Data from Fathead Minnow study on FC-93 (25% NH4 salt of PFOS in IPA and water)

ACUTE TOXICITY TO FISH

TEST SUBSTANCE

Identity: Perfluorooctanesulfonate, Ammonium salt; may also be referred to as PFOS NH_4^+ salt or FC-93. (1-Octanesulfonic acid, 1,1,2,2,3,3,4,4,5,5,6,6,7,7,8,8,8-heptadecafluoro-, ammonium salt, CAS # 29081-56-9)

Remarks: Test sample was taken from 3M production lot #1. The test sample is a mixture of the test substance in isopropanol and water (25% test substance, 20% isopropanol, 55% water). No calculations were made to adjust for the actual concentration of the test substance in the test sample.

METHOD

Method: Not noted.
Type: Static acute
GLP: No
Year completed: 1974
Species: *Pimephales promelas*
Supplier: Not noted.
Analytical monitoring: pH and DO content
Exposure period: 96-hours
Statistical methods: Plotted LC_{50}
Test fish age: Not noted.
Length and weight: Average length = 2 inches, Average weight = 1.5 g
Loading: Not noted.
Pretreatment: Not noted

Test conditions:

Dilution water: carbon filtered city of St. Paul, MN water
Dilution water chemistry: Not noted.

Stock and test solution preparation: Not noted.
Concentrations dosing rate: Once
Stability of the test chemical solutions: Not noted.
Exposure vessels: Not noted.
Number of replicates: One.
Number of concentrations: five plus a negative control
Water chemistry during the study:

Dissolved oxygen range (0 – 96 hours):

5.0-5.9 mg/L (control exposure)
4.2-5.0 mg/L (100 mg/L exposure)

pH range (0 – 96 hours)
7.0-7.1 (control exposure)
7.0-7.1 (100 mg/L exposure)

Test temperature range (0 – 96 hours)
21 – 22°C (70-72°F)

RESULTS

Nominal concentrations: Bk control, 10, 25, 50, 75, 100 mg/L
Element value: 96-hour LC_{50} = 85 mg/L (C.I. not determined)
Mortality of controls: None
Remarks: 95% confidence limits were not calculated for this material. Additionally, testing was conducted on the mixture of the test substance in 20% isopropanol and 55% water. The value reported applies to that mixture and not the test substance. No attempt was made to determine the impact of the presence of the organic solvent or what portion of the toxicity can be contributed to the Perfluorooctanesulfonate, ammonium salt.

CONCLUSIONS

The test sample containing 25% Perfluorooctanesulfonate, ammonium salt exhibited a 96-hour LC_{50} for fathead minnow of 85 mg/L

Submitter: 3M Company, Environmental Laboratory, P.O. Box 33331, St. Paul, Minnesota, 55133

DATA QUALITY

Reliability: Klimisch ranking 3.

REFERENCES

This study was conducted by the 3M Company, Environmental Laboratory, 7/29/74 to 8/2/74.

