

LEPF-97-04

FINAL REPORT

A Collaborative Demonstration and Deployment Project to Reduce Emissions of the Suspected Human Carcinogen, Tetrachloroethylene, To Lake Erie and to Ohio's Air, Water, and Soil

July 1996 – July 2000

To

The Lake Erie Protection Fund

By

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PROCESSED CHLORINE FREE
Contains 20% Post-consumer Waste

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Note to Readers: *The chemical name “tetrachloroethylene” found on the preceding title page is also known as “perchloroethylene,” or “perc” or PCE. In this report, all subsequent references will use these last three designations, not tetrachloroethylene.*

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A Collaborative Demonstration and Deployment Project to Reduce Emissions of the Suspected Human Carcinogen, Perchloroethylene, To Lake Erie and to Ohio's Air, Water, and Soil

I. Phase I – Summary¹

A. Overview

This project evolved logically from CAMP, Inc.'s "Organochlorine Project," which officially started in 1995 with funding from the George Gund Foundation, the Joyce Foundation, and the Great Lakes Protection Fund. Its purpose was to identify opportunities to reduce emissions of persistent, toxic bioaccumulating chemicals in the Great Lakes basin. During Phase I, the research and planning work revealed data that have immediate concerns for the environmental quality of Lake Erie and Ohio, their natural resources, as well as the economic competitiveness of the state's industry. Those facts compelled a preproposal to the Lake Erie Protection Fund in May 1996. The Fund then invited CAMP to submit a full proposal, which it did on July 24, 1996.

Initial CAMP research found that just four chemicals comprise *most* of the total quantity of emissions of chlorinated solvents reported in the 1993 Toxic Release Inventory (TRI). From further analysis, CAMP discovered that 40% of total U.S. releases of these chlorinated solvents came from eight Great Lakes basin states alone, as shown in the table below.

**Releases of Four Persistent, Toxic Chemicals in Eight Great Lakes Basin States and the Percent of Total U.S. Releases
(1993 U. S. EPA Data)**

Chemical	Amount Released (Pounds)	% of Total U. S. Releases
1,1,1-Trichloroethane (TCA)	18,652,896	29%
Dichloromethane (DCM)	24,888,666	38%
Trichloroethylene (TCE)	16,637,115	55%
Perchloroethylene (DCE)	3,856,230	33%

In addition, CAMP discovered that of these four chlorinated solvents, one—perchloroethylene—is released in 10 times the quantity by *nonreporting* dry cleaners than it is by the *reporting* emitters in the Great Lakes basin. In these eight states, dry cleaners alone released an additional 40,000,000 pounds of PCE in 1993 (Chlorine Institute, 1993).

It is, therefore, the dry cleaning industry's PCE emissions to Ohio's air, water, and soil that CAMP targeted in this project for the Lake Erie Protection Fund.

¹ See Appendix A, Phase I, Executive Summary, July 1995 – June 1997, pp. A-1 through A-13, for further details.

B. PCE Toxicology and Exposure

For orientation, PCE is used in large quantities for metal parts cleaning and degreasing and in greater quantity in the dry cleaning of clothing and other fabrics. It is a known carcinogen in test animals and a probable-to-possible carcinogen in humans. Epidemiological studies have associated occupational exposure to an increased risk of leukemia as well as several types of cancer, including cancer of the esophagus, kidney, liver, bladder, lung, cervix, and pancreas. Additionally, PCE exposure correlates with immunological and lymphoreticular, neurological, reproductive, developmental, and genotoxic effects (Agency for Toxic Substances and Disease Registry, 1996).

Exposure to PCE is occurring in all segments of the population through contaminated, air, water, and food. Once inhaled or ingested, PCE accumulates in the body and has been found in the blood, fatty tissue, breath, and breast milk of U. S. and Canadian populations. It is transported through the atmosphere where it can then contaminate soils and waters. PCE also may accidentally or wittingly be spilled on the ground, flushed into public sewage systems, leaked from landfills, and released by other pathways—all resulting in the contamination of private and public drinking water supplies.

For these reasons, PCE is on the U. S. EPA's Hazardous Substance List. It is regulated by the Occupational Safety and Health Administration, and it is cited by the National Institute of Occupational Safety and Health, Cancer advisory Group, Agency for Toxic Substances and Disease Registry of the Centers for Disease Control, the Department of Transportation, and the National Firemen's Protection Association. PCE is also specified in the International Joint Commission's secondary track list of chemicals of concern found in the Great Lakes ecosystem.

C. PCE in Ohio

There are over 34,000 neighborhood dry cleaning shops in the U. S., 3,500 in Canada, presently using PCE or petroleum chemicals (UniMac, 1995), with 10,700 in the eight Great Lakes basin states (Chemical Manufacturers Association, 1995). This toxic chemical enters the environmental pathways mostly by evaporating into the *air* during use, by discharge or leaks onto *soil*, and by direct flushing to public *water* supplies. PCE was found in 38% of 9,232 surface water sampling sites throughout the U. S. (Agency for Toxic Substances and Disease Registry, 1996), and in 14.5% of 836 ground water sites across Canada (Hough, 1996). It also has been identified in at least 771 of the 1,416 hazardous waste sites proposed for inclusion on the EPA National Priorities List (Agency for Toxic Substances and Disease Registry, 1995), from which PCE can escape to the atmosphere and / or ground and drinking water sources. By deduction, the relatively ubiquitous presence of PCE in the U. S. and Canada implies that Ohio will receive fallout from down-wind plumes originating in other states and down-stream flows from the upper Great Lakes basin watershed.

In Ohio, approximately 888 dry cleaning establishments (Chemical Manufacturers Association, 1995) pose a risk of exposure to PCE by inhalation at the workplace and in homes where dry cleaned clothing is stored (Blackler et al., 1995) and ingestion from the contamination of wells and public water supplies or, rarely, food prepared near air emission sites or with polluted water. The Ohio EPA, the Ohio Department of Health, the Ohio Air Quality Development Authority, and the Occupational Safety and Health Administration report a number of actions directed toward the reduction of releases and the clean-up of

contamination for the protection of human health, state-wide air and water resources, and pathways to Lake Erie, the Ohio River, and the Great Lakes basin. Some examples follow below.

