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Chemical Fact Sheet

Chemical Abstract Number (CAS #)	1746016
Synonyms	2,3,7,8-TCDD
	Dibenzo[b,e][1,4]dioxin, 2,3,7,8-tetrachloro-
	Dioxin
	2,3,7,8-Tetrachlorodibenzo-p-dioxin
Analytical Method	EPA Method 613
Molecular Formula	$C_{12}H_4Cl_4O_2$
Use	RESEARCH CHEMICAL TCDD HAS BEEN TESTED FOR USE IN FLAMEPROOFING POLYMERS, EG, POLYESTERS, & AGAINST INSECTS & WOOD-DESTROYING FUNGI. IT IS HOPED THAT THESE USES HAVE NEVER BEEN EXPLOITED COMMERCIALLY. NOT USED COMMERCIALLY IN USA
Apparent Color	COLORLESS NEEDLES
Melting Point	305-306 DEG C
Molecular Weight	322
Sensitivity Data	Acute exposure to 2,3,7,8-tetrachlorodibenzo-p-dioxin results in irritation of the eyes, skin, and respiratory tract.
Environmental Impact	2,3,7,8-Tetrachlorodibenzodioxin (TCDD) is currently released to the environment primarily through emissions from the incineration of municipal and chemical wastes, in exhaust from automobiles using leaded gasoline, and from the improper disposal of certain chlorinated chemical wastes. If released to the atmosphere, gas-phase TCDD may be degraded by reaction with hydroxyl radicals and direct photolysis. Particulate-phase TCDD may be physically removed from air by wet and dry deposition. If released to water, TCDD will predominantly be associated with sediments and suspended material. TCDD near the water's surface may experience significant photodegradation. Volatilization from the water column may be important, but adsorption to sediment will limit the overall rate by which TCDD is removed from water. The persistence half-life of TCDD in lakes has been estimated to be in excess of 1.5 yr. Bioconcentration in aquatic organisms has been demonstrated. If released to soil, TCDD is not expected to leach. Photodegradation on terrestrial surfaces may be an important transformation process. Volatilization from soil surfaces during warm conditions may be a major removal mechanism. The persistence half-life of TCDD on soil surfaces may vary from less than 1 yr to 3 yrs, but half-lives in soil interiors may be as long as 12 years. Screening studies have shown that TCDD is generally resistant to biodegradation. The major route of exposure to the general population results from incineration processes and exhausts from leaded gasoline engines.
Environmental	TERRESTRIAL FATE: Vertical distribution of TCDD has been monitored in soil at Seveso, Italy

Fate	down to depth of approx 30 cm at several sites & times in 1976 & 1977. As a rule, the amt of TCDD detected more than 8 cm below the surface were approx 1/10 or less than those detected down to 8 cm. Being only slightly sol in water, its migration in soil may have occurred along with soil colloids & particles to which it may have been bound. No definite conclusions may as yet be drawn as to mechanisms responsible for TCDD vertical movement. Moreover, available data indicate that some soil stabilization of TCDD distribution occurred in 1977 as compared to 1976. Water transport of TCDD is limited since its solubility in water is only 0.2 ppb. TERRESTRIAL FATE: Soil adsorption studies and monitoring of various soils contaminated by 2,3,7,8-TCDD have demonstrated that TCDD does not leach. Movement by surface erosion of soil particles or flooding may be possible, however . TCDD exposed to sunlight on terrestrial surfaces may be susceptible to photodegradation. Volatilization from soil surfaces during warm, summer months may be a major mechanism by which TCDD is removed from soil. Volatilization during cold, winter months or from soil depths several centimeters below the boundary layer is extremely slow. Various biological screening studies have demonstrated that TCDD is generally resistant to biodegradation. The half-life of TCDD on soil surfaces may vary from less than 1 yr to 3 yrs, but half-lives in soil interiors may be as long as 12 years(1,SRC). AQUATIC FATE: Due to its very low water solubility, most of the 2,3,7,8-TCDD occurring in water is expected to be associated with sediments or suspended material. Aquatic sediments may be an important, and ultimate, environmental sink for all global releases of TCDD . Two processes which may be able to remove TCDD from water are photolysis and volatilization. The photolysis half-life at the water's surface has been estimated to range from 21 hr in summer to 118 hr in winter; however, these rates will increase significantly as water depth increases. Many bottom sediments may therefore not be susceptible to significant photodegradation. The volatilization half-life from the water column of an environmental pond has been estimated to be 46 days; however, when the effects of adsorption to sediment are considered, the volatilization model predicts an overall volatilization removal half-life of over 50 years. Various biological screening studies have demonstrated that TCDD is generally resistant to biodegradation. The persistence half-life of TCDD in lakes has been estimated to be in excess of 1.5 yr . TCDD has been shown to bioconcentrate in aquatic organisms. ATMOSPHERIC FATE: Although 2,3,7,8-TCDD has an extremely low vapor pressure (7.4X10-10 mm Hg at 25 deg C) , it has been shown to be volatile and to occur in air in both the gas-phase and particulate-phase . Gas-phase TCDD reacts with photochemically produced hydroxyl radicals in air at an estimated half-life rate of 8.3 days; direct photolysis of gas-phase TCDD may occur at a faster rate than hydroxyl radical reaction. Sufficient data are not currently available to estimate the potential photolysis rate of particulate-phase TCDD. TCDD particulates may be physically removed from the atmosphere by wet and dry deposition. Monitoring data have indicated that TCDD may be transported long distances through the atmosphere. An ultimate environmental sink of airborne particulates may be sediments of the earth's surface waters(4,SRC). Polychlorinated dibenzo-p-dioxins and dibenzofurans ranging from tetra- to octachlorocongeners in ash and fly ash from incinerators, river water, effluent water from incinerators, groundwater, soil, and sediment were determined isomer specifically by high-resolution gas chromatography/mass spectrometry in order to manifest an environmental situation polluted with those cmpd in Japan. The most toxic 2,3,7,8,-tetrachlorodibenzo-p-doxin was detected only in fly ash. TERRESTRIAL FATE: Preliminary results of a new study on TCDD environmental persistence at Seveso (Milan, Italy) are presented. For this study, the most contaminated territory, Zone A, was divided into areas to fractionate the available TCDD levels in soil into data sets with reduced value spreads. In addition, various time subsets were defined for each area. Selected data were fitted with the exponential model y=yO.e-k.cntdot.t. It was estimated that at least 1.2 kg TCDD was present in Zone A shortly after the accident. On average, a considerable portion (23%) of this amount lay on vegetation; TCDD which was not photodegraded or volatilized before the heavy rains of fall 1976, was later washed off and transferred to ground by water action. From this study, mean analytical underestimations affecting Jan 1977 and Mar 1978 contamination map data were on the order of 30 and 24%. All the above figures are considered optimistic. A few years after the accident, mean TCDD half-life in soil appeared to be 9.ly (t1/2 -95% cLs, 6.2-17y).

Drinking Water Impact	DRINKING WATER: 2,3,7,8-TCDD has not been reported to occur in drinking water . SURFACE WATER: 2,3,7,8-TCDD has reportedly been detected (no concn reported) in the ecosystems of Lakes Ontario, Huron and Superior . TCDD has reportedly been positively detected in 0.2% of 491 USEPA STORET water observation stations . OTHER WATER: 2,3,7,8-TCDD was not detected in the preliminary analysis of stormwater runoff from 15 US cities as conducted by the USEPA National Urban Runoff Program . EFFL: Soot samples from six major PCB transformer and capacitor fires in the USA contained