSCA-90-H-18", with respect to Section 8(e). Although the report indicates toxicity to animals, this notice is **FOR YOUR INFORMATION ONLY** because the information need not be reported under the provisions of Article VII of EPA Statement of Interpretation and Enforcement Policy; Notification of Substantial Risk dated March 16, 1978 (Reference: RTECS No. EM 4295000).

I am the Vice President and Technical Director of the Company. My address is at Company headquarters:

Halocarbon Products Corporation
887 Kinderkamack Road
River Edge, New Jersey 07611
Phone: 201-262-8899

The address of the Company manufacturing site is:

Halocarbon Products Corporation
1100 Dittman Court
North Augusta, South Carolina 29841
Phone: 803-278-3500



These appended reports for the chemical substance 2-Chloro-1,1,1,4,4,4-hexafluorobutene-2 (CAS-400-44-2) were prepared by:

Hazelton Laboratories America, Inc.
1330-B Piccard Drive
Rockville, Maryland 20850

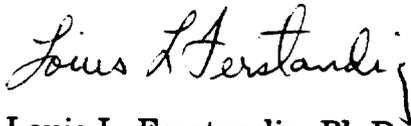
We are not aware of any additional information or supporting technical data.

(These appended reports covered more than one compound so, in connection with this submission, please refer to the data relating to the referenced compound only.)

In summary, the data show:

The LC50 for rats for a 15 minute exposure was found to be 78 ppm. Gross necropsy of the animals revealed pulmonary hemorrhage.

Very truly yours,



Louis L. Ferstandig, Ph.D
Vice President & Technical Director

LLF:bc



Halocarbon

PRODUCTS CORPORATION

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CONTAINS NO CBI

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April 7, 1994

Document Processing Center (TS-790)
Attn: Section 8(e) Coordinator
Office of Toxic Substances
U.S. Environmental Protection Agency
401 M Street, S.W.
Washington, DC 20460

RECEIVED
OFFICE OF REGULATION
AND TOXICS
APR 12 11 06 AM '94

Re: Consent Order regarding Halocarbon Products Corporation Docket No. TSCA 90-H-18

Dear Sir/Madame:

This submission is made pursuant to the Consent Order referenced above.

Transmitted herewith are reports on the chemicals listed below:

- * Trifluoroacetyl chloride (CAS 354-32-5)
- ** 2-Chloro-1,1,1,4,4,4-hexafluorobutene-2 (CAS 400-44-2)
- ** Asym dibromodifluoroethylene (CAS 430-85-3)
- ** 1,1,1,2-Tetrabromo-2,2,-difluoroethane (CAS 3470-67-5)
- ** 1,3,4,4-Tetrachloro-1,2,3,4-tetrafluoro-1-butene
- ** C₄F₆Br₄ (CAS 375-24-6)
- ** C₄F₄Br₄Cl₂
- ** CFCl₂(CF₂CFBr)_nCl where n is approximately 2 to 5
- ** CFClBr(CF₂CFBr)_nBr where n is approximately 5 to 10
- ** CFClBr(CF₂CFBr)_nBr where n is approximately 4 to 8
- ** CFClBr(CF₂CFBr)_nBr where n is approximately 2 to 5
- ** CFCl₂(CF₂CFBr)_nCl where n is approximately 3 to 6
- ** CFCl₂(CF₂CFBr)_nCl where n is approximately 4 to 8
- ** 1,1,1,4,4,4-Hexafluoro-2-butanone
- ** 2-Hydroxy-1,1,1,4,4,4-hexafluorobutane
- * 1,1,3,3-Tetrabromo-1,2,2,3-tetrafluoropropane (99%) (CAS 36567-29-0)
- ** Mixture of 2,3-dichloro-1,1,1,4,4,4-hexafluoro-2-butene (99.94%) (CAS 374-07-2) & 2-chloro-1,1,1,4,4,4-hexafluoro-2-butene (0.06%) (CAS 400-44-2)
- ** 1,1-Dibromo-1-chloro-2,2,2-trifluoroethane (CAS 754-17-6)
- ** Cl(CF₂CFCl)₂Cl (CAS 423-38-1)

Reports on chemicals designated by a single asterisk (*) are submitted under paragraph V.F.b of said Consent Order.

Reports on chemicals designated by double asterisks (**) are submitted under paragraph V.F.c on a For Your Information Only basis.

I hereby certify on behalf of Halocarbon Products Corporation that the audit required by said Consent Order has been completed and that to the best of my information and belief the reports listed above are the only reports or studies required or questionably required to be submitted to EPA pursuant to said Consent Order.