- In 1996 Ohio EPA formed the “Dry Cleaning Initiative Team” and offered free compliance assistance inspections for a 30-day amnesty period (started August–September 1996). Thereafter, it selected 10% of Ohio’s total dry cleaning shops—especially those most likely to be using old equipment that emits substantial quantities of PCE—for required inspections and violations (Ohio EPA, personal conversation). Ohio EPA’s concerns are that PCE, upon release to the atmosphere, degrades in 119–125 days to compounds that include phosgene, formic acid, chloroacetylchlorides, carbon monoxide, carbon tetrachloride, and hydrochloric acid, which have additional health and environmental impacts (Agency for Toxic Substances and Disease Registry, 1996).
- Ohio EPA’s Wellhead Protection Program has identified 17 public water supplies, 14 of which are contaminated with PCE (and the other three chemicals in the table above) as well as with chemicals formed as PCE breaks down biologically in water to trichloroethylene, dichloroethylene, vinyl chloride, and ethylene (Ohio EPA, personal conversation). Like PCE’s atmospheric degradation products, these water-based degradation products cause environmental problems.
- Ohio EPA’s Division of Drinking and Ground Waters samples 2,400–2,500 commercial transient (e.g., gas stations, camp grounds) and fixed or commercial public water stations (e.g., schools) for chlorinated solvents, including PCE, which it finds in 8–10% of them (Ohio EPA, personal conversation).
- The Ohio Department of Health’s Bureau of Environmental Health and Toxicology has found that in Lincoln Fields, near Mansfield, up to 288 parts per billion (ppb) of PCE in 10 community wells, and 74 ppb in 54 residential wells (where 5 ppb is the U. S. EPA maximum contaminant level for public water sources, and remedial action is required at 70 ppb); in Chesterland, 18 community wells had an average of 1,187 ppb and 2 residential wells tested at 370 ppb; and in Bainbridge, 10 community wells had 5,000 ppb and 111 residential wells, 25 ppb; and in Copley, 1 residential well contained 70 ppb and 7 more contained PCE breakdown products, among them vinyl chloride (a toxic) at 150,000 ppb (Ohio Department of Health, personal conversation).

D. Ohio’s Emissions of PCE by the Dry Cleaning Industry Are Harmful to Its Economy

During Phase I of the Organochlorine Project, CAMP also discovered evidence about the costs of specific pollution events in Ohio’s economy. For instance, remediation of the Copley contamination sites, mentioned above, cost \$765,000, and the replacement water supply system in Lincoln Fields, also cited above, will cost an estimated \$4,068,000. And, because of Ohio EPA’s Dry Cleaning Initiative, it is reasonable to assume that a number of small dry cleaning businesses will be forced to close since they will not be able to afford violation penalties or the cost of upgrading equipment to a new “generation” of machines that have minimal emissions.

E. The Rationale for CAMP's Involvement in this Project

CAMP was established with the specific mission of helping the region's manufacturers to improve and maintain their competitiveness. Incorporated as a 501(c)3 Ohio economic development initiative in 1984, CAMP was funded in part by the U. S. National Institute of Standards and Technology and the State of Ohio. With the growing costs of solid and hazardous waste management (waste collection and storage, transfer and disposal, reporting obligations, liability insurance, etc.) becoming increasingly onerous, and the safeguarding of human health and the environment a heightened value, one of CAMP's major efforts has become helping business and industry to comply with pollution regulations and, especially, to transfer the evolving technology from command-and-control techniques to pollution prevention practices. In short, CAMP's mission has logically evolved to the broader, coinciding goals of *protecting the environment and enhancing economic competitiveness*.

As the polarities between environmental and business interests grew during the 1980s, CAMP anticipated that as a third-party institution serving both, it could help bring these two interests together. This perspective promoted the design of the Organochlorine Project, and then its proposal to the George Gund and the Joyce Foundations and the Great Lakes Protection Fund. Awarded grants in 1995 (\$35,000, \$80,000, and \$100,000, respectively), CAMP began the first tasks: (1) to identify high volume, toxic chemicals emissions in the Great Lakes basin, and (2) to select those processes, uses, and / or industries where alternative technologies could be demonstrated that would reduce or eliminate those emissions. The search resulted in CAMP's first targets, the four chemicals listed above—TCA, DCM, TCE, and PCE—and three industry sectors: metal parts cleaning, recycling of post-consumer polyvinyl chloride (PVC), and dry cleaning. (CAMP prepared demonstration projects in parts cleaning and PVC recycling separately, and sought funding sources for them.)

CAMP has established itself as a technology transfer agent and a trusted facilitator. It has established a group of basin-wide collaborators to forward the goals of the Organochlorine Project. Therefore, CAMP proposed to begin the long, challenging work toward helping the dry cleaning industry protect the environment while improving its own economic competitiveness.

II. Phase II - Summary

A. Definition of Wetcleaning

To distinguish among *dry cleaning* (which conventionally uses perchloroethylene or other petroleum-based solvents), *laundering* (which uses water and detergents in traditional washing or commercial laundering machines), and *professional wetcleaning*, the American Association of Textile Chemists and Colorists' Committee on Professional Textile Care approved the following definition of professional wetcleaning, using the accepted spelling of the two words, wet cleaning, as one word:

Professional Wetcleaning — A process for cleaning sensitive textiles (e.g. wool, silk, rayon, linen) in water by professionals using special technology, detergents and additives to minimize the potential for adverse effects. It is followed by appropriate drying and restorative finishing procedures.

B. Overview of CAMP's Wetcleaning Demonstration and Deployment Project at Reehorst Cleaners, North Olmsted, Ohio, November 1, 1997 through October 31, 1998

(Note: The full report on the Reehorst project appears as Enclosure A. Copies can be obtained from The Lake Erie Protection Fund, The Great Lakes Commission, Lake Erie Office, One Maritime Plaza, Toledo, Ohio 43604-1866, Tel. 419-245-2514, Fax. 419-245-2519; ask for LEPF 97-04, *Wetcleaning Demonstration and Deployment Project at Reehorst Cleaners, North Olmsted, Ohio*; Project Director: CAMP, Inc.)

