

# Dry Cleaning

Dry cleaners are the most significant emission source of perchloroethylene in the United States. Figure 1 shows the number of dry cleaners in Washington State by SIC code from one source. However, there is believed to be approximately 800 commercial dry cleaners in Washington (Brady). The largest toxic emissions from dry cleaners are perchloroethylene, trichlorofluoroethane, and petroleum solvents.

**Figure 1. Number of Dry Cleaners in Washington State by SIC Code**  
(Ecology, 1/20/98)

SIC Code	SIC Description	No. of Sources
7215	Coin-operated	37
7216	Commercial	402
7218	Industrial	7

Washington State Department of Ecology has published the *Dry Cleaning Reference Manual* that is useful for complying with state and federal regulations.

## Description of Process

The dry cleaning industry consists of coin-operated (Standard Industrial Classification (SIC) Code 7215), commercial (SIC 7216), and industrial sectors (SIC 7218). Coin-operated cleaners use only synthetic solvents and are generally small (about 3.6 to 11.5 kg capacity). Commercial cleaners are larger (14-27 kg capacity) and can use synthetic or petroleum solvents. Industrial cleaners are the largest (230 kg capacity) and about 50% of them use perchloroethylene. (AP-42<sup>1</sup>, 4.1-1)

The basic steps in dry cleaning are washing, spinning, and drying. The two types of machines used for this process are transfer and dry-to-dry machines. A transfer machine is one in which the washing and drying takes place in different machines and a dry-to-dry machine is one in which the washing and drying takes place in one machine.

The chemicals used for cleaning are either petroleum solvents or synthetic solvents. Petroleum solvents are inexpensive combustible hydrocarbon mixtures and can be used in dry-to-dry and transfer machines. The most common petroleum solvents used in cleaning is the Stoddard solvent (mineral spirits) and 140-F. Synthetic solvents are nonflammable more expensive halogenated hydrocarbons. The two synthetic solvents used today are perchloroethylene (perc), trichlorotrifluoroethane (CFC-113), and 1,1,1-trichloroethane (TCA). Perc plants use transfer and/or dry-to-dry machines and fluorocarbon plants use dry-to-dry machines. Perc is the most common synthetic solvent used, as CFC-113 and TCA are used mostly in specialty cleaning operations. (AP-42, 4.1-1)

<sup>1</sup> U.S. Environmental Protection Agency, *Compilation of Air Pollutant Emissions Factors Volume 1: Stationary Point and Area Sources*, Fifth Edition with Supplements, October 1997, Document No. AP-42.

For synthetic cleaners the garments are first washed in “charged” solvent which is used solvent with a small portion of detergent for better cleaning. Then the garment is rinsed in pure solvent and is sent to the dryer. The solvent is filtered and part is returned to be used as “charged” solvent. The other portion is distilled to remove oils, fats, greases, and then used in the pure solvent tank. The solids (muck) are removed from the filters once per day and are usually cooked to remove more solvent. The vapors are sent to a refrigerated condenser and separator to recover the solvent. In older perc plants the vapor stream may be sent to a carbon adsorption system to recover the perc instead of a refrigerated condenser, and in fluorocarbon plants the stream can be sent to an unvented refrigeration system. The emissions from the dryer are also sent through similar control devices. (AP-42, 4.1-3)

Petroleum plants are the same as synthetic cleaners except in the transfer machines the solvents are removed by spin-drying. Some plants don’t bother to recover the solvent, however, some use water-cooled condensers to recover solvent. There are no control devices for petroleum plants, but emissions can be reduced by maintaining equipment and using good operating practices. (AP-42, 4.1-1)

The major toxic emission from a dry cleaning facility is the solvent used and emissions come from all units.

## **Methods of Determining Emissions**

Coin-operated and commercial dry cleaners are usually considered area sources. Industrial dry cleaners are usually considered point sources. The commercial dry cleaner category produces the most emissions.

Perc, CFC-113, and TCA are not considered photochemically reactive, therefore, they do not contribute to tropospheric ozone formation and should not be included in an VOC inventory. However, perc and TCA (listed as methyl chloroform in Washington Administrative Codes (WAC) 173-460) are air toxics and should be included in a toxics inventory. CFC-113 is not listed as an air toxic in Washington State regulations, but may be listed in other states as an air toxic. TCA and CFC-113 are also stratospheric ozone-depleting substances. (EIIP, 4.2-2)

For determining emissions from a specific dry cleaner, the best method is material balance for the solvent used.

EIIP (pg. 4.3-1) recommends other methods for determining emissions over large areas summarized below:

“Number of facilities or dry cleaning units:

- Local per facility emission factors (using survey or permit information)
- Emission factors based on type of machine
- National average per facility emission factors

Number of employees:

- Local per employee emission factors (using survey or permit information)
- National average per employee emission factors

Per capita:

- National average per capita emission factor”

The document goes into detail about how to apply these methods to different dry cleaner operations.

For determining emissions over large areas for coin-operated and commercial cleaners it is best to establish local emission factors using a survey (detailed in EIIP, 4.4-1). The dry cleaning NESHAP requires all those facilities using perc to report a description of their dry cleaning machine and the amount of perc used to their EPA Regional Office, therefore a survey may not be necessary. However, if developing local emission factors is not practical, national emission factors are available in AP-42 on a kg per kg of garments washed basis and also on a per capita basis.

## References

Brady, Bernard. Washington State Department of Ecology, Personal Communication.

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U.S. Environmental Protection Agency, *Compilation of Air Pollutant Emissions Factors Volume I: Stationary Point and Area Sources*, Fifth Edition with Supplements, January 1995, Document No. AP-42. (Section 4.1, Dry Cleaning, April 1981)

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Washington State Department of Ecology, *Controlling Air Toxics: Complying with State Laws*, June 1992, Publication No. 92-51.

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