091385

Excerpt from: National Library of Medicine, TOXNET (Toxicology Data Network), Hazardous Substances Data Bank (HSDB). "1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE." http://toxnet.nlm.nih.gov/, accessed July 19, 2007.

1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE

CASRN: 76-13-1

Environmental Fate/Exposure Summary:

1,1,2-Trichloro-1,2,2-trifluoroethane's former production and use as solvent may have resulted in its release to the environment through various waste streams. Fully halogenated chlorofluorocarbons (CFCs), such as 1,1,2-trichloro-1,2,2-trifluoroethane, were scheduled for production phase-out in 1987 by the Montreal Protocol. Although originally scheduled for 50% production phase-out by the year 2000 in developed countries, the worsening ozone depletion has forced acceleration of the CFC phase-out. If released to air, a vapor pressure of 363 mm Hg at 25 deg C indicates 1,1,2-trichloro-1,2,2-trifluoroethane will exist solely as a vapor in the ambient atmosphere. This compound does not react with photochemically produced hydroxyl radicals, ozone molecules or nitrate radicals in the troposphere. This compound will gradually diffuse into the stratosphere above the ozone layer where it will slowly degrade due to direct photolysis from UV-C radiation and contribute to the catalytic removal of stratospheric ozone. If released to soil, 1,1,2-trichloro-1,2,2-trifluoroethane is expected to have moderate mobility based upon an estimated Koc of 316. Volatilization from moist soil surfaces is expected to be an important fate process based upon a Henry's Law constant of 5.3X10-1 atm-cu m/mole. 1,1,2-Trichloro-1,2,2-trifluoroethane may volatilize from dry soil surfaces based upon its vapor pressure. If released into water, 1,1,2-trichloro-1,2,2-trifluoroethane is expected to adsorb slightly to suspended solids and sediment based upon the estimated Koc. Biodegradation in water is not an important environmental fate process; however, some loss was noted under anoxic groundwater conditions. Volatilization from water surfaces is expected to be an important fate process based upon this compound's Henry's Law constant. Estimated volatilization half-lives for a model river and model lake are 4 hrs and 5 days, respectively. Hydrolysis is not expected to occur due to the lack of hydrolyzable functional groups. A BCF range of 11 to 86 suggests bioconcentration in aquatic organisms is low to moderate. Occupational exposure to 1,1,2-trichloro-1,2,2-trifluoroethane may occur through inhalation and dermal contact with this compound at workplaces where 1,1,2-trichloro-1,2,2-trifluoroethane is produced or used. Due to its long atmospheric residence time, the general population is exposed to 1,1,2-trichloro-1,2,2-trifluoroethane through inhalation of ambient air. Monitoring data indicate that the general population may also be exposed to 1,1,2-trichloro-1,2,2-trifluoroethane via ingestion of contaminated water, and via inhalation and dermal contact with this compound and other consumer products containing 1,1,2-trichloro-1,2,2-trifluoroethane. (SRC)
PEER REVIEWED

Environmental Fate:

Because CFC 113 has very limited solubility in water and is highly volatile, all releases of CFC 113 can be expected to be eventually conveyed to the atmosphere.
[USEPA; Health Assessment Document for 1,1,2-Trichloro-1,2,2-Trifluoroethane p.2 (1983) EPA-600/58-82-002F]**PEER REVIEWED**

16406

ATMOSPHERIC: Because it is essentially inert in the troposphere, CFC 113 is transported slowly to the stratosphere. While CFC 113 has some potential to perturb stratospheric ozone, there is presently no evidence demonstrating that any indirect effects of CFC 113 on human health has or is likely to occur as a result of ozone perturbation.
[USEPA; Health Assessment Document for 1,1,2-Trichloro-1,2,2-Trifluoroethane p.2 (1983) EPA-600/58-82-002F]**PEER REVIEWED**