To deploy aqueous cleaning technologies in the dry cleaning industry, CAMP proposed a collaborative experiment with Cleveland's Cuyahoga Community College. The College would develop a modern wetcleaning instructional and training laboratory, while CAMP would demonstrate commercial feasibility of the evolving wetcleaning process with dry cleaners. CAMP built upon the experimental results of the Center for Neighborhood Technology's (CNT) U.S. EPA-funded "The Greener Cleaner" project, a start-up 100% wetcleaning shop.

By November 1977, CAMP had been introduced to Dan and Bob Reehorst, owners of Reehorst Cleaners on Cleveland's west side. With the goal of helping other dry cleaners, and with funds earmarked for wetcleaning from the Lake Erie Protection Fund, Dan and Bob agreed to work with CAMP, install wetcleaning equipment, receive training from CNT, and do the following: (1) release its staff for training, (2) record CAMP-specified data about items wetcleaned, (3) give CAMP access to internal accounting records that would help assess the impact of wetcleaning on the profitability of their business, (4) allow occasional visitors at the shop who were interested in wetcleaning, and (5) review for accuracy and completeness CAMP's written materials about the project.

The Reehorst Cleaners' 12-month commercial analysis of wetcleaning vs. dry cleaning is presented in the full report at the source noted above.

C. The Findings at Reehorst Cleaners

- Over the 12-month period, the Reehorsts cleaned a total of 179,805 items in the North Olmsted plant; 33,955 of them, nearly 20%, were wetcleaned, with one weekly high of 29.2% and one weekly low of 12.4% wetcleaning done. Wetcleaning (i.e., with wetcleaning equipment, not washing machines) before the project started was approximately 5%.
- Of 1,276 wetcleaned test garments pre- and post-measured for dimensional change, 102 items, or 8%, underwent change. Of those 102 items, 95 (7.5% of the tested garments) were corrected in finishing, while 7 (or 0.5% of the tested garments) could not be corrected.
- Data for two 37-week periods, one pre-wetcleaning and one during wetcleaning, show that labor efficiency during the wetcleaning period actually improved over labor efficiency during the pre-wetcleaning period, except for the piece handling per hour in finishing, which was higher by two garments per hour. These positive project data are in part attributable to the Reehorsts' moving *all* dry cleaning to the North Olmsted plant mid-project, in June 1998, helping to increase labor efficiency:

	Pre-wetcleaning	With Wetcleaning
Avg cleaning hrs/week	77.06	48.34
Avg cleaned pieces/operator	39.11	60.95
Avg finishing hours/wk	111.98	103.05
Avg finished pieces/operator	26.12	28.52

- Although CAMP did not ask that claims be tracked against wetcleaned items, the Reehorsts reported no increase in customer claims during the wetcleaning project.
- Including tax, freight, and installation, the Reehorsts spent a total of \$14,025.35 on wetcleaning washers and dryers used for the project: two 24–pound Daewoo washers and two 30–pound and one 50–pound UniMac dryers. They used an existing Milnor commercial washer in tandem with this equipment. They spent an additional \$7,698.32 on physical plant upgrades that included a hot water tank, pump system, and hot water heater.
- The Reehorsts used Fabritec’s “Casual Care” and “Elegant Care” detergents and its “Revitalize” conditioner in the Daewoos and Milnor. After the project ended, the Reehorsts moved the Milnor washer to their shirt laundry location and installed a 50–pound UniMac wetcleaning machine that is now used in tandem with one Daewoo. (A few months after the project, one of the Daewoo machines which needed a number of repairs was no longer reparable.)
- It is important to have multiple wetcleaning machines to allow flexibility in processing the variety of items they wetclean and to economize on load sizes and chemical use. Bob Reehorst reported that they used the Daewoos all day long, five days a week, but knowing what they know now about equipment, he believes they would have been better off buying two small UniMacs, which they would now use in tandem with a 50–pound UniMac, which was installed after the official end of the project.
- Although the Reehorsts reported no actual decline in perc usage because they have efficient recycling of solvent in their state–of–the–art dry cleaning equipment, they were able to reduce the number of dry cleaning machines at the North Olmsted plant from three to two after wetcleaning was added.
- At the end of the project, the Reehorsts were comfortable with an average of approximately 20% wetcleaning of items through the plant, and in the months following staff anecdotally estimated as much as 30%. The Reehorsts believe that pushing that number higher would increase their labor costs, which they do not wish to do at this time.
- Overall, the Reehorsts see wetcleaning as filling an important niche in their cleaning service, one that delivers high quality products for certain garment types and certain soils. It has given them cleaning options they simply could not have offered their customers before its addition.

D. Announcement of the Project's Findings by Ed Share, Reehorst Cleaners' Plant Manager & Onsite Supervisor of the Project

One year after completion of the 12-month Demonstration and Deployment Project, Ed Share, who had supervised the commercial wetcleaning work at Reehorst Cleaners, described the study and its findings, to members of the Professional Wetcleaning Network in Cleveland, Ohio, on October 9, 1999. An excerpt of his presentation was published in the Network's periodical, *Wetcleaning Update*, Winter 2000, Volume 6, Issue I, titled, "The Productivity, Profitability and Performance of Wetcleaning." That excerpt appears in full below:

The Productivity, Profitability and Performance of Wetcleaning

I have heard many statements about wetcleaning while calling on plants in this region and from conversations with cleaners in other parts of the United States. For the drycleaner who says, "I'm never going to wetclean because I'm a drycleaner," I say, "Too bad for you." Because it's these same myopic attitudes that have left the fabricare industry in disarray. For the cleaner who says, "Hell, I've been wetcleaning all my life," I say, "Oh yeah, in 1910 you were using microprocessor-controlled machinery with steam injection and dryers with 400 humidity sensors in the lifting fins? No, you were using tubs, buckets or washing machines. This is the new wetcleaning."

