



Doing laundry is a common household activity. Whether the activity is performed physically using brushes and detergents or through the use of programmable washing machines, the process depends on soap and water. Traditionally dry cleaning has been done without the use of water. Contrary to popular belief, dry cleaning is by no means dry; clothes are immersed and cleaned using a liquid solvent. Different dry cleaning technologies use different liquid chemical solvents. These chemicals may impact worker health, consumer health and the health of the environment. Since the health risks due to exposure to these solvents vary from carcinogenic (causes cancer) to mostly harmless, it is important to be aware of the various cleaning options when selecting a cleaner to care for your clothes.

Currently, there are four popular garment cleaning technologies in use by professional garment cleaners in San Francisco. The health effects and environmental effects of these processes are summarized below and are listed from most hazardous to most benign. As is consistent with the Precautionary Principle, SFE uses a hazard-based, rather than a risk-based, approach in summarizing the potential health and environmental impacts of dry cleaning solvents.

4 Perchloroethylene: Since World War II, perchloroethylene (“perc”) became the solvent of choice for use in garment cleaning and is used by many “dry” cleaners in San Francisco. Perc has a particular odor that is commonly associated with dry cleaner shops or dry cleaned clothes.

- Health Effects to workers¹: Perc is listed by the state of California as a chemical known to cause cancer (bladder, esophageal, stomach, intestinal and pancreatic cancers) and reproductive toxicity. Reproductive effects such as reduced fertility and spontaneous abortions have been reported from occupational exposure to perc. Long-term exposure can result in neurological effects, such as dizziness and diminished cognitive ability, as well as damage to the liver and kidneys. High levels of exposure in enclosed spaces, even for short periods of time, can cause respiratory failure and even death.
- Impacts to consumers: Perc off-gases from clothes dry cleaned using this chemical. Short-term exposure to perc (such as in a dry cleaning shop) can cause dizziness, rapid heartbeat, fatigue, headaches, confusion, nausea, and skin, eye and respiratory tract irritation. In addition, if the dry cleaning machine using perc is not properly insulated, perc can seep through walls and expose residents and businesses adjacent to the cleaner. Such exposure can cause long-term health effects to residents, similar to those found in workers.
- Environmental Effects: Perc has been shown to contaminate soil, water and air. It is quite volatile and so pollutes indoor and outdoor air. Perc spills are considered severe environmental accidents as perc can seep down into the soil and reach drinking water aquifers.

3 GreenEarth®: A dry cleaning solvent called GreenEarth® was introduced as an alternative to perc in the last decade. The chemical present in the dry cleaning solvent sold under the Green Earth® trademark is decamethylcyclopentasiloxane or D5. Although this solvent is not widely used in San Francisco currently, it may become more available. D5 has been reviewed extensively by OEHHA (Office of Environmental Health Hazard Assessment, a California state agency) as well as the Canadian government. Below is a summary of their findings on human health and environmental impacts of D5.

For more information, visit SFEnvironment.org/garmentcleaning or call 415-355-3766.

SFEnvironment is a department of the City & County of San Francisco.

- Health Effects to workers²: In a 2007 report, OEHHA stated “a statistically significant increase in a malignant tumor (uterine adenocarcinoma) due to D5, a chemical that may be bioconcentrated and is a candidate to replace perchloroethylene in dry cleaning, indicates a potential hazard for workers in the dry cleaning industry and perhaps for the general public.” Based on available science, OEHHA concluded that D5 poses a concern for potential carcinogenicity relevant to humans. Potential non-carcinogenic effects of D5 include impacts to the nervous system, fat tissue, the liver (bile formation), and the immune system. Exposure to D5 is known to aggravate liver disorders and cause liver weight changes in rats exposed to it. Should this combustible solvent ignite and start a fire, one of the resulting products is formaldehyde, an acute respiratory and nervous system toxicant and cancer hazard.³
- Impacts to consumers: As with perc, the use of GreenEarth® introduces another unnecessary chemical to our household. Furthermore, GreenEarth® is a Class IIIA combustible solvent that is regulated by the fire department, and its flammability may present a potential fire hazard for adjacent residents and businesses.
- Environmental Effects²: D5 persistence⁴ in the environment and in animal and human tissues is a concern. D5, which is highly lipophilic, has been measured in aquatic species in a number of environments and has a long half-life in human tissues. Canada recently concluded that D5 is persistent in the environment, consistent with OEHHA’s evaluations. Concerns about D5 as an environmental contaminant is based primarily on environmental sampling which has indicated accumulation in wildlife, including fish. More widespread and intensive use of D5 could therefore result in human exposure via the consumption of fish.

2 Hydrocarbon: The first dry cleaning chemicals were hydrocarbon solvents. However, due to flammability issues, they became less common and gave way to perc. As the use of perc is gradually being phased out, most cleaners are choosing hydrocarbon solvents as a replacement. However, the hydrocarbon solvents have their own health and environmental effects. Hydrocarbon solvents include DF-2000 (ExxonMobil), EcoSolv (Chevron Philipps), Shell Sol (Shell), and Pure Dry (Niran).