TERRESTRIAL FATE: Based on a classification scheme(1), an estimated Koc value of an 316(2) indicates that 1,1,2-trichloro-1,2,2-trifluoroethane is expected to have moderate mobility in soil(SRC). Volatilization of 1,1,2-trichloro-1,2,2-trifluoroethane from moist soil surfaces is expected to be an important fate process(SRC) given an estimated Henry's Law constant of 5.26X10-1 atm-cu m/mole(SRC), based upon its vapor pressure, 363 mm Hg(3), and water solubility, 170 mg/l(4). The potential for volatilization of 1,1,2-trichloro-1,2,2-trifluoroethane from dry soil surfaces may exist(SRC) based upon its vapor pressure(3). 1,1,2-Trichloro-1,2,2-trifluoroethane was degraded under anaerobic landfill conditions using an anoxic landfill leachate microcosm(2), suggesting this compound may biodegrade in soils under anaerobic conditions(SRC).
[(1) Swann RL et al; Res Rev 85: 17-28 (1983) (2) Jackson RE et al; pp. 511-26 in Environ Sci Pollut Control Ser 4(Groundwater Contam Anal Haz Waste Sites). Lesage S, Jackson RE, eds. NY, NY: M Dekker (1992) (3) Boublik T et al; The Vapour Pressures of Pure Substances. 2nd Rev Ed, Amsterdam: Elsevier p. 74 (1984) (4) Horvath AL et al; J Phys Chem Ref Data 28: 395-507 (1999)]**PEER REVIEWED**

AQUATIC FATE: Based on a classification scheme(1), an estimated Koc value of 316(2) indicates that 1,1,2-trichloro-1,2,2-trifluoroethane is not expected to adsorb to suspended solids and sediment(SRC). Volatilization from water surfaces is expected(4) based upon an estimated Henry's Law constant of 5.26X10-1 atm-cu m/mole(SRC), based upon its vapor pressure, 363 mm Hg(3), and water solubility, 170 mg/l(5). Using this Henry's Law constant and an estimation method(5), volatilization half-lives for a model river and model lake are 4 hrs and 5 days, respectively(SRC). According to a classification scheme(6), BCFs of 11-86(7) suggest the potential for bioconcentration in aquatic organisms is low to moderate. The compound is non-biodegradable under aerobic conditions(7), however biodegradation was observed in anoxic groundwater studies(8).
[(1) Swann RL et al; Res Rev 85: 17-28 (1983) (2) Jackson RE et al; pp. 511-26 in Environ Sci Pollut Control Ser 4(Groundwater Contam Anal Haz Waste Sites). Lesage S, Jackson RE, eds. NY, NY: M Dekker (1992) (3) Boublik T et al; The Vapour Pressures of Pure Substances. 2nd Rev Ed, Amsterdam: Elsevier p. 74 (1984) (4) Horvath AL et al; J Phys Chem Ref Data 28: 395-507 (1999) (5) Lyman WJ et al; Handbook of Chemical Property Estimation Methods. Washington, DC: Amer Chem Soc pp. 4-9, 15-1 to 15-29 (1990) (6) Franke C et al; Chemosphere 29: 1501-14 (1994) (7) Chemicals Inspection and Testing Institute; Biodegradation and bioaccumulation data of existing chemicals based on the CSCL Japan. Japan Chemical Industry Ecology - Toxicology and Information Center. ISBN 4-89074-101-1 p. 2-22 (1992) (8) Semprini L et al; Environ Sci Technol 26: 2454-61 (1992)]**PEER REVIEWED**

ATMOSPHERIC FATE: According to a model of gas/particle partitioning of semivolatile organic compounds in the atmosphere(1), 1,1,2-trichloro-1,2,2-trifluoroethane, which has a vapor pressure of 363 mm Hg at 25 deg C(2), is expected to exist solely as a vapor in the

ambient atmosphere. The moderate water solubility of 170 mg/l suggests that some loss by wet deposition occurs, but any loss by this mechanism is probably returned to the atmosphere by volatilization. 1,1,2-Trichloro-1,2,2-trifluoroethane will not degrade in the troposphere, thus diffusion from the troposphere to the stratosphere would be the sole removal mechanism (half-life 20 years(4)). This compound will gradually diffuse into the stratosphere above the ozone layer where it will slowly degrade due to direct photolysis from UV-C radiation and contribute to the catalytic removal of stratospheric ozone. The stratospheric lifetime of this compound ranges between 63 and 122 years(5). As a result of this persistence in the atmosphere(5), this vapor-phase compound can be transported long distances and therefore, its concn should be fairly uniform throughout the globe away from known sources(SRC).