I supervised a one-year wetcleaning study that was conducted by Reehorst Cleaners and CAMP with funding from the Lake Erie Protection Fund. CNT [Center for Neighborhood Technology] was also involved in the project. This study was one of the first to look at a mixed-use plant. We were not out to set the world on fire. We never set out to wetclean 100% of all garments. We set out to study how to add wetcleaning to a plant: how it would affect production, profitability and performance; and what was the quality of the end product.

I recently called a couple of cleaners in the area who had never wetcleaned and asked them what they would want to know about wetcleaning before they would consider "doing it." They both asked the same questions and those questions mirrored what we were trying to find out in our study.

- Is it easy to add wetcleaning to a plant?
- What type of machinery do I buy?
- Do I have enough water pressure?
- Will I need soft water?
- Where will I install the wetcleaning system that will best benefit production and yet co-exist with my drycleaning equipment?
- What type of training do I need?
- What type of additives or agents do I use?

There are many other considerations, but one of the first questions usually is, "How much is all this stuff going to cost me?" An average 50 lb. perc machine has a list price of \$45,000 to \$60,000 and a good wetcleaning package lists from \$20,000 to \$26,000. Pound for pound, the equipment investment is much less for wetcleaning.

Productivity

With the addition of wetcleaning, you have another machine adding to the flow of garments. So if you are tired of having pressers waiting for garments, add a machine—add wetcleaning.

- The average amount of cleaning hours per week will be reduced.
- The average number of pieces cleaned per hour will increase.
- If you wetclean 40% or less, your finishing hours should not be any different, and your finished pieces per operator should stay the same.
- If you want to wetclean larger percentages of your volume, invest in tensioning equipment, as you will be wetcleaning more heavily constructed garments.
- If you want true wetcleaning production, keep the machinery in the existing cleaning area. Layout is very important
- Look into soft mount wetcleaning machines to give you more versatility with higher extract speeds that cut drying times and provide better overall washing performance.

Profitability

- If you advertise and market alternative environmentally-safe technology—safe for the earth, safe for your clothes, and your customer, and with no odors . . .
- If you are trained to wetclean properly . . .
- If you produce a better product than your competitor, because you wetclean and they don't, or are well trained and they are not . . .
- If you belong to the Professional Wetcleaning Network for the latest information and training . . .
- If you take advantage of wetcleaning's diversified capabilities to clean leathers and suedes . . .

. . . Then you will make big profits. Market and they will come.

Performance

With the evolution of "casual days" and the invasion of cotton textiles, wetcleaning is a "must" in today's fabricare environment. Anyone not wetcleaning in their plants and not providing this service is missing the boat. Those who hop on the boat produce a far superior product as a whole, compared to those who do not.

The feel of wetcleaned garments when the proper cycles, additives and dry times are used can surpass drycleaned garments. The colors, the loft, the hand, and brightness all can surpass drycleaning. Wet side spots that you always pre- or post-spot in drycleaning come clean in wetcleaning. Performance-wise, wetcleaning is miraculous at times and can turn in a much better product in many cases.

Wetcleaning is not a fad. It will always be around in some shape or form. Can you say that for a single dry solvent right now? Catch the wave.

Editor's Note: The above article reflects the opinions of Ed Share. For more information on the Professional Wetcleaning Network, visit the web at www.tpwn.net or call 708/447-0879.

E. Dissemination of Project Information in Ohio, the Great Lakes Basin, and the Nation

In Ohio, the Great Lakes basin, and the nation, the Demonstration and Deployment Project generated evidence proving the feasibility of wetcleaning as an alternative to drycleaning. A sampling of dissemination of the project's findings follows below.

1. During the course of the Organochlorine Project, CAMP produced four Newsletters. These featured facts and plans to address reduction of PCE in dry cleaning. They were mailed to approximately 300 Project Collaborators and distributed at many conferences within the state and the Great Lakes basin.²
2. The Center for Neighborhood Technology featured the CAMP wetcleaning project in its newsletter, which is distributed nationwide, and also made excerpts from the Reehorst Cleaners Final Report available at its Website.
3. Project staff presented findings on the Reehorst Project at the U.S. EPA Design for the Environment Garment and Textile Care Partnership's "Garment and Textile Care: An Eye to the Future" conference in Arlington, VA, March 31 – April 2, 1998.
4. CAMP also produced a videotape on wetcleaning on its television program, "Manufacturing Matters," which featured Cleveland's London Cleaner owner, Alex Shvartshtenyn, who also wetcleans at his facility. The show was broadcast on northeast Ohio television.
5. In addition to new wetcleaning operations started at Reehorst Cleaners, North Olmsted, Ohio, under the project, they were also started at Colony Cleaners in Cleveland and at LaFrance Cleaners in Youngstown, Ohio.
6. The wetcleaning and deployment report on the Reehorst Cleaners project was given to agencies throughout Ohio, including over 100 drycleaners identified by the Ohio EPA as expressing "interest in" wetcleaning as an alternative to PCE-based cleaning.

² Copies included in Appendix B.

7. The Professional Wetcleaning Network, a national organization, sponsored a workshop in the fall of 1999 where Ed Share, supervisor of the wetcleaning project for Reehorst Cleaners, reported the results of the project to attendees.

III. Trends in the Dry Cleaning Industry

A. Reduction of Perc Usage by the Dry Cleaners

The Textile Care Allied Trades Association (TCATA), a trade association of manufacturers and distributors of laundry and dry cleaning equipment and supplies, reported in the industry's newspaper, *National Clothesline*, in July 2000, that the use, and thereby the potential for emissions, of perc had been reduced by 70% over the past 10 years, from 235,000,000 lbs in 1988 to 63,000,000 lbs in 1999.

The article is quoted and the 10-year reduction figures are charted below.

A 12% drop in 1999 Continues Long Decline in U. S. Cleaners' Perc Demand

Perc demand in the drycleaning industry resgistered a 12 percent drop from 1998 to 1999, continuing a decades-long trend in which perc demand by the U.S. drycleaning industry has fallen dramatically.