OTHER

Last changed: 5/3/00

740101

ENVIRONMENTAL ENGINEERING LABORATORY
AQUATIC TOXICITY WORK SHEET

Type Test 96 hour static — Material Tested [redacted] Lot #1

Test Organism Fathead Minnow — Avg. Weight 1.5g — Size 2 Inches

Date Started 7-29-74 — Date Completed 8-2-74

Time Started 2:30 PM — Plotted LC_{50} 85 ppm

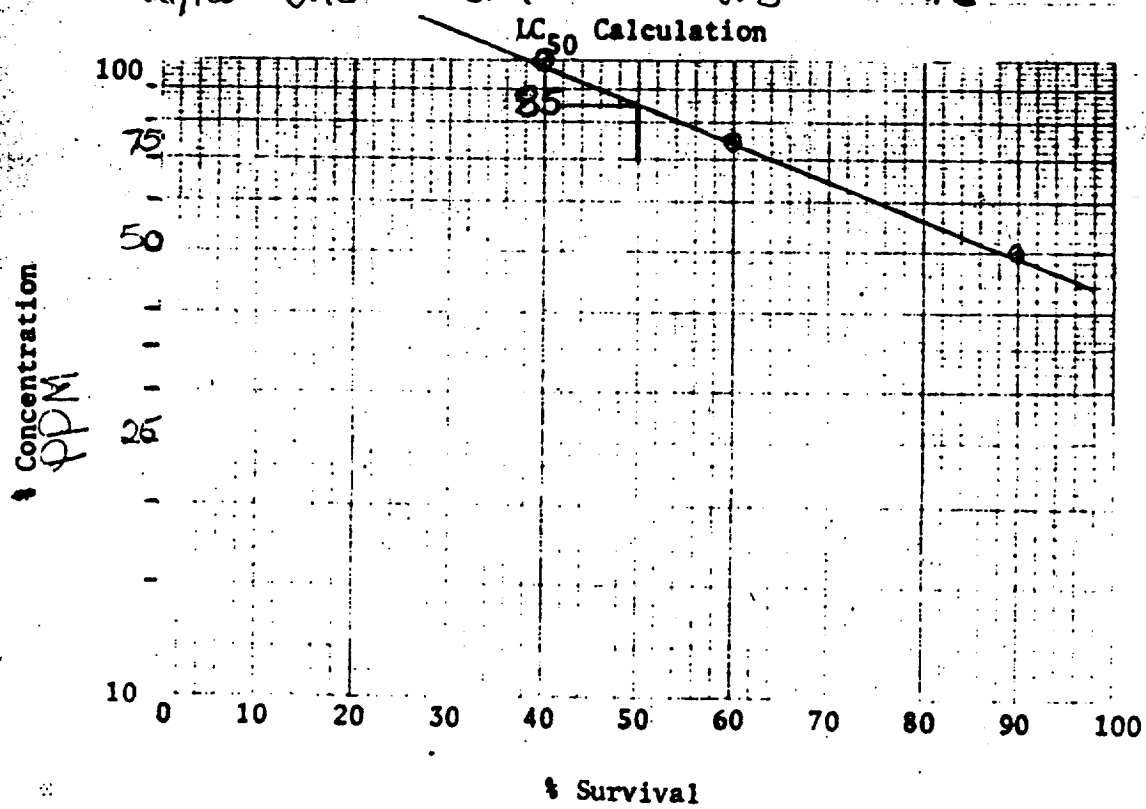
Dilution Water Carbon filtered-city water

	24 hrs			48 hrs			72 hrs			96 hrs		
Conc.	% Survival	pH	D.O ppm	% Survival	pH	D.O ppm	% Survival	pH	D.O ppm	% Survival	pH	D.O ppm
Control	100	7.0	5.9	100	7.0	5.5	100	7.0	5.2	100	7.1	5.0
10 PPM	100	7.0	5.4	100	7.0	5.0	100	7.0	4.7	100	7.0	4.5
25	100	7.1	5.2	100	7.0	5.0	100	7.1	4.7	100	7.1	4.5
50	100	7.0	5.2	100	7.1	5.0	90	7.0	4.5	90	7.0	4.3
75	100	7.0	5.2	100	7.1	4.9	70	7.0	4.5	60	7.0	4.2
100	100	7.0	5.0	50	7.1	4.9	40	7.1	4.5	40	7.0	4.2
Average Temperature			70			72			70			70

Comments:

%	0.001	0.0025	0.005	0.0075	0.01
ml/liter	0.16	0.4	0.8	1.2	1.6

LC_{50} Calculation



MATERIAL SAFETY DATA SHEET

3M
3M Center
St. Paul, Minnesota
55144-1000
1-800-364-3577 or (651) 737-6501 (24 hours)

DIVISION: 3M SPECIALTY MATERIALS
TRADE NAME:
FC-93 FLUORAD Brand Etching Bath Additive
ID NUMBER/U.P.C.:
98-0211-0192-2 00-51135-09187-6 98-0211-0201-1 00-51135-09190-6
ISSUED: December 17, 1999
SUPERSEDES: September 04, 1998
DOCUMENT: 10-3795-1