Very truly yours,
Halocarbon Products Corporation

By Louis L. Ferstandig
Louis L. Ferstandig, Ph.D
Vice President & Technical Director

LLF:bc
Enclosures

ACUTE INHALATION EXPOSURE, 15 MINUTES - RATS

COMPOUNDS:

- 2-chloro-1,1,1,4,4,4-hexafluorobutene-2 10a
- asym dibromodifluoroethylene 10b
- asym tetrabromodifluoroethane 10c
- 1,3,4,4-tetrachloro-1,2,3,4-tetrafluorobutene-1 10d
- D-1 10e

Submitted to

Halocarbon Products Corporation
Hackensack, New Jersey

February 7, 1966



HAZLETON LABORATORIES, INCORPORATED
Metropolitan Washington, D. C. *Area Code 703 • Jefferson 2-5800*
P.O. BOX 30, FALLS CHURCH, VIRGINIA 22046



Sponsor: Halocarbon Products Corporation

Date: February 7, 1966

Materials: Compound 1: 2-chloro-1,1,1,4,4,4-hexafluorobutene-2
Compound 2: asym dibromodifluoroethylene
Compound 3: asym tetrabromodifluoroethane
Compound 4: 1,3,4,4-tetrachloro-1,2,3,4-tetrafluorobutene-1
Compound 5: D-1

Subject: Acute Inhalation Exposure, 15 Minutes - Rats

OBJECTIVE

The purpose of this study was to assess the acute inhalation toxicity of the above materials by exposing groups of four rats respectively to aerosols of Compounds 3 and 5 and vapors of Compounds 1, 2, and 4 for 15-minute periods.

MATERIALS

The materials were received from Halocarbon Products Corporation on January 14, 1966. Compounds 1 through 4 were clear, volatile liquids stored in metal cylinders. Compound 5 was a clear, viscous liquid contained in a glass container.

METHOD

Five groups of animals, each consisting of four male Charles River Caesarian-derived rats (210 to 230 grams), were exposed respectively



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to an aerosol or a vapor atmosphere of Compounds 1 through 5. The exposures were conducted under dynamic conditions in a 100-liter exposure chamber.

The aerosols of Compounds 3 and 5 were generated by metering the liquids with a precision liquid metering pump into a positive pressure spray nozzle assembly. The saturated vapors were generated by bubbling a known flow of air through a fritted disk bubbler jar. The aerosols or vapors were introduced into the main chamber airflow which was maintained by a positive pressure rotary pump located at the exhaust side of the chamber. The total chamber flow was monitored by a rotameter.

Nominal chamber concentrations were calculated from the ratio of the rate of liquid feed to the total airflow in the case of the aerosols or the ratio of the flow rate of the saturated vapors to the total airflow in the case of the vapor atmospheres.

During exposure the animals were housed in compartmented stainless steel exposure baskets, centered in the chamber on bars. The animals were observed continuously for toxic signs and death. Following exposures the surviving animals were group housed and observed daily for latent toxic effects and death for 14 days.

Necropsies were performed on all animals which succumbed during the study. At the termination of the 14-day observation period, the survivors were sacrificed by carbon dioxide asphyxia. The lungs, liver, and kidneys were examined grossly for pathological signs and stored in 10% formalin solution for possible histological studies.



RESULTS

Compound 1 (2-chloro-1,1,1,4,4,4-hexafluorobutene-2)

Saturated vapor atmosphere of Compound 1 having an approximate concentration of 790,000 ppm at 25° C. was introduced at a rate of 158 milliliters per minute into the airstream of the chamber. The total chamber flow, vapor flow plus the make-up airflow, was 50 liters per minute. The nominal concentration of the agent was calculated to be 2500 ppm.

Hyperemia in the exposed body surfaces such as the ears and the paws was the only observable reaction during and after the 15-minute exposure. However, one rat died at Day 1 postexposure, two at Day 3, and the last one at Day 8. The mortality was 100%.

Gross necropsy of the animals which died at Day 1 revealed pulmonary hemorrhage and a frothy mucus-like substance blocking the lumen of the trachea. More severe pulmonary hemorrhage was noted in the other three animals.

Compound 2 (asym dibromodifluoroethylene)

At 25° C. a saturated vapor of Compound 2 has a concentration of 197,000 ppm. At a rate of 635 milliliters per minute, this saturated vapor was diluted with air to give a final rate of 50 liters per minute. The calculated nominal concentration of the compound was 2500 ppm.

During the 15-minute exposure gasping was the prominent sign. Following the exposure gasping, hypopnea, periods of apnea, and hyperemia



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of the skin were noted. Within two hours postexposure two rats succumbed. The third rat died in the next half hour and the fourth within 24 hours.