The annual survey sponsored by the Textile Care Allied Trade Association and conducted by Industry Insights Inc. shows that demand for perc in the U. S. drycleaning industry was 63 million pounds in 1999, down from 72 million pounds in the previous year. In 1985, demand was 260 million pounds and has been falling ever since—a drop of more than 70 percent in the last decade.

TCATA attributes the decline to the use of more efficient equipment and improved work practices. Despite some plant operators switching to alternative processes in the past few years, the association said that perc continues to be the primary solvent used in 85 to 90 percent of the U. S. drycleaning establishments.

“This 70 percent reduction in perc use is an admirable achievement for the drycleaning industry,” said David Cotter, CEO of TCATA. “To provide perspective, one needs only to consider pollution prevention initiatives which were sponsored by the Environmental Protection Agency in the early 1990s. Commonly referred to as the ‘33/50 Initiative,’ the program goals, generally targeted to an individual company, were to reduce the use and emissions of chemicals by 33 percent in three years and 50 percent in five years.

“Achieving an industry wide 70 percent reduction is a significant milestone in which the entire industry can feel proud to have participated,” Cotter concluded.

TCATA has sponsored the survey of perc demand in the industry since 1975. Perc demand was even higher in the 1970s—as much as 360 million gallons in 1978. Cleaners today report processing five to ten times more clothes per gallon of perc today than they did in the 1970s.

From an environmental stewardship perspective, the industry's record is even better than the usage statistics indicate since up to 40 percent of the perc used in drycleaning is recovered and reused in other industries, such as metal cleaning.

Other stewardship measures, like closed-loop delivery systems and elimination of contact water disposal to sewers, represent further reductions in emissions of perc to the environment which are not readily apparent in perc sales data.

TCATA, whose members include companies that make and distribute equipment and supplies to the industry, was among groups recognized by EPA for leadership in the Design for the Environment Garment Care and Textile Care Program.

(The Association's offices are in Fairfield, NJ; phone (973) 244-1790 or e-mail <<tcata@ix.netcom.com>>.)

Drop in Perc Usage

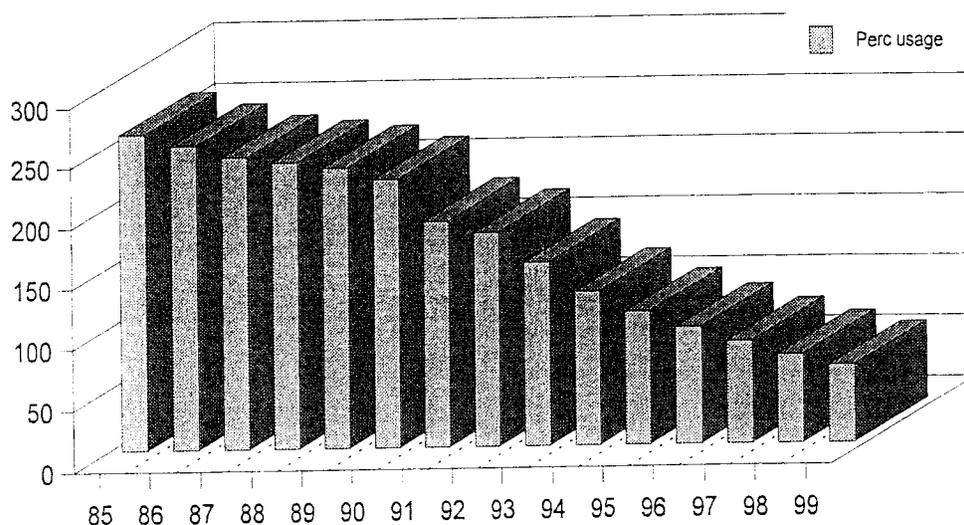


Chart shows annual perc usage (in millions of pounds) by the U.S. drycleaning industry from 260 million pounds in 1985 to 63 million pounds in 1999.

B. Factors Influencing the Reduction of Perc Usage

The Professional Wetcleaning Network sponsored a three-day conference, June 2 – 4, 2000, in Chicago, to review the status of dry cleaning vs. wetcleaning and to discuss various change factors that bear upon the cleaning industry overall. From this conference, a range of publications, and discussions with owners and operators of cleaning establishments, the most recent opinions about what has brought about this reduction in perc usage are listed here.

1. Improvements in dry cleaning equipment: Newer generations of machines include closed-system cycles, so that perc can be injected after the door is closed and evacuated

before the door is open, thereby avoiding escape of perc into the workplace atmosphere. Cleaners can process, the TCATA reports in the article above, five to ten times the amount of clothing per gallon than they could in the 1970s by close-looping the solvent and reusing it many times before recycling it.

2. Regulations: The U.S. EPA, through its National Emissions Standards for Hazardous Air Pollution (NESHAPS) regulations, and OSHA, with its workplace threshold limits, continue to lower the numbers of parts per million of perc to which workers can be exposed. Cleaners are taking steps to minimize their risk of liability, such as ending sewer discharge of separator water; installing dikes and containment structures around dry cleaning machines; sealing floor drains; using perc-resistant floor coatings; and implementing closed delivery systems, available over the last two years by perc suppliers Dow Chemical and Vulcan. ("Perchloroethylene White Paper," Halogenated Solvents Industry Alliance, November 1999, 8 pages, available at the following Website: http://www.hsia.org/white_papers/perc.htm)
3. Costs: Perc price increases (e.g., Oregon increased the cost per gallon from \$12.00 to \$21.65, effective January 1, 2000); hazardous waste handling expenses also are rising.
4. New Wetcleaning Chemistries: The flyer that follows from Adco, Inc., typifies the market's development of new products "In response to environmental and health issues . . ." Their detergent, the ad asserts, "contains great removing additives, quick soil release and soil suspending agents for effective cleaning, combined with protective colloids to help prevent shrinkage, pilling, felting, and dye bleeding." Such wetcleaning products offer the promise of reducing the costs incurred when wetcleaning, and offer an effective alternative to drycleaning with perc.