1. INGREDIENT

INGREDIENT	C.A.S. NO.	PERCENT
WATER	7732-18-5	55.0
AMMONIUM PERFLUOROALKYL SULFONATE	29081-56-9	19.0 - 23.0
ISOPROPYL ALCOHOL (IPA)	67-63-0	20.0
AMMONIUM PERFLUOROALKYL SULFONATE	68259-07-4	0.1 - 2.0
AMMONIUM PERFLUOROALKYL SULFONATE	68259-08-5	0.1 - 2.0
AMMONIUM PERFLUOROALKYL SULFONATE	68259-09-6	0.1 - 2.0
AMMONIUM PERFLUOROALKYL SULFONATE	68259-10-9	0.1 - 2.0

The components of this product are in compliance with the chemical notification requirements of TSCA. All applicable chemical ingredients in this material are listed on the European Inventory of Existing Chemical Substances (EINECS), or are exempt polymers whose monomers are listed on EINECS.

2. PHYSICAL DATA

BOILING POINT:	ca. 82 C (Initial)
VAPOR PRESSURE:	ca. 34 mmHg Calc. @ 20 C.
VAPOR DENSITY:	ca. 1.0 Air=1 Calc. @ 20 C.
EVAPORATION RATE:	< 1.0 BuOAc=1
SOLUBILITY IN WATER:	moderate
SPECIFIC GRAVITY:	ca. 1.1 Water=1
PERCENT VOLATILE:	ca. 75 %
pH:	ca. 7

Abbreviations: N/D - Not Determined N/A - Not Applicable CA - Approximately

2. PHYSICAL DATA (continued)

	(0.1% Aqueous)
VISCOSITY:	N/D
MELTING POINT:	N/A

APPEARANCE AND ODOR:
Liquid, Clear amber solution, Ammonia, Isopropyl Alcohol odor.

3. FIRE AND EXPLOSION HAZARD DATA

FLASH POINT:	27 C Setaflash
FLAMMABLE LIMITS - LEL:	N/D
FLAMMABLE LIMITS - UEL:	N/D
AUTOIGNITION TEMPERATURE:	N/D

EXTINGUISHING MEDIA:
Water, Carbon dioxide, Dry chemical, Foam

SPECIAL FIRE FIGHTING PROCEDURES:
Wear full protective clothing, including helmet, self-contained, positive pressure or pressure demand breathing apparatus, bunker coat and pants, bands around arms, waist and legs, face mask, and protective covering for exposed areas of the head.

UNUSUAL FIRE AND EXPLOSION HAZARDS:
See Hazardous Decomposition section for products of combustion.

4. REACTIVITY DATA

STABILITY: Stable

INCOMPATIBILITY - MATERIALS/CONDITIONS TO AVOID:
Not applicable.

HAZARDOUS POLYMERIZATION: Hazardous polymerization will not occur.

HAZARDOUS DECOMPOSITION PRODUCTS:
Carbon Monoxide and Carbon Dioxide, Oxides of Sulfur, Hydrogen Fluoride, Ammonia, Toxic Vapors, Gases or Particulates.

5. ENVIRONMENTAL INFORMATION

SPILL RESPONSE:
Refer to other sections of this MSDS for information regarding physical and health hazards, respiratory protection, ventilation, and personal protective equipment. Ventilate area. Extinguish all ignition sources. Contain spill. Evacuate unprotected personnel from hazard area. Cover with absorbent material. Cover spill area with Light Water Brand or other ATC foam. (For further information on ATC foam usage, contact 3M Fire Protection Systems.) Collect using non-sparking tools. Clean up residue with water. Place in an approved metal container. Seal the container.

RECOMMENDED DISPOSAL:
Incinerate in a permitted hazardous waste incinerator. Combustion products will include HF.