- Health Effects to workers⁵: One of the most alarming aspects of the hydrocarbon solvents is the great lack of toxicity data. There are very few studies exploring carcinogenicity, toxicity or effects of long-term exposure. However, existing studies indicate that inhalation exposure can depress the central nervous system. High vapor concentrations, as can happen in small spaces, may cause headaches, dizziness, anesthesia, drowsiness, unconsciousness and other central nervous system effects, including death. Exposure can cause irritation to the eyes, skin and respiratory tract. Furthermore, these chemicals pose significant fire hazards given that they are all combustible liquids and are thus regulated by the fire department.
- Impacts to consumers: The lack of toxicity information about common hydrocarbon solvents makes it very difficult to judge how safe they are. However, hydrocarbon solvents are volatile organic chemicals that contribute to smog formation, which is known to cause and aggravate asthma. As Class IIIA combustible solvents, the flammability of hydrocarbon solvents may present a potential fire hazard for adjacent residents and businesses.
- Environmental Effects: The use of hydrocarbon solvents promotes yet another petroleum based technology, which increases our dependence on limited fossil fuels. Hydrocarbon solvents also emit smog and contribute to global warming.

1 Professional Wet Cleaning: Wet cleaning is a cleaning technology that uses specialized washers and dryers that control revolutions, temperature and moisture content of the clothes. Controlling these factors eliminates problems with damage to garments or shrinkage, concerns which are often associated with cleaning specialized garments in normal home washers. New professional wet cleaning machines allow us to go back to using water and soap.

- Health Effects to workers: Given that the workers are mostly using only soap and water, the health effects do not vary much from the ones of doing laundry at home. In addition the detergents can be odorless, biodegradable and low-toxic. As is the case with other professional garment cleaning technologies, cleaners will need to select spotting chemicals carefully to minimize potential hazards.
- Impacts to consumers: Consumers that use wet cleaning know that the clothes they send to the cleaners do not return home with any chemicals that might be harmful to themselves or their families. All of the clothes that can be washed in a dry cleaning system can be professionally wet cleaned, giving the consumer an option that provides the same quality in an environmentally sound fashion.
- Environmental Effects: There have been several studies that further verify that the environmental impact of wet cleaning is minimal. Multiple studies examining the wastewater leaving a wet cleaning plant have shown that wastewater from wet cleaning facilities is of little to no concern.⁶ Furthermore, cleaners that have switched to wet cleaning from traditional dry cleaning have found reductions in their energy bills and in many cases their water bills as well.⁷

What is the government doing?

California has moved to phase out perc; the state is requiring all perc dry cleaners within 300 feet of residential buildings, schools, medical facilities and other sensitive areas to stop operating perc machines by 2010. Remaining machines must be phased out by 2023. The state, through the Air Resources Board, has also begun an incentive program to encourage perc cleaners to change to environmentally friendly cleaning options, such as carbon dioxide or wet cleaning. This program provides a \$10,000 grant for cleaners willing to change, and an additional \$5,000 is available for wet cleaning demonstration sites to supplement state funding. The City of San Francisco also offers financial incentives (\$5,000 per cleaner) to convert from perc to wet cleaning.

What should you do?

- ✓ You have already begun by informing yourself about the dry cleaning technologies available.
- ✓ Ask your dry cleaner what kind of technology he/she uses and encourage him/her to choose the greenest option, professional wet cleaning.
- ✓ Encourage him/her to adopt practices that create less waste such as using reusable garment bags and hangers, and accepting and recycling hangers.
- ✓ If your cleaner uses perc, *be sure to let your clothes air out before putting them in your closet.*
- ✓ When buying new clothes, read the care labels and choose garments that can be machine washed or hand-washed.

Want to know more? Please contact SF Environment at 415-355-3766

¹ Agency for Toxic Substances and Disease Registry (ATSDR). Toxicological profile for Tetrachloroethylene (PERC). Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service. 1997.

² OEHHA. Comments on Human Health and Environmental Hazards for Green Earth. Memorandum from Sarah Hoover to Sushma Dhulipala Bhatia. Nov 5, 2009.

³ GE. Cyclopentasiloxane Material Safety Data Sheet, Aug 30, 2006; Dow Corning. Fabric Cleaning Solution MSDS. Dec 12, 2006.

⁴ Persistent: Organic substances that do not break down quickly in the environment and are readily taken in by living organisms through contaminated food or polluted water or air. (Environment Canada)

⁵ Fong, M. et al. State of California, Air Resources Board, California Dry Cleaning Industry Technical Assessment Report. Feb 2006.

⁶ Star, A. and Eyring W. Pollution Prevention Products for Illinois Dry Cleaners: Testing and Recommendations of Chemicals for Wetcleaning. A Report of The Center for Neighborhood Technology. May 2002

⁷ Sinsheimer, P, Severi, G, and Namkoong, A. Commercialization of Environmental Technologies in the Garment Care Industry. Jan 2008.