C. Apparel Manufacturers Producing 80% of Their Fall 2000's Lines in Machine Washable Fabrics

Apparel vendors Liz Claiborne, Inc., Pendleton Woolen Mills, Bernard Chaus, Leslie Fay Company, and others cited in an article from *National Clothesline*, May 2000, Vol. 40, No. 8, quoted in full below, report that consumers are resisting garments that require dry cleaning. It summarizes that "consumers have been demanding washable fabrics, . . . now the technology has caught up with the demand."

The implication is that the dry cleaning sector of the industry can anticipate further reductions in the use of perc.

To Satisfy Customers, Garment Makers Want to Replace Dryclean-only with Washable

Citing consumer resistance to garments that require drycleaning, apparel manufacturers are expanding production of washables and many companies expect to offer 80 percent or more of their fall lines in machine washable fabrics.

Wetcleaning Detergent, Wetcleaning Sizing and Conditioner, Wetcleaning Combo

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ADCO
1-800-821-7556

PIP-311-0398

***Prespotting:** ADCO recommends ADCO's *Nox Spots* sprayed or brushed on oily or heavily soiled areas to penetrate and condition heavy or oily soil for release during wetcleaning. *Nox Spots* is pH neutral and is used "straight", with no dilution.

FOR REGULAR SHIRTS, LINENS, JEANS AND MORE HEAVILY SOILED ITEMS THAT CAN WITHSTAND REGULAR LAUNDRY PROCESSING, TRY ADCO'S REGULAR LAUNDRY LINE.

- *ADCO Detergent* - highly concentrated, non-alkaline, liquid laundry detergent
- *Amaze* - gentle but effective - for home or laundromat machines
- *White 'n Brite* - concentrated fluorescent brightener
- *ADCO Booster* - controlled alkalinity additive to remove tough, ground-in dirt and grease or activate bleaches
- *ADCO's Discover* - a synthetic detergent with controlled alkalinity plus optical brighteners. For shirts and commercial-type laundries.
- *H-2-O Size* - water soluble sizing. Gives light to moderate body to shirts and uniforms, eases finishing and holds press.
- *Viva* - a blend of natural and synthetic starches that provides body and stiffness to all types of fabrics.
- *Horizon* - a 100% oxygen "safe" bleach
- *ADCO's CNC* - remarkably effective cuff and collar prespotter
- *Fabrisoft* - fabric softener, antistat and stain repellent all in one product

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Introduces

Adco INC.
Quality, Integrity & Dependability Since 1908

"WETCLEANING"

In response to environmental and health issues, fabricare specialists are finding ways to reduce their usage of perchloroethylene, the most widely used drycleaning solvent. To accomplish this, fabricare specialists are relearning and perfecting the art of "wetcleaning" - defined as a method of cleaning garments normally drycleaned using aqueous solutions rather than organic solvents. "Wetcleaning" requires the skill, experience and knowledge of fabricare specialists together with proper equipment and supplies.

TO CONTRIBUTE TO THE IMPROVEMENT OF WETCLEANING RESULTS, ADCO IS INTRODUCING THREE NEW PRODUCTS DESIGNED FOR HAND OR MACHINE "WETCLEANING".

ADCO'S WETCLEANING DETERGENT

A state-of-the-art air controlled broad spectrum wetcleaning wool, silk, rayon and other fine fabrics laundry detergent. It is specially formulated for use in automatic and hand washing machines. ADCO's *Wetcleaning Detergent* contains proteolytic enzymes which help break down soil particles and prevent them from re-depositing on the fabric. It also contains a built-in fabric softener to help prevent shrinkage, pilling, fading and dye bleeding. ADCO's *Wetcleaning Detergent* is also used for soaking hand washing machine-style washers in machine wash cycles. It is safe to use in warm and cold water and does not require rinsing. Always use caution to provide proper attention to the manufacturer's instructions.

ADCO'S WETCLEANING SIZING AND CONDITIONER

This product gives body to the fabric, helps control drying to prevent static, reduces wrinkling and gives a smooth finish to the fabric. ADCO's *Wetcleaning Sizing and Conditioner* contains proteolytic enzymes which help break down soil particles and prevent them from re-depositing on the fabric. It is safe to use in warm and cold water and does not require rinsing. Always use caution to provide proper attention to the manufacturer's instructions.

ADCO'S WETCLEANING COMBO

ADCO's *Wetcleaning Combo* is formulated for wetcleaning wool, silk, rayon and other fine fabrics. It contains a combination of proteolytic enzymes which help break down soil particles and prevent them from re-depositing on the fabric. ADCO's *Wetcleaning Combo* also contains proteolytic enzymes which help break down soil particles and prevent them from re-depositing on the fabric. It is safe to use in warm and cold water and does not require rinsing. Always use caution to provide proper attention to the manufacturer's instructions.

Washable fabrics have long been a mainstay of manufacturers who cater to budget-conscious consumers, but giants in the “better” market like Liz Claiborne, Pendleton Woolen Mills and Bernard Chaus are “waking up to the call for easy-care garments,” according to a report in *Women’s Wear Daily*.

Garment makers are responding to retailers who are responding to consumers, said WWD.

“It’s a major issue,” Conrad Szymanski, president of Bealls Department Store in Bradenton, FL, was quoted. “It’s particularly germane in the moderate market. People don’t want to pay \$29 to \$39 for a career jacket and then have to invest \$6 on drycleaning.”

Bealls, which operates 55 stores, carries washable and drycleanable linens, but the big volume is in washables.

Apparel vendors, feeling pressure from retailers, are pushing suppliers to come up with specially treated fabrics that will help them increase their machine-washable assortments.

“The consumer is time poor,” said Denise Seegal, president of Liz Claiborne. “We are doing everything to make her life easier.”

Liz Claiborne has expanded its washable line over the past couple of years, from merlino [sic] to washable cashmere sweaters and, this fall, washable jackets with a wool hand.

Chaus’ offerings in washable clothes will include tailored rayon polyester and Lycra blend trousers and matte polyester blouses, from ruffled looks to bow styles.