ENVIRONMENTAL DATA:
Contains only "exempt" solvents by "Rule 66" type regulations; COD=.41 g/g; BOD20=.29 g/g; 96-Hr. LC50, Fathead Minnow(Pimephales promelas)=85 mg/l.

REGULATORY INFORMATION:
Volatile Organic Compounds: 220 gms/liter.
VOC Less H2O & Exempt Solvents: N/A.

Since regulations vary, consult applicable regulations or authorities before disposal. In the event of an uncontrolled release of this material, the user should determine if the release qualifies as a reportable quantity. U.S. EPA Hazardous Waste Number = D001 (Ignitable)

This product is in compliance with the chemical registration requirements of TSCA, EINECS, AICS, CDSL, MITI and Korea.

OTHER ENVIRONMENTAL INFORMATION:
This product contains one or more organic fluorochemicals that have the potential to resist degradation and persist in the environment.

EPCRA HAZARD CLASS:
FIRE HAZARD: Yes PRESSURE: No REACTIVITY: No ACUTE: Yes CHRONIC: Yes

6. SUGGESTED FIRST AID

EYE CONTACT:
Immediately flush eyes with large amounts of water. Get immediate medical attention.

Abbreviations: N/D - Not Determined N/A - Not Applicable CA - Approximately

6. SUGGESTED FIRST AID (continued)

SKIN CONTACT:
Flush skin with large amounts of water. If irritation persists, get medical attention.

INHALATION:
If signs/symptoms occur, remove person to fresh air. If signs/symptoms continue, call a physician.

IF SWALLOWED:
If swallowed, call a physician immediately. Only induce vomiting at the instruction of a physician. Never give anything by mouth to an unconscious person.

7. PRECAUTIONARY INFORMATION

EYE PROTECTION:
Avoid eye contact with vapor, spray, or mist. Wear vented goggles.

SKIN PROTECTION:
Avoid skin contact. Wear appropriate gloves when handling this material. A pair of gloves made from the following material(s) are recommended: butyl rubber. Use one or more of the following personal protection items as necessary to prevent skin contact: apron, coveralls. Protective garments (other than gloves) should be made of either of the following materials: polyethylene/polyvinylidene chloride (Saranex).

RECOMMENDED VENTILATION:
If exhaust ventilation is not adequate, use appropriate respiratory protection. Provide ventilation adequate to control vapor concentrations below recommended exposure limits and/or control spray or mist.

RESPIRATORY PROTECTION:
Avoid breathing of airborne material. Select one of the following NIOSH approved respirators based on airborne concentration of contaminants and in accordance with OSHA regulations: Half-mask organic vapor respirator with dust/mist prefilter.

PREVENTION OF ACCIDENTAL INGESTION:
Do not eat, drink or smoke when using this product. Wash exposed areas thoroughly with soap and water. Wash hands after handling and before eating.

RECOMMENDED STORAGE:
Store away from areas where product may come into contact with food or pharmaceuticals. Store away from heat. Store out of direct sunlight. Keep container closed when not in use. Keep container in

7. PRECAUTIONARY INFORMATION (continued)

well-ventilated area.

FIRE AND EXPLOSION AVOIDANCE:
Keep container tightly closed. Flammable liquid and vapor. Keep away from heat, sparks, open flame, and other sources of ignition.

OTHER PRECAUTIONARY INFORMATION:
No smoking: Smoking while using this product can result in contamination of the tobacco and/or smoke and lead to the formation of the hazardous decomposition products mentioned in the Reactivity Data section of this MSDS.

HMIS HAZARD RATINGS: HEALTH: 2 FLAMMABILITY: 3 REACTIVITY: 0
PERSONAL PROTECTION: X (See precautions, section 7.)

