

Relevant Historical Timeline of D5 and GreenEarth

YEAR	ORGANIZATION	FINDING	OUTCOME
1943	Dow Corning	Unique properties of silicone help dry, damaged skin.	First use in personal care products: skin lotion.
1944-2009	Various	D5 silicone an ideal base ingredient in a variety of personal care products.	Widespread use in variety of personal care products.
1994	U.S. EPA	Direct final rulemaking: D5 specifically exempt from regulation as a Volatile Organic Compound (VOC).	D5 does not require regulation.
2000	California Industrial Hygienist Services (Roxanne Fynboh)	Air Sampling Analysis: no risk to employee health when used as dry cleaning solvent in dry-to-dry machines.	GreenEarth moves to market after 18 months of Affirmation Site Testing.
2000	Severn Trent Labs	Waste Stream Analysis: D5, used in dry-to-dry machines both by itself and in conjunction with additives, is not a hazardous waste.	GreenEarth classified by waste haulers as non-hazardous waste.
2003	Silicone Environmental Health & Safety Council (SEHSC)	Preliminary bioassay study: concern around precancerous indicators in female rats subjected to high continuous exposures of D5 over a two year period.	Additional research to determine relevance of findings.
2005	Silicone Environmental Health & Safety Council (SEHSC)	Follow-On research: disease pathway that exists in rats does not exist in humans; D5 poses no risk to human health.	SEHSC findings accepted by the Society of Toxicologists.
2006	EPA Region 8	GreenEarth has no known or expected health issues, requires no special handling or permits, is non-toxic whether contact is oral, dermal or from inhalation. The byproduct of the cleaning operation is so benign it is permissible for landfills.	GreenEarth's Colorado Mountain Cleaners recognized with the EPA's Environmental Achievement Award.
2006	Illinois Dry Cleaner Environmental Response Fund (DERTFI)	Typical exposure to D5, whether occupationally, to consumers or to the general public, would not result in a significant risk to human health. There are no significant environmental risks from the use of D5 in dry cleaning.	GreenEarth designated 'green' solvent in Illinois by DERTFI.
2008	California Air Resources Board (CARB)	Based on Office of Environmental Health Hazard Assessment (OEHHA) review, D5 as an alternative dry cleaning solvent does not pose an adverse health risk to the public. No regulation is required.	CARB affirmed GreenEarth as an acceptable alternative dry cleaning solvent that does not require regulation.
2009	Canadian Ministers of Environment & Health	Final Screening Assessment: amounts of D5 entering the environment do not pose a risk to human health.	No impact to dry cleaning application of D5 is anticipated.

Key Facts About GreenEarth

GreenEarth is the brand name for the patented process of dry cleaning with D5 (Decamethylcyclopentasiloxane).

D5 is exempted from regulation as a VOC by the U.S. EPA¹ as well as by the State of California.² D5 does not impact ozone, is not a greenhouse gas and does not interact with greenhouse gases.

GreenEarth has been affirmed by the California Air Resources Board (CARB) as an acceptable alternative dry cleaning solvent that will not pose an adverse health risk to the public and does not require CARB regulation.²

D5 is non-toxic (oral, dermal, inhalation), as measured by EPA protocol.³

GreenEarth utilizes D5 in a closed loop dry cleaning system. Employee exposure level is less than .5 ppm.⁴

D5 is non-irritating to skin and non-sensitizing. D5 has no immunosuppressant effects.⁵

D5 is not a hazardous waste under federal or state laws.⁶ Not regulated by EPA, RCRA, CERCLA or California Prop 65.

D5 is listed by EPA as "SNAP" material, a good substance to use in place of ozone-depleting chemicals.

If released to the environment, D5 degrades to sand (SiO₂) and trace amounts of H₂O and CO₂.⁷ No special permits required (except in BAAQMD, where a permit is required not to have a permit).

CITED RESEARCH STUDIES

1 59 Federal Register No. 192, October 5, 1994, pp. 50693-50696.

In a final direct rulemaking, the EPA specifically exempted D5 from regulation as a Volatile Organic Compound (VOC).