Two years ago, about half of the Leslie Fay Company’s offerings were machine or hand washable. For fall, the line will be 90 percent washable. The company’s products have expanded beyond polyester to include tailored jackets in rayon polyesters, wool blends and silk dresses.

“Who would dream that they could take a blazer and throw it into the washing machine?” asked Bob Salem, marketing director at Leslie Fay Co. “The impact on washable fabrics that cater to the traditional target customer is extremely important.”

Salem added that the issue is not just the cost of drycleaners. In his travels about the country, he said he has found that many customers don’t have access to drycleaners.

More washables have meant more sales for Notations, which went from 60 percent hand or machine washable three years ago to at least 90 percent today. Sales are up 20 percent.

“As a rule, drycleaning just doesn’t work,” Kurt Erman, president of Notations, said in reference to consumer price resistance. “Consumers are telling stores, which are telling us. We are working with the mills.”

Another maker, J. G. Hook, has increased its washable by a similar amount. Eric King, a partner at J. G. Hook, told WWD that the decision was based on the bottom line: “lost business on some items that needed to be drycleaned.”

All of the company's embellished merchandise, which accounted for 20 percent of last fall's offerings, had to be drycleaned. Sales were poor. Working with mills to develop different treatments, the company has made sure that most of its embellished items for this fall can be hand washed.

Lasting Impressions has stepped up its washable assortments to 70 percent this fall from 50 percent last year. Included are washable suits and other tailored garments.

"Consumers have been demanding washable fabrics," said Marge Levine, marketing director, "Now the technology has caught up with the demand."

D. The Center for Neighborhood Technology Announces Successful Completion of the Alternative Clothes Cleaning Demonstration Project

The Center (CNT) announced conclusion of the project it started in 1992 (with US EPA financial support, among others) "to assist the professional fabricare (or drycleaning) industry in adopting new environmentally friendly technologies for the care of clothes." CNT conducted a study at The Greener Cleaner, a 100% wetcleaning shop in Chicago, and assisted CAMP's work with the Reehorst Cleaners.

CNT will issue its final report later this year, but project manager Sylvia Ewing stated in their June 7, 2000, announcement that, "Today cleaners are adopting many of the ideas that CNT has developed and advocated, and they are on the way towards a transformation of the industry. As a result, our outreach and education work to cleaners is ending."

CNT additionally leaves a successor organization, the Professional Wetcleaning Network (PWN). Their list of wetcleaners in the U. S. and Canada numbers 212 from 38 states and the District of Columbia.³ The PWN has already planned a number of activities to support the wetcleaning technology. Some of these are (1) hosting a summer workshop in Chicago, (2) conducting road trips to promote further development of wetcleaning; (3) helping the Federal Trade Commission with new care labeling proposals; (4) assisting the International Fabricare Institute in expanding the Certified Professional Wetcleaners examination; and (5) participating in trade shows by hosting seminars and sponsoring a booth to increase membership. For further information, contact: Ann Hargrove, Executive Director, The Professional Wetcleaning Network, P.O. Box 1, Lyons, Illinois 60534; or by E-mail: AHargr7630@aol.com.

IV. Future Needs to Increase Wetcleaning and to Reduce Drycleaning

To implement wetcleaning on an ever increasing scale, while simultaneously phasing out the use of perchloroethylene, the major Ohio, national, and international needs appear to center around the following general topics.

³ List of current PWN members in Appendix C

A. Consumer Education:

Most dry cleaning shops with additional wetcleaning capability have been reluctant to tell their customers about the benefits of the latter technology. Their fear is that since most fabrics are currently labeled “dry clean only,” the customer may become angered if, in fact, it was actually wetcleaned. The plant owner is concerned about the loss of customer confidence and the potential for financial liability.

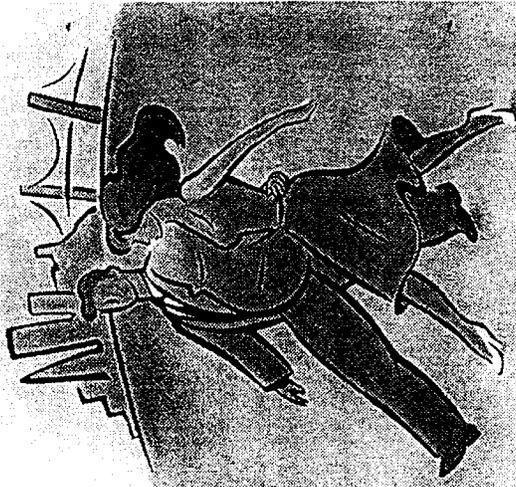
But, now with the growing success of wetcleaning, documented by such projects as the Reehorst Cleaners’ demonstration of that process, and the growing possibility of labeling with alternatives that include wetcleaning, these plant owners—principally members of the Professional Wetcleaning Network, are initiating a new public education effort. At the conference in Chicago June 2 -4, these upcoming events were reported:

1. Six agencies (the U. S. EPA, the International Fabricare Institute, NCO International [a worldwide management organization of drycleaners and associations], Ecology Action, Earth’s 911, along with the PWN) have produced a tri-fold flyer urging consumers to “Ask for Professional Wetcleaning,” reproduced in full below. The flyer, which includes a space for the wetcleaner’s own logo, name, and address, will become available to cleaners this summer.
2. *Good Housekeeping* magazine will feature wetcleaning during the second half of 2000.
3. A national television program on wetcleaning is expected in about six months.
4. It is rumored that some Hollywood “stars” will promote wetcleaning, again later this year.
5. PWN members are planning a series of road trips to educate the general public about wetcleaning benefits and to train dry cleaners how to wetclean.

B. Labeling:

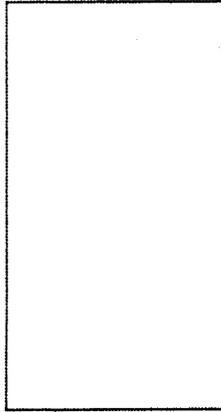
In response to the fears described above, the PWN is working with the Federal Trade Commission to develop fabric labels that will permit wetcleaning of appropriate materials. This requires coordination with designers and fabric producers. (Currently, as mentioned above, the FTC favors a label that indicates it is “washable,” rather than professionally wetcleaned, which may encourage consumers to attempt laundering at home—thereby precluding that business for the wetcleaners. Consequently, the PWN is continuing to work with the FTC to use a label code that indicates “professional wetcleaning” as well as hand washing / machine washing as acceptable cleaning processes.)