Gross necropsy of all these animals revealed severe pulmonary hemorrhage and tracheal blockage by frothy mucus-like substance.

Compound 3 (asym tetrabromodifluoroethane)

A total of 282.75 milliliters of the solution of Compound 3 was aerosolized in the 15-minute exposure. The solution consisted of 10% of active ingredient. The total chamber flow was 100 liters per minute. The calculated nominal concentration of the compound was 1200 ppm.

Hyperemia, apnea, and muscular twitching were noted during and after the inhalation exposure. All four animals succumbed within one hour postexposure. Convulsions preceded death in two of the animals.

Necropsy findings were foamy nasal discharge, pulmonary hemorrhage, and exceptionally rapid blood coagulation. The liver of one of the rats was congested.

Compound 4 (1,3,4,4-tetrachloro-1,2,3,4-tetrafluorobutene-1)

Saturated vapor of Compound 4, having an approximate concentration of 10,500 ppm, was diluted with air to provide a nominal chamber concentration of 2500 ppm. The rate of vapor flow was 12 liters per minute, and the total flow rate was 50 liters per minute.

During exposure all animals exhibited hyperemia. Muscular spasms were also noted in two animals. Two rats died at Day 1 post-exposure and one at Day 11. No significant abnormality was detected in the single survivor during the 14-day observation period.



Gross necropsy on the animals which succumbed showed pulmonary hemorrhage and tracheal blockage. However, no pathologic tissue alteration was noted in the sacrificed animal.

Compound 5 (D-1)

A total of 16.3 milliliters of Compound 5 was aerosolized in the 15-minute exposure. The total chamber flow, i.e., air ejected through the spray nozzle plus the make-up air, was 50 liters per minute. The calculated chamber concentration was 2500 ppm.

Apnea was observed in all animals during exposure. In addition, foamy nasal discharge, hyperemia of the body surfaces, and ptosis were noted after the exposure. All four animals died within one hour, and death was preceded by convulsions.

The major findings at necropsy were profuse salivation, foamy nasal discharge, and pulmonary hemorrhage.

SUMMARY

The dose-mortality data for the five compounds are summarized below.

<u>Compound</u>	<u>Nominal Conc.</u> ppm	<u>15-Min. Exposure</u>	<u>Mortality</u>											<u>Cumulative Mortality</u>
			<u>Hours After Exposure</u>				<u>Days After Exposure</u>							
			1	2	3	24	1	2	3	4	5	8	11	
1	2500	0	-	-	-	-	1	-	2	-	-	1	-	4/4
2	2500	0	-	2	1	1	-	-	-	-	-	-	-	4/4
3	1200	0	4	-	-	-	-	-	-	-	-	-	-	4/4
4	2500	0	-	-	-	-	2	-	-	-	-	-	1	3/4
5	2500	0	4	-	-	-	-	-	-	-	-	-	-	4/4



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The inhalation toxicities of five compounds have been investigated. Compounds 2, 3, and 5 caused the death of the animals within hours after a 15-minute exposure. Compounds 1 and 4 exhibited latent toxic effects and caused fatality within two weeks. Pulmonary damage was the prominent finding in necropsies.

Submitted by *H. N. MacFarland*
H. N. MacFARLAND, Ph.D.
Director
Inhalation Division

Supervision: Leong
Experimental: Beasley, Martin

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ACUTE INHALATION TOXICITY - RATS

COMPOUND 1: 2-chloro-1,1,1,4,4,4-hexafluorobutene-2

FINAL REPORT

Submitted to

Halocarbon Products Corporation
Hackensack, New Jersey

April 7, 1966



HAZLETON LABORATORIES, INCORPORATED

FALLS CHURCH, VIRGINIA



Sponsor: Halocarbon Products Corporation

Date: April 7, 1966

Material: Compound 1: 2-chloro-1,1,1,4,4,4-hexafluorobutene-2

Subject: Acute Inhalation Toxicity - Rats
15-Minute Exposures
Determination of LC_{50}

$LC_{50} = 78$ (15 min)

OBJECTIVE

The purpose of this study was to determine the LC_{50} of Compound 1 in rats undergoing 15-minute inhalation exposures to various vapor concentrations of the material.

MATERIAL

Compound 1 was received from Halocarbon Products Corporation on January 14, 1966. It was a clear, volatile liquid stored in a metal cylinder. For the purpose of this study, the material was considered to be free of impurities and was used as received.