2 California Air Resources Board, 2008, Dry Cleaning Alternative Solvents: Health and Environmental Impacts Fact Sheet.

After an exhaustive 18-month review of all available research, CARB concluded that D5 is not a VOC and that available exposure information indicates that the use of D5 as an alternative dry cleaning solvent will not pose a risk to the public living near businesses using D5.

3 Battelle Northwest Toxicology 2001, Plotzke et al. 2002, Dow Corning Corporation 1999, 2003a, 2003b, 2003d, 2005b, Utell 2004, Anderson et al. 2005, Reddy et al. 2005a, 2005b.

Multiple studies cite D5 as non-toxic regardless of exposure type (oral, dermal, inhalation).

4 California Industrial Hygienist Services (CIH Services, Inc), 2000, SB32 Air Sampling Study, Environ International Corporation, 2006.

Industrial Hygiene (IH) survey, consisting of both personal and area monitoring, measured employee exposures as both an 8-hour time-weighted average (TWA) as well as for Short-Term Exposure Limits (STELs) for particular tasks within the dry cleaning process. Based on measurement techniques prescribed by the Occupational Health and Safety Administration (OHSA) and the National Institute for Occupational Health & Safety (NIOHS), average employee exposure level was less than .22 ppm on an 8-hour time-weighted average (TWA) in approved dry-to-dry machines, well below estimated Margins of Safety (MOS) limits. Later corroborated by Environ evaluation of exposure to D5 for consumers, workers and the public prepared for the Silicones Environmental Health and Safety Council. Mean value for occupational exposure to D5 in workplace air was measured at .143 ppm for dry cleaners.

5 Burns-Naas et al. 1998.

D5 was not immunotoxic when administered by inhalation for 28 days at concentrations up to 160 ppm.

6 Severn Trent Laboratories, 2000, Waste Streams Analysis.

Sampling and analysis of D5 in dry-to-dry machines, done at intervals over a four-month period, concluded that D5 by itself (and also when used in conjunction with appropriate additives such as detergent, spotting chemicals, etc.) is not a hazardous waste under federal or California law. The residue sometimes referred to as "still bottoms", remaining after the D5 is distilled off for recycling into the dry cleaning process, contains all of the substances cleaned off the clothes as well as any other chemicals introduced into the process, and as such, may be a hazardous waste. Similarly, filter cartridges, designed to remove the larger particulate that may come into the process from soiled laundry, could also potentially lead to a hazardous waste, despite D5 itself being classified as non-hazardous.

7 Dry Cleaner Environmental Response Trust Fund of Illinois (DERTFI), 2006, Assessment of the Human Health Risk and the Environmental Fate and Effects of GreenEarth® (Decamethylcyclopentasiloxane) Used in Dry Cleaning.

The environmental fate and effects of D5, based on fugacity modeling assessments made of potential concentrations of D5 in the environment resulting from its use as a dry cleaning solvent, were investigated in order to determine potential risk for the general public as well as aquatic species. Using the Equilibrium Criterion (EQC) multimedia fugacity model (Mackay et al. 1996), it was determined that more than 99.9% of the emission of D5 resides in the air; intermediate exchange of D5 from air into other environmental compartments (water, soil, or sediment) was insignificant. About 22% of D5 was removed from the model environment by degradation in air, and 78% was removed by advective transport in air. Total residence time of D5 in the model environment was about 3.2 days. D5 will not partition to soil or water in remote regions because it does not have the potential for deposition in the biosphere after transport. While D5 is not soluble in water and tends to evaporate (Henry's Law Constant = 0.318 atm m³ mol⁻¹), chronic and acute aquatic toxicity tests were conducted under very stringent laboratory conditions. In most cases, the No Effect Concentrations (NOECs) were determined to be equal to or greater than the limit of water solubility. The environmental modeling and testing clearly indicate that there are no significant environmental hazards from the use of D5 in dry cleaning. Based on the extensive data available for D5, the safety of the GreenEarth system was supported.