Ask for Professional Wetcleaning!

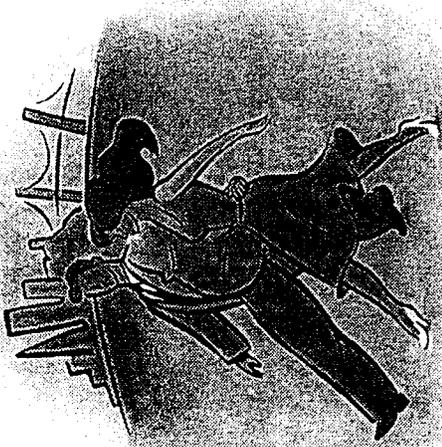
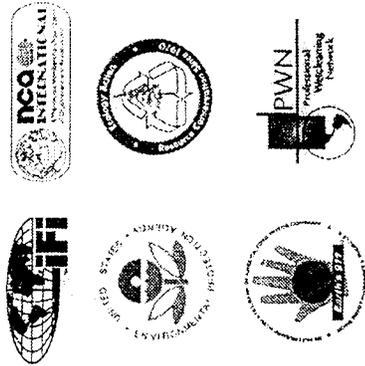


Looking Your Sharpest Naturally!

Technology in the garment care industry is rapidly evolving. The industry's dual goals are to provide you with the finest garment care possible while offering you options that utilize new cleaning technologies. Professional Wetcleaning brings together the hottest new technologies with age-old, and trusted, fabricare wisdom. Give it a try!



This information brought to you by:



Look No Further!
 Your cleaner can provide you with safe and effective garment care. **Naturally!**
 Ask for Professional Wetcleaning Today.

Silk Linen Rayon Leather Suede Down Knitwear Wool Injera Cashmere & More

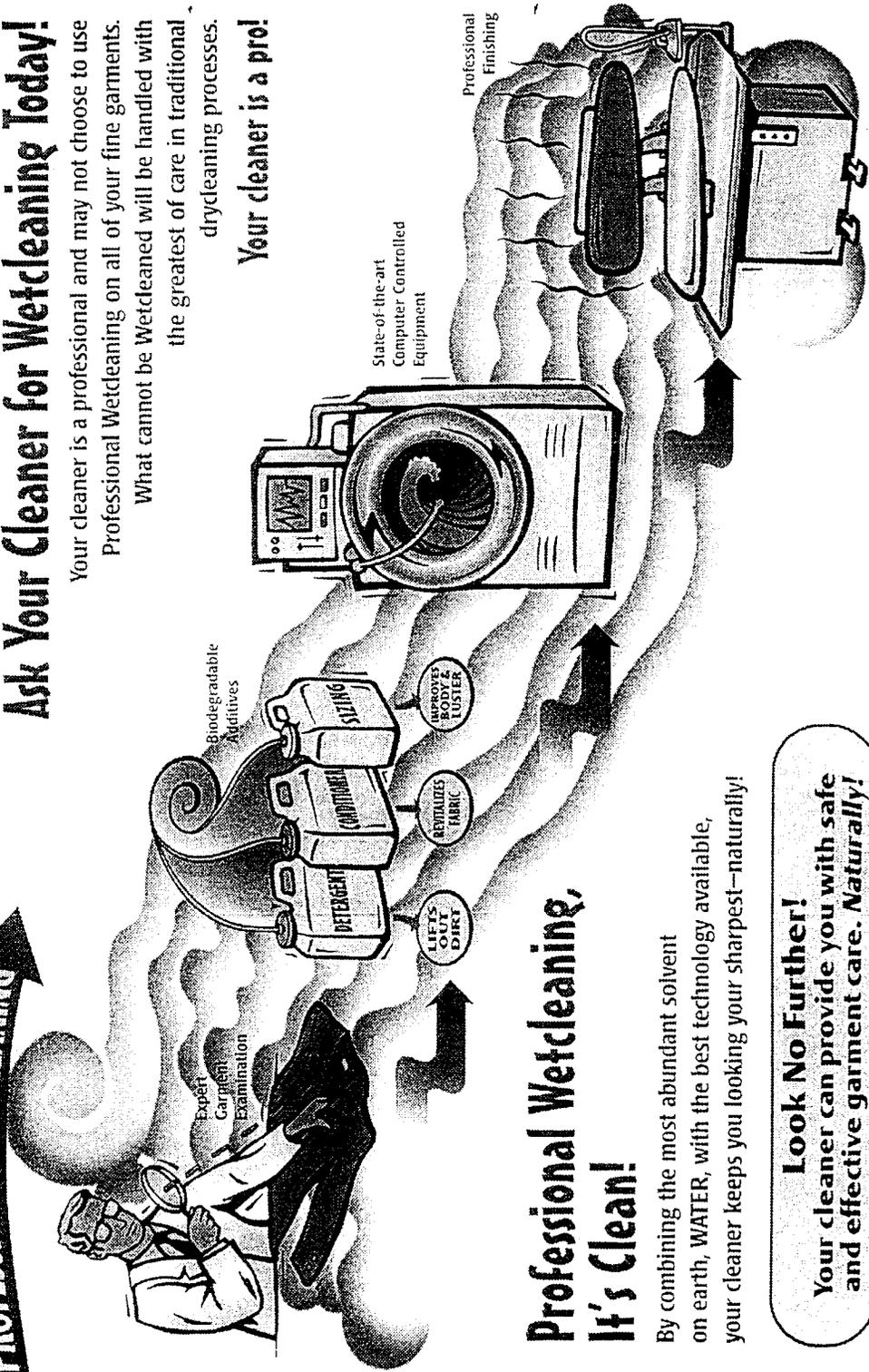
PROFESSIONAL WETCLEANING

Ask Your Cleaner for Wetