



Project Summary

Evaluation of Perchloroethylene Emissions from Dry Cleaned Fabrics

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A study was conducted to evaluate the emissions of perchloroethylene (perc) from dry cleaned fabrics to determine: a) how the introduction of fresh dry cleaning into a home affects the indoor concentration of perc, and b) the effectiveness of "airing out" for reducing perc emissions. Small chamber tests were conducted to determine perc emission characteristics for three fabrics at several temperatures and air exchange rates. Test house studies were conducted to determine the indoor concentration of perc due to the placement of dry cleaned clothing in the house. Based on the study results, and assuming the test conditions were representative of normal dry cleaning and consumer practices, it is concluded that:

- 1) Emissions from freshly dry cleaned clothing cause elevated levels of perchloroethylene in residences, and
- 2) For the three fabrics tested, "airing out" of dry cleaned clothing by consumers will not be effective in reducing perchloroethylene emissions.

Significant variations in dry cleaning practices and/or in the mix of fabrics and clothing being cleaned could provide different results and conclusions.

This Project Summary was developed by EPA's Air and Energy Engineering Research Laboratory, Research Triangle Park NC, to announce key findings of the research project that is fully

documented in a separate report of the same title (see Project Report ordering information at back).

Introduction

The EPA's Air and Energy Engineering Research Laboratory (EPA/AEERL) conducted a short term study to evaluate the emissions of perchloroethylene (perc) from dry cleaned fabrics. Specifically, the study was designed to answer two questions:

- To what extent does the residual perc in dry cleaned fabric increase the concentration of perc in residential environments?
- How effective is "airing out" in reducing indoor perc concentrations?

A study consisting of five components was conducted: 1) Fabric/Clothing Selection; 2) Emission Factor Determination (Small Chamber Testing); 3) Evaluation of Perc Residuals (Solvent Extraction); 4) Indoor Air Quality (IAQ) Model Analysis; and 5) Evaluation of Indoor Concentrations (Test House).

Results

Emission Factors

Emission factors for perchloroethylene from dry cleaned fabrics were determined by testing in small environmental test chambers under controlled conditions. Evaluation of the data from these tests provided several conclusions:

- A preliminary screening evaluation showed that wide variations in initial emission factor, R_0 , and emission factor half-lives, $t(1/2)$, occurred between different fabrics. Thus, the

type of fabric is important in determining indoor emissions of perc from dry cleaned clothes.

- Based on the screening study and on the prevalence of fabrics used in dry cleaned clothing, three fabrics were selected for investigation: 55% polyester/45% wool; 100% wool; and 50%polyester/50% rayon.
- The air exchange rate showed no effect on the emission factor or decay rate for the three fabrics investigated. This suggests that the emissions are limited by the diffusion of perc within the fabric and are not controlled by evaporative processes. This also suggests that increasing the ventilation by airing out the clothes will not speed up the emission of perc.
- Since the three fabrics tested had emission factor half-lives of about a day, airing the clothes out for a few hours before hanging them in the home will do little to reduce the indoor perc concentrations. For fabrics with faster perc decay rates, airing out may be more practical.

- Temperature had a major impact on the emission factors and decay rates. Increases in temperature caused higher initial emission factors and lower half-lives. Thus, exposing the clothing to higher temperatures prior to bringing them home shows promise as a means of reducing in-home exposure to perc.

Residuals

No acceptable data were developed on the perc residuals within the fabric. The solvent extraction procedure, using methylene chloride, failed to produce reliable results. A fully tested "standard method" is needed.

Indoor Concentrations

All the test house experiments showed that the introduction of dry cleaned clothing caused elevated levels of perc in the house. Differences in concentration between the tests were probably due to differences in the amount of perc retained at the dry cleaner.

Model Results

The IAQ model, using emissions developed in the small chamber predicted indoor perc concentration which compared favorably with the measured in the test house. The effect of perc "sinks" in the test house was also demonstrated.

Conclusions

Based on the study results, assuming the test conditions a representative of normal dry cleaning a consumer practices, it is concluded that

1) Emissions from freshly cleaned clothing cause elevated levels perchloroethylene in residences.

2) For the three fabrics tested "airing out of dry cleaned clothing consumers is not effective in reducing perchloroethylene emissions."

It is emphasized that the conclusions are based on the results of the study reported herein. Significant variations in dry cleaning practices and in the mix of fabrics and clothing being cleaned could provide different results and conclusions.

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Bruce A. Tichenor is the EPA Project Officer (see below).

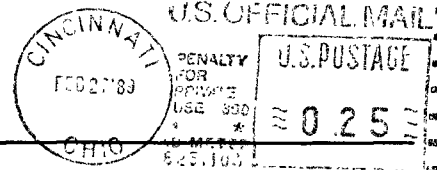
The complete report, entitled "Evaluation of Perchloroethylene Emissions from Dry Cleaned Fabrics," (Order No. PB 89-118 681/AS; Cost: \$15.95, subject to change) will be available only from:

National Technical Information Service
5285 Port Royal Road
Springfield, VA 22161
Telephone: 703-487-4650

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