EXPOSURE LIMITS

INGREDIENT	VALUE	UNIT	TYPE	AUTH	SKIN*
WATER.....	NONE	NONE	NONE	NONE	
AMMONIUM PERFLUOROALKYL SULFONATE....	0.1	MG/M3	TWA	3M	Y
ISOPROPYL ALCOHOL (IPA).....	400	PPM	TWA	ACGIH	
ISOPROPYL ALCOHOL (IPA).....	500	PPM	STEL	ACGIH	
ISOPROPYL ALCOHOL (IPA).....	400	PPM	TWA	OSHA	
ISOPROPYL ALCOHOL (IPA).....	500	PPM	STEL	OSHA	
AMMONIUM PERFLUOROALKYL SULFONATE....	0.1	MG/M3	TWA	3M	Y
AMMONIUM PERFLUOROALKYL SULFONATE....	0.1	MG/M3	TWA	3M	Y
AMMONIUM PERFLUOROALKYL SULFONATE....	0.1	MG/M3	TWA	3M	Y
AMMONIUM PERFLUOROALKYL SULFONATE....	0.1	MG/M3	TWA	3M	Y

* SKIN NOTATION: Listed substances indicated with 'Y' under SKIN refer to the potential contribution to the overall exposure by the cutaneous route including mucous membrane and eye, either by airborne or, more particularly, by direct contact with the substance. Vehicles can alter skin absorption.

SOURCE OF EXPOSURE LIMIT DATA:
- 3M: 3M Recommended Exposure Guidelines
- ACGIH: American Conference of Governmental Industrial Hygienists
- OSHA: Occupational Safety and Health Administration

- NONE: None Established

8. HEALTH HAZARD DATA

EYE CONTACT:
Mild Eye Irritation: signs/symptoms can include redness, swelling, pain, and tearing.

8. HEALTH HAZARD DATA (continued)

SKIN CONTACT:
Mild Skin Irritation (after prolonged or repeated contact): signs/symptoms can include redness, swelling, and itching.

May be absorbed through the skin and produce effects similiar to those caused by inhalation and/or ingestion.

INHALATION:
Single overexposure, above recommended guidelines, may cause:

Central Nervous System Depression: signs/symptoms can include headache, dizziness, drowsiness, incoordination, slowed reaction time, slurred speech, giddiness and unconsciousness.

Irritation (upper respiratory): signs/symptoms can include soreness of the nose and throat, coughing and sneezing.

IF SWALLOWED:
Animal studies conducted on organic fluorochemicals which are present in this product indicate effects including liver disturbances, weight loss, loss of appetite, lethargy, and neurological, pancreatic, adrenal and hematologic effects. There are no known human health effects from anticipated exposure to these organic fluorochemicals when used as intended and instructed.

Illness may result from a single swallowing of a moderate quantity of this material.

Irritation of Gastrointestinal Tissues: signs/symptoms can include pain, vomiting, abdominal tenderness, nausea, blood in vomitus, and blood in feces.

Central Nervous System Depression: signs/symptoms can include headache, dizziness, drowsiness, muscular weakness, incoordination, slowed reaction time, fatigue, blurred vision, slurred speech, giddiness, tremors and convulsions.

Ingestion may cause:

Aspiration Pneumonitis: signs/symptoms can include coughing, difficulty breathing, wheezing, coughing up blood and pneumonia, which can be fatal.

OTHER HEALTH HAZARD INFORMATION:
A Product Toxicity Summary Sheet is available.

This product contains one or more organic fluorochemicals that have the potential to be absorbed and remain in the body for long periods of time, either as the parent molecule or as metabolites, and may accumulate with repeated exposures. There are no known human health

---

8. HEALTH HAZARD DATA (continued)

---

effects from anticipated exposure to these organic fluorochemicals when used as intended and instructed.

The presence of organic fluorochemicals in the blood of the general population and subpopulations, such as workers, has been published dating back to the 1970's. 3M's epidemiological study of its own workers indicates no adverse effects.

SECTION CHANGE DATES

PRECAUTIONARY INFO. SECTION CHANGED SINCE September 04, 1998 ISSUE

Abbreviations: N/D - Not Determined N/A - Not Applicable CA - Approximately

---