METHOD

Four groups of animals, each group consisting of 10 male Charles River Caesarian-derived rats (200 to 230 grams), were exposed to various concentrations of Compound 1. The exposures were conducted under dynamic conditions in a 100-liter exposure chamber.



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Saturated vapor of Compound 1 was generated by bubbling a known flow of air through a fritted finger gas bubbler. The vapor was then directed into the main chamber airflow which was maintained by a positive pressure rotary pump located at the exhaust side of the chamber. The total chamber airflow was monitored by a rotameter flowmeter. Nominal chamber concentrations were calculated from the ratio of the rate of flow of the saturated vapors to the total airflow.

During exposure, the animals were housed in compartmented exposure baskets, centered in the chamber on bars. The animals were observed continuously for toxic signs and death. Following exposures, the surviving animals were group housed and observed daily for latent toxic effects and death for 14 days.

Necropsies were performed on the animals which succumbed during the study. At the termination of the 14-day observation period, the survivors were sacrificed by carbon dioxide asphyxia. The lungs, liver, and kidneys were examined grossly for pathological signs and stored in a 10% formalin solution for possible histological studies.

RESULTS

500 ppm

Saturated vapor atmosphere of Compound 1, having an approximate concentration of 790,000 ppm at 25° C., was introduced at a rate of 31.6 milliliters per minute into the chamber airstream. The total chamber airflow, vapor flow plus the make-up airflow, was 50 liters



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per minute. The mean nominal chamber concentration was calculated to be 500 ppm.

During exposure, the animals exhibited gasping and muscular twitching. Immediately following exposure, the animals were prostrate, and bloody nasal discharge was noted in a few. During the observation period, asthenia, hyperpnea, ptosis, bloody nasal discharge, and a humped posture were noted for all the animals. Six animals succumbed on Day 2, three on Day 6, and one on Day 7.

15-min exposure

Gross necropsies revealed pulmonary hemorrhage in all of the animals.

140 ppm

At the rate of 8.85 milliliters per minute, saturated vapor was metered into the mean chamber airflow which was maintained at 50 liters per minute. The mean nominal chamber concentration was calculated to be 140 ppm.

No significant reactions were noted during exposure. Following exposure, dyspnea was noted for four days. Eight animals succumbed on Day 4. The remaining animals exhibited slight dyspnea for the duration of the observation period.

Pulmonary hemorrhage was the major finding at gross necropsy of the animals which succumbed. No histopathological change was detected in the remaining animals.



50 ppm

At the rate of 3.16 milliliters per minute, saturated vapor was introduced into the main chamber airflow of 50 liters per minute. The mean nominal chamber concentration was calculated to be 50 ppm.

Sneezing, hypopnea, and slight gasping were noted in a few of the animals during exposure.

A few of the animals exhibited severe hyperpnea following exposure. One animal died on Day 2 and two on Day 3. The surviving animals appeared essentially normal for the remaining 11 days.

Pulmonary hemorrhage was noted at gross necropsy for those animals which succumbed.

20 ppm

At the rate of 1.17 milliliters per minute, saturated vapor was diluted to 50 liters per minute with air. The mean nominal chamber concentration was calculated to be 20 ppm.

No abnormal reaction was detected during both the exposure period and the 14-day observation period.

No significant pathological alterations were noted at terminal necropsy.

Dose-Mortality Data

The dose-mortality data for Compound 1 are summarized below.

Nominal Conc. ppm	15-Minute Exposure	Mortality							Cumulative Mortality
		Days After Exposure							
		<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>7</u>	
500	-	-	6	-	-	-	3	1	10/10
140	-	-	-	-	8	-	-	-	8/10
50	-	-	1	2	-	-	-	-	3/10
20	-	-	-	-	-	-	-	-	0/10



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Graphic analysis of the dose-mortality data showed the LC_{50} of Compound 1 for a 15-minute exposure was 78 ppm. The 95% confidence limits were 46 and 132 ppm. The slope function was 2.34.

SUMMARY

The LC_{50} of Compound 1 for a 15-minute exposure had been determined to be 78 ppm. The major toxic reactions observed in the animals following the exposure were hyperpnea, gasping, and nasal discharge. The intensity of response varied directly with the level of exposure.

Gross necropsy of the animals which succumbed revealed pulmonary hemorrhage. No significant pathological condition was observed in the surviving animals.

Prepared by

A. Gerald Beasley
A. GERALD BEASLEY, B.A.
Inhalation Toxicology
Section
Inhalation Division

Submitted by

B. J. Leong

K. J. LEONG, Ph.D.
Supervisor, Inhalation
Toxicology Section
Inhalation Division

Supervision: Leong
Experimental: Beasley, Hillard

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