[(1) Bidleman TF; Environ Sci Technol 22: 361-367 (1988) (2) Boublik T et al; The Vapour Pressures of Pure Substances. 2nd Rev Ed, Amsterdam: Elsevier p. 74 (1984) (3) Horvath AL et al; J Phys Chem Ref Data 28: 395-507 (1999) (4) Dilling WL; pp. 154-97 in Environmental Risk Analysis for Chemicals. Conway RA, ed. NY, NY: Van Nostrand Reinhold Co (1982) (5) Chou CC et al; J Phys Chem 82: 1-7 (1978)]**PEER REVIEWED**

Environmental Biodegradation:

AEROBIC: 1,1,2-Trichloro-1,2,2-trifluoroethane, present at 100 mg/l, reached 0-5% of its theoretical BOD in 4 weeks using an activated sludge inoculum at 30 mg/l and the Japanese MITI test(1). Therefore this compound is not expected to biodegrade rapidly.

[(1) Chemicals Inspection and Testing Institute; Biodegradation and bioaccumulation data of existing chemicals based on the CSCL Japan. Japan Chemical Industry Ecology - Toxicology and Information Center. ISBN 4-89074-101-1 p. 2-22 (1992)]**PEER REVIEWED**

ANAEROBIC: Using a 1,1,1-trichloroethane, CFC-11, and 1,1,2-trichloro-1,2,2-trifluoroethane contaminated shallow sand and gravel aquifer at the Moffett Field Naval Air Station in Mountain View, CA, an average 1,1,2-trichloro-1,2,2-trifluoroethane concn of 0.0062 mg/l was 8, 20 , and 18% transformed along 3 well sampling sites for the period between 1450 and 1550 hrs after commencing biostimulation through the addition of acetate(1). This compound appears to be persistent in groundwater but biotransforms to a very toxic vinyl chloride analogue(2). The half-life of 1,1,2-trichloro-1,2,2-trifluoroethane in an anoxic landfill leachate microcosm study was 5.3 days at 21 deg C(2).

[(1) Semprini L et al; Environ Sci Technol 26: 2454-61 (1992) (2) Jackson RE et al; pp. 511-26 in Environ Sci Pollut Control Ser 4(Groundwater Contam Anal Haz Waste Sites). Lesage S, Jackson RE, eds. NY, NY: M Dekker (1992)]**PEER REVIEWED**

Environmental Abiotic Degradation:

1,1,2-Trichloro-1,2,2-trifluoroethane is not expected to undergo hydrolysis in the environment due to the lack of hydrolyzable functional groups(1,2). 1,1,2-Trichloro-1,2,2-trifluoroethane is essentially inert to reaction with photochemically generated radicals and ozone molecules(3,4). This compound will not undergo direct photolysis in the troposphere(5). The stratospheric lifetime of 1,1,2-trichloro-1,2,2-trifluoroethane has been estimated to range from 63 and 122 years with direct photolysis being the dominant removal mechanism and reaction with singlet oxygen being the secondary removal mechanism(6). In the stratosphere this compound will

slowly photolyze to release chlorine atoms which in turn participates in the catalytic removal of stratospheric ozone(5). The infrared intensity for 1,1,2-trichloro-1,2,2-trifluoroethane is 4,905 sq cm/atm, which, in combination with its long atmospheric lifetime(6), contribute to its greenhouse potential(7). 1,1,2-Trichloro-1,2,2-trifluoroethane has a GWP (greenhouse warming potential) of 1.24(8).

[(1) Du Pont de Nemours Co; Freon Products Information B-2; A98825 12/80 (1980) (2) Lyman WJ et al; Handbook of Chemical Property Estimation Methods. Washington, DC: Amer Chem Soc pp. 7- 4, 7-5 (1990) (3) Atkinson R; Chem Rev 85: 69-201 (1985) (4) GEMS; Graphical Exposure Modeling System. FAP Fate of Atmos Pollut (1986) (5) Makide T et al; Chem Lett 4: 355-8 (1979) (6) Chou CC et al; J Phys Chem 82: 1-7 (1978) (7) Rogers JD, Stephens RD; J Geophys Res 93: 2423-8 (1988) (8) Montague DC, Perrine RL; Atmos Environ 24A: 1331-9 (1990)]**PEER REVIEWED**

Soil Adsorption/Mobility:

The Koc of 1,1,2-trichloro-1,2,2-trifluoroethane has been estimated as 316(1). According to a classification scheme(2), this estimated Koc value suggests that 1,1,2-trichloro-1,2,2-trifluoroethane is expected to have moderate mobility in soil. Because of its density in both the liquid and vapor phases, 1.565 and 4.46 respectively, 1,1,2-trichloro-1,2,2-trifluoroethane sinks rapidly through soils to the water table(1).

