Technical Factsheet on: 2,4 - D

List of Contaminants

As part of the Drinking Water and Health pages, this fact sheet is part of a larger publication:
National Primary Drinking Water Regulations

Drinking Water Standards
MCLG: 0.07 mg/L
MCL: 0.07 mg/L
HAL(child): 1 day: 1 mg/L; 10-day: 0.3 mg/L

Health Effects Summary

Acute: EPA has found 2,4-D to potentially cause nervous system damage from short-term exposures at levels above the MCL.

Drinking water levels of 2,4-D which are considered "safe" for short-term exposures: For a 10-kg (22 lb.) child consuming 1 liter of water per day, a one-day exposure of 1 mg/L, or a ten-day exposure to 0.3 mg/L.

Chronic: 2,4-D has the potential to cause damage to the nervous system, kidneys and liver from long-term exposure at levels above the MCL.

Cancer: There is inadequate evidence to state whether or not 2,4-D has the potential to cause cancer from lifetime exposures in drinking water.

Usage Patterns

2,4-D is registered in the US as a herbicide for the control of broad-leaf weeds in agriculture, and for control of woody plants along roadsides, railways, and utilities rights of way. It has been most widely used on such crops as wheat and corn, and on pasture and rangelands.

Other uses of 2,4-D include brush control in forests, to increase the latex output of old rubber trees, and as a jungle defoliant.

It may also be used as a plant growth regulator to control fruit drop, such as on tomatoes to cause all fruits to ripen at the same time for machine harvesting.

Production of 2,4-D was steady: from 48.2 million lbs. in 1978 to 45.1 million lbs in 1982. 1991 data indicates only that production exceeded 5000 lbs. In 1991, it was estimated that industries consumed 2,4-D as follows: agriculture, 83 percent; for industrial/commercial uses, 11 percent; for lawns and turf, 3 percent; for aquatic uses, 3 percent.

Release Patterns

Major environmental releases of 2,4-D are due to agricultural applications of systemic herbicides. It is also released as a result of the production or disposal of 2,4-D or its by-products. From 1987 to 1993, according to EPA's Toxic Chemical Release Inventory, 2,4-D releases to land and water totalled over 116,000 lbs., most of which was released to land. These releases were primarily from cane sugar-related industries (except refineries). The largest releases (10% or more of the total) occurred in Hawaii.

Environmental Fate

There are a variety of microorganisms in soil, freshwater and marine ecosystems which are capable of degrading 2,4-D. If released on land, 2,4-D will probably readily biodegrade (typical half-lives <1 day to several weeks).

Reported experimental (free acid) KOC values are 19.6 to 109.1. Adsorption appears to increase with increasing organic content and decreasing pH of soil. Leaching to groundwater will likely be a significant process in coarse-grained sandy soils with low organic content or with very basic soils. In general little runoff occurs with 2,4-D or its amine salts and runoff behavior is the inverse of adsorption behavior. Thus, 2,4-D can be desorbed from mineral soils, but not from those containing much organic matter.

Percolating water appears to be the principal means of movement and diffusion is important only for transport over very small distance. Upward movement of 2,4-D occurs when the soil surface dries or if rapid evaporation occurs. Thus, 2,4-D can be concentrated at the soil surface, where it can be photolyzed, transported by wind either on dust or in vapor form, or leached downwards again.

If released to water, it will be lost primarily due to biodegradation (typical half-lives 10 to >50 days). It will be more persistent in oligotrophic waters and where high concentrations are released. Degradation will be rapid in sediments (half-life <1 day). Half-lives of 2-4 days were reported for ultraviolet photolysis in water.

Volatilization of 2,4-D free acid from water and soil is expected to be negligible based on its extremely low reported Henry's Law constant (1.02X10-8 atm-cu m/mole or less). It will not appreciably adsorb to sediments, especially at basic pH's. Its release to the air will also be subject to photooxidation (estimated half-life of 1 day).

There is no evidence that bioconcentration of 2,4-D occurs through the food chain. This has been demonstrated by large-scale monitoring for 2,4-D residues in soils, foods, feedstuffs, wildlife, human beings, and from examinations of the many routes of metabolism and degradation that exist in ecosystems.

Human exposure will be primarily to those workers involved in the making and using 2,4-D compounds as herbicides as well as those who work in and live near fields sprayed and treated with 2,4-D compounds. Exposure may also occur through ingestion of contaminated food products and drinking water.

Chemical/ Physical Properties

CAS Number: 94-75-7

Color/ Form/Odor: Colorless, odorless powder; available as soluble liquids, powder, dust, aerosol spray (foam)

M.P.: 138 C B.P.: 160 C

Vapor Pressure: 53 Pa at 160 C

Octanol/Water Partition (Kow): Log Kow = 2.81

Density/Spec. Grav.: 1.42 at 15 C

Solubility: 0.5 g/L of water at 20 C; Slightly soluble in water

Soil sorption coefficient: Koc values are 19.6 to 109.1; low to moderate mobility in soil

Odor/Taste Thresholds: N/A

Bioconcentration Factor: BCFs of 0.003 to 7 for various fish and aquatic plants; not expected to bioconcentrate in aquatic organisms.

Henry's Law Coefficient: 1.02x 10-8 atm-cu m/mole;

Trade Names/Synonyms: "Agent White", Bladex-B, Brush Killer 64, Dicofur, Dormon, Ipaner, Moxon, Netagrone, Pielik, Verton 38, Mota Maskros, Silvaprop 1, Agricorn D, Acme LV4, Croprider, Fernesta, Lawn-Keep, Pennamine D, Plantgard, Tributon, Weed-B-Gon, Weedatul, Agroxone, Weedar, Salvo, Green Cross Weed-No-More 80, Red Devil Dry Weed Killer, Scott's 4XD Weed Control, Weed-Rhap LV40, Weedone 100, 2,4-Dichlorophenoxyacetic acid

Other Regulatory Information

Monitoring For Ground/Surface Water Sources:

Initial Frequency- 4 quarterly samples every 3 years
Repeat Frequency- If no detections during initial round:
2 quarterly per year if serving >3300 persons;
1 sample per 3 years for smaller systems
Triggers - Return to Initial Freq. if detect at > 0.0005 mg/L
Analysis:

Reference Source	Method Numbers
EPA 600/4-88-039	515.1; 515.2; 555

Treatment- Best Available Technologies:
Granular Activated Charcoal

Toxic Release Inventory - Releases to Water and Land, 1987 to 1993 (in pounds):

	Water		Land	
TOTALS	**3,444**		**113,358**	
Top Five States				
HI	0	73,679		
FL	5	38,456		
MO	1,817	0		
MI	822	8		
TX	800	0		
Major Industries				
Cane sugar		0		99,886
Agri. chems.		2,616		815
Plastics, resins		696		0
Misc. manufact.		0		400
Gen. Chemical.		126		8

* Water/Land totals only include facilities with releases greater than a certain amount - usually 1000 to 10,000 lbs.

For Additional Information:

EPA can provide further regulatory and other general information:
EPA Safe Drinking Water Hotline - 800/426-4791

Other sources of toxicological and environmental fate data include:
Toxic Substance Control Act Information Line - 202/554-1404
Toxics Release Inventory, National Library of Medicine - 301/496-6531
Agency for Toxic Substances and Disease Registry - 404/639-6000
National Pesticide Hotline - 800/858-7378