[(1) Jackson RE et al; pp. 511-26 in Environ Sci Pollut Control Ser 4(Groundwater Contam Anal Haz Waste Sites). Lesage S, Jackson RE, eds. NY, NY: M Dekker (1992) (2) Swann RL et al; Res Rev 85: 17-28 (1983)]**PEER REVIEWED**

Volatilization from Water/Soil:

The Henry's Law constant for 1,1,2-trichloro-1,2,2-trifluoroethane is estimated as 5.3X10-1 atm-cu m/mole(SRC) based upon its vapor pressure, 363 mm Hg(1), and water solubility, 170 mg/l(2). This Henry's Law constant indicates that 1,1,2-trichloro-1,2,2-trifluoroethane is expected to volatilize rapidly from water surfaces(3). Based on this Henry's Law constant, the volatilization half-life from a model river (1 m deep, flowing 1 m/sec, wind velocity of 3 m/sec)(3) is estimated as 4 hours(SRC). The volatilization half-life from a model lake (1 m deep, flowing 0.05 m/sec, wind velocity of 0.5 m/sec)(3) is estimated as 5 days(SRC). Half-lives in ponds, lakes, and rivers were estimated at 10.3-4.9, 11.4-3.8, and 11.4-0.1 days, respectively, using an estimated transfer rate of 12.2 cm/h(4). 1,1,2-Trichloro-1,2,2-trifluoroethane's Henry's Law constant(1,2) indicates that volatilization from moist soil surfaces may occur(SRC). The potential for volatilization of 1,1,2-trichloro-1,2,2-trifluoroethane from dry soil surfaces may exist(SRC) based upon its vapor pressure(1).

[(1) Boublik T et al; The Vapour Pressures of Pure Substances. 2nd Rev Ed, Amsterdam: Elsevier p. 74 (1984) (2) Horvath AL et al; J Phys Chem Ref Data 28: 395-507 (1999) (3) Lyman WJ et al; Handbook of Chemical Property Estimation Methods. Washington, DC: Amer Chem Soc pp. 15-1 to 15-29 (1990) (4) Okouchi S; Environ Inter 18: 389-96 (1992)]**PEER REVIEWED**

Chemical/Physical Properties:

Molecular Formula:
C2-Cl3-F3
PEER REVIEWED

Molecular Weight:
187.38
[Lide, D.R. (ed.). CRC Handbook of Chemistry and Physics. 79th ed. Boca Raton, FL: CRC Press Inc., 1998-1999., p. 3-157]**PEER REVIEWED**

Color/Form:
Colorless gas
[Sax, N.I. Dangerous Properties of Industrial Materials. Vol 1-3 7th ed. New York, NY: Van Nostrand Reinhold, 1989., p. 1775]**PEER REVIEWED**

Volatile liquid
[Lewis, R.J., Sr (Ed.). Hawley's Condensed Chemical Dictionary. 13th ed. New York, NY: John Wiley & Sons, Inc. 1997., p. 1127]**PEER REVIEWED**

Colorless to water-white liquid ... [Note: A gas above 118 degrees F].
[NIOSH. NIOSH Pocket Guide to Chemical Hazards. DHHS (NIOSH) Publication No. 97-140. Washington, D.C. U.S. Government Printing Office, 1997., p. 316]**PEER REVIEWED**

Clear, dense, colorless liquid
[Gerhartz, W. (exec ed.). Ullmann's Encyclopedia of Industrial Chemistry. 5th ed.Vol A1: Deerfield Beach, FL: VCH Publishers, 1985 to Present., p. VA9 (87) 290]**PEER REVIEWED**

Odor:
Nearly odorless
[Lewis, R.J., Sr (Ed.). Hawley's Condensed Chemical Dictionary. 13th ed. New York, NY: John Wiley & Sons, Inc. 1997., p. 1127]**PEER REVIEWED**

Odor like carbon tetrachloride at high concentrations
[Sittig, M. Handbook of Toxic and Hazardous Chemicals and Carcinogens, 1985. 2nd ed. Park Ridge, NJ: Noyes Data Corporation, 1985., p. 888]**PEER REVIEWED**

Faint solvent odor
[Gerhartz, W. (exec ed.). Ullmann's Encyclopedia of Industrial Chemistry. 5th ed.Vol A1: Deerfield Beach, FL: VCH Publishers, 1985 to Present., p. VA9 (87) 290]**PEER REVIEWED**

Boiling Point:
47.7 deg C

[Lide, D.R. (ed.). CRC Handbook of Chemistry and Physics. 79th ed. Boca Raton, FL: CRC Press Inc., 1998-1999., p. 3-157]**PEER REVIEWED**

Melting Point:
-35 deg C
[Lide, D.R. (ed.). CRC Handbook of Chemistry and Physics. 79th ed. Boca Raton, FL: CRC Press Inc., 1998-1999., p. 3-157]**PEER REVIEWED**

Corrosivity:
... 1,1,2-Trichloro-1,2,2-trifluoroethane will attack some forms of plastics, rubber, & coatings.
[Mackison, F. W., R. S. Stricoff, and L. J. Partridge, Jr. (eds.). NIOSH/OSHA - Occupational Health Guidelines for Chemical Hazards. DHHS(NIOSH) Publication No. 81-123 (3 VOLS). Washington, DC: U.S. Government Printing Office, Jan. 1981., p. 2]**PEER REVIEWED**

Critical Temperature & Pressure:
Critical temperature: 214.3 deg C; critical pressure: 3.42 MPa
[Lide, D.R. (ed.). CRC Handbook of Chemistry and Physics. 79th ed. Boca Raton, FL: CRC Press Inc., 1998-1999., p. 6-49]**PEER REVIEWED**

Density/Specific Gravity:
1.5635 @ 25 deg C/4 deg C
[Lide, D.R. (ed.). CRC Handbook of Chemistry and Physics. 79th ed. Boca Raton, FL: CRC Press Inc., 1998-1999., p. 3-157]**PEER REVIEWED**

Heat of Vaporization:
28.4 kJ/mol @ 25 deg C
[Lide, D.R. (ed.). CRC Handbook of Chemistry and Physics. 79th ed. Boca Raton, FL: CRC Press Inc., 1998-1999., p. 6-104]**PEER REVIEWED**

Octanol/Water Partition Coefficient:
log Kow= 3.16
[Hansch, C., Leo, A., D. Hoekman. Exploring QSAR - Hydrophobic, Electronic, and Steric Constants. Washington, DC: American Chemical Society., 1995., p. 3]**PEER REVIEWED**

Solubilities:
Soluble in ethanol. Miscible in ethyl ether and benzene.
[Lide, D.R. (ed.). CRC Handbook of Chemistry and Physics. 79th ed. Boca Raton, FL: CRC Press Inc., 1998-1999., p. 3-157]**PEER REVIEWED**

In water, 170 mg/l @ 25 deg C
[Horvath AL et al; J Phys Chem Ref Data 28: 395-507 (1999)]**PEER REVIEWED**

Spectral Properties:

Index of refraction: 1.3557 @ 25 deg C/D

[Lide, D.R. (ed.). CRC Handbook of Chemistry and Physics. 79th ed. Boca Raton, FL: CRC Press Inc., 1998-1999., p. 3-157]**PEER REVIEWED**

SADTLER REF NUMBER: 23717 (IR, PRISM); 10998 (IR, GRATING)

[Weast, R.C. (ed.). Handbook of Chemistry and Physics. 60th ed. Boca Raton, Florida: CRC Press Inc., 1979., p. C-294]**PEER REVIEWED**

UV absorbance, maxima: 1.00 at 231 nm; 0.20 at 240 nm; 0.01 at 260-400 nm. /Photrex reagent, 1.00 cm path vs distilled water/

[JT Baker Chemical Co; Reagents and Laboratory Products Catalog 860C p.143 (1986)]**PEER REVIEWED**

IR: 1925 (Coblentz Society Spectral Collection)

[Weast, R.C. and M.J. Astle. CRC Handbook of Data on Organic Compounds. Volumes I and II. Boca Raton, FL: CRC Press Inc. 1985., p. V1 607]**PEER REVIEWED**

MASS: 1277 (Atlas of Mass Spectral Data, John Wiley & Sons, New York)

[Weast, R.C. and M.J. Astle. CRC Handbook of Data on Organic Compounds. Volumes I and II. Boca Raton, FL: CRC Press Inc. 1985., p. V1 607]**PEER REVIEWED**

Surface Tension:

0.0196 N/m @ 20 deg C

[Gerhartz, W. (exec ed.). Ullmann's Encyclopedia of Industrial Chemistry. 5th ed.Vol A1: Deerfield Beach, FL: VCH Publishers, 1985 to Present., p. VA9 (87) 51]**PEER REVIEWED**

Vapor Density:

6.5 (Air= 1)

[Mackison, F. W., R. S. Stricoff, and L. J. Partridge, Jr. (eds.). NIOSH/OSHA - Occupational Health Guidelines for Chemical Hazards. DHHS(NIOSH) Publication No. 81-123 (3 VOLS). Washington, DC: U.S. Government Printing Office, Jan. 1981., p. 2]**PEER REVIEWED**

Vapor Pressure:

363 mm Hg @ 25 deg C

[Boublik, T., Fried, V., and Hala, E., The Vapour Pressures of Pure Substances. Second Revised Edition. Amsterdam: Elsevier, 1984., p. 74]**PEER REVIEWED**

Relative Evaporation Rate:

>1 (Butyl acetate= 1)
[Mackison, F. W., R. S. Stricoff, and L. J. Partridge, Jr. (eds.). NIOSH/OSHA - Occupational Health Guidelines for Chemical Hazards. DHHS(NIOSH) Publication No. 81-123 (3 VOLS). Washington, DC: U.S. Government Printing Office, Jan. 1981., p. 2]**PEER REVIEWED**

1.3 (Ether= 1)
[Flick, E.W. Industrial Solvents Handbook. 3rd ed. Park Ridge, NJ: Noyes Publications, 1985., p. 87]**PEER REVIEWED**

170 (CCl4= 100)
[Gerhartz, W. (exec ed.). Ullmann's Encyclopedia of Industrial Chemistry. 5th ed.Vol A1: Deerfield Beach, FL: VCH Publishers, 1985 to Present., p. VA9 (87) 51]**PEER REVIEWED**

Viscosity:
0.497 mPa.s @ 48.9 deg C (liq); 0.0108 mPa.s @ 49 deg C (gas)
[Kirk-Othmer Encyclopedia of Chemical Technology. 4th ed. Volumes 1: New York, NY. John Wiley and Sons, 1991-Present., p. V11 (94) 512]**PEER REVIEWED**

Other Chemical/Physical Properties:
Dielectric constant at 60 Hz= 2.41
[Flick, E.W. Industrial Solvents Handbook. 3rd ed. Park Ridge, NJ: Noyes Publications, 1985., p. 87]**PEER REVIEWED**

Volume resistivity= 1x10+16 ohm/cm
[Flick, E.W. Industrial Solvents Handbook. 3rd ed. Park Ridge, NJ: Noyes Publications, 1985., p. 87]**PEER REVIEWED**

Critical volume= 325 cu cm/mol; critical density= 0.576 g/cu m; density of saturated vapor at boiling point= 7.38 g/l: solubility of water in **freon 113** @ 25 deg C= 0.011 (wt%)
[Lide, D.R. (ed). CRC Handbook of Chemistry and Physics. 72nd ed. Boca Raton, FL: CRC Press, 1991-1992., p. 6-172]**PEER REVIEWED**

Ozone Depleting Potential: 0.8
[Environmental Defense Fund; Environmental Defense Scorecard on 1,1,2-trichloro-1,2,2-trifluoroethane (76-13-1). Available from the Database Query page at http://www.scorecard.org/chemical-profiles/ as of July 27, 2000.]**PEER REVIEWED**

GWP (greenhouse warming potential) = 1.24
[Montague DC, Perrine RL; Atmos Environ 24A: 1331-9 (1990)]**PEER REVIEWED**

Manufacturing/Use Information:

Major Uses:
CHEM INT FOR POLYCHLOROTRIFLUOROETHYLENE RESINS & POLYCHLOROTRIFLUOROETHYLENE-VINYLIDENE FLUORIDE.
PEER REVIEWED

Fully halogenated chlorofluorocarbons (CFCs) such as 1,1,2-trichloro-1,2,2-trifluoroethane were scheduled for production phase-out in 1987 by the Montreal Protocol. Although originally scheduled for 50% production phase-out by the year 2000 in developed countries, the worsening ozone depletion has forced acceleration of the CFC phase-out.
[Kirk-Othmer Encyclopedia of Chemical Technology. 4th ed. Volumes 1: New York, NY. John Wiley and Sons, 1991-Present., p. V21 (97) 132]**PEER REVIEWED**

Dry-cleaning solvent, fire extinguishers, to make chlorotrifluoroethylene, blowing agent, polymer intermediate, solvent drying, drying electronic parts and precision equipment.
[Lewis, R.J., Sr (Ed.). Hawley's Condensed Chemical Dictionary. 13th ed. New York, NY: John Wiley & Sons, Inc. 1997., p. 1127]**PEER REVIEWED**

CFC-113 IS USED IN CENTRIFUGAL COMPRESSOR SYSTEMS FOR WATER OR BRINE CHILLING.
[CHEMICAL PRODUCTS SYNOPSIS: FLUOROCARBONS (1984)]**PEER REVIEWED**

INTERMEDIATE IN THE PRODUCTION OF CHLOROTRIFLUOROETHYLENE MONOMER BY REACTION WITH ZINC.
[SITTIG. HDBK TOX & HAZARD CHEM & CARCINOGENS 2ND ED (1985) p.888]**PEER REVIEWED**

It is not used in aerosol formulations as a propellant component, but is used as a solvent or active ingredient in certain aerosol formulations.
[USEPA; Health Assessment Document for 1,1,2-Trichloro-1,2,2-Trifluoroethane p.2 (1983) EPA-600/58-82-002F]**PEER REVIEWED**

... Selective solvent in degreasing electrical equipment, photographic films, magnetic tapes, precision instruments, plastics, glass, elastomers, or metal components. Dry cleaning solvent for all fabrics, leather, and suede. ... Solvent in textile industry, and ... in special laboratory usage.
[Mackison, F. W., R. S. Stricoff, and L. J. Partridge, Jr. (eds.). NIOSH/OSHA - Occupational Health Guidelines for Chemical Hazards. DHHS(NIOSH) Publication No. 81-123 (3 VOLS). Washington, DC: U.S. Government Printing Office, Jan. 1981., p.]**PEER REVIEWED**

... Refrigerant in commerical/industrial air conditioning and industrial process cooling.
[Mackison, F. W., R. S. Stricoff, and L. J. Partridge, Jr. (eds.). NIOSH/OSHA - Occupational Health Guidelines for Chemical Hazards. DHHS(NIOSH) Publication No. 81-123 (3 VOLS). Washington, DC: U.S. Government Printing Office, Jan. 1981., p.]**PEER REVIEWED**

... Chem intermediate for dechloronization of chemicals in the manufacture of polymers and copolymers in the production of high-temp lubricants.
[Mackison, F. W., R. S. Stricoff, and L. J. Partridge, Jr. (eds.). NIOSH/OSHA - Occupational Health Guidelines for Chemical Hazards. DHHS(NIOSH)

Publication No. 81-123 (3 VOLS). Washington, DC: U.S. Government Printing Office, Jan. 1981., p.]**PEER REVIEWED**

... Foaming or blowing agent in the manufacture of polymers for flame retardancy.
[Mackison, F. W., R. S. Stricoff, and L. J. Partridge, Jr. (eds.). NIOSH/OSHA - Occupational Health Guidelines for Chemical Hazards. DHHS(NIOSH) Publication No. 81-123 (3 VOLS). Washington, DC: U.S. Government Printing Office, Jan. 1981., p.]**PEER REVIEWED**

Clean /semiconductor/ wafers; remove grease from printed circuit boards; in defluxing operations to remove solder flux after components are attached /to printed circuit boards/.
[Desktop Analysis Tool for Common Data Base, Report to the National Science Foundation by Chemical Abstract Services and American Chemical Society, 1968., p. VA9 (87) 290]**PEER REVIEWED**

Major dry cleaning solvent
[Gerhartz, W. (exec ed.). Ullmann's Encyclopedia of Industrial Chemistry. 5th ed.Vol A1: Deerfield Beach, FL: VCH Publishers, 1985 to Present., p. VA9 (87) 49]**PEER REVIEWED**

Manufacturers:
AlliedSignal Inc., 101 Columbia Rd., P.O. Box 1057, Morristown, NJ 07962-1057, (973) 455-2000. AlliedSignal Specialty Chemicals; Production site: Baton Rouge, LA 70805
[SRI. 1999 Directory of Chemical Producers -United States. Menlo Park, CA. SRI Consulting 1999., p. 648]**PEER REVIEWED**

DuPont, 1007 Market St., Wilmington, DE 19898, (302) 774-1000. DuPont Specialty Chemicals, DuPont Fluoroproducts ; Production site: Corpus Christi, TX 78400
[SRI. 1999 Directory of Chemical Producers -United States. Menlo Park, CA. SRI Consulting 1999., p. 648]**PEER REVIEWED**

Methods of Manufacturing:
REACTION OF PERCHLOROETHYLENE WITH A MIXTURE OF HYDROGEN FLUORIDE AND CHLORINE IN THE PRESENCE OF A ZIRCONIUM FLUORIDE CATALYST
PEER REVIEWED

From perchloroethylene and hafnium.
[Lewis, R.J., Sr (Ed.). Hawley's Condensed Chemical Dictionary. 13th ed. New York, NY: John Wiley & Sons, Inc. 1997., p. 1127]**PEER REVIEWED**

... Catalytic fluorination of perhalo-olefins or alkanes with hydrogen fluoride.
[Matheson Gas Products; Matheson Gas Data Book 6th Ed p.678 (1980)]**PEER REVIEWED**

... By electrolysis of bromotrichloroethylene, lithium fluoride, and calcium fluoride in liquid hydrogen fluoride.
[Matheson Gas Products; Matheson Gas Data Book 6th Ed p.678 (1980)]**PEER REVIEWED**

Formulations/Preparations:
GRADES: TECHNICAL; SPECTROPHOTOMETRIC.
[Hawley, G.G. The Condensed Chemical Dictionary. 10th ed. New York: Van Nostrand Reinhold Co., 1981., p. 1043]**PEER REVIEWED**

Impurities:
Maximum limits of impurities: Residue after evaporation: 0.0005%; Water (by Karl Fischer titrn): 0.05%. /'Photrex' reagent/
[JT Baker Chemical Co; Reagents and Laboratory Products Catalog 860C p.143 (1986)]**PEER REVIEWED**

Consumption Patterns:
MOST CFC 113 ... IS USED AS A SOLVENT /ALTHOUGH/ IT ALSO HAS REFRIGERANT APPLICATIONS (1984).
[CHEMICAL PRODUCTS SYNOPSIS: FLUOROCARBONS (1984)]**PEER REVIEWED**

REFRIGERANTS, 39%; FOAM BLOWING AGENTS, 17%; SOLVENTS, 14%; FLUOROPOLYMERS, 14%; STERILANT GAS, 2%; AEROSOL PROPELLANTS, 2%; FOOD FREEZANT, 1%; OTHER, 8%; EXPORTS, 3% (1985) /FLUOROCARBONS/
[CHEMICAL PROFILE: FLUOROCARBONS (1986)]**PEER REVIEWED**

Approximately 160-170 million lb/yr ... is consumed in the United States, particularly by the electronics industry.
[Jackson RE et al; pp. 511-26 in Environ Sci Pollut Control Ser 4(Groundwater Contam Anal Haz Waste Sites). Lesage S, Jackson RE, eds. NY, NY: M Dekker (1992)]**PEER REVIEWED**

U. S. Production:
(1974) 2.9X10+10 GRAMS
PEER REVIEWED

(1975) GREATER THAN 4.54X10+5 GRAMS
PEER REVIEWED

>35 million lbs annual capacity
[SRI. 1999 Directory of Chemical Producers -United States. Menlo Park, CA. SRI Consulting 1999., p. 648]**PEER REVIEWED**

Synonyms:
F 113
PEER REVIEWED

R 113

PEER REVIEWED

ARCTON 63
PEER REVIEWED

ARKLONE P
PEER REVIEWED

CFC-113
PEER REVIEWED

Daiflon S 3
PEER REVIEWED

ETHANE, 1,1,2-TRICHLORO-1,2,2-TRIFLUORO-
PEER REVIEWED

FC 113
PEER REVIEWED

Flugene 113
PEER REVIEWED

FORANE 113
PEER REVIEWED

FREON R 113
PEER REVIEWED

FREON 113
PEER REVIEWED

FREON TF
PEER REVIEWED

FREON 113 TR-T
PEER REVIEWED

FRIGEN 113TR-N
PEER REVIEWED

FRIGEN 113TR-T
PEER REVIEWED

FRIGEN 113
PEER REVIEWED

FRIGEN 113A
PEER REVIEWED

FRIGEN 113TR
PEER REVIEWED

Genesolv D
PEER REVIEWED

GENETRON 113
PEER REVIEWED

HALOCARBON 113
PEER REVIEWED

Kaltron 113MDR
PEER REVIEWED

Khladon 113
PEER REVIEWED

TCTFE
PEER REVIEWED

Trichlorotrifluoroethane
PEER REVIEWED

1,2,2-**TRICHLOROTRIFLUOROETHANE**
PEER REVIEWED

TTE
PEER REVIEWED

UCON FLUOROCARBON 113
PEER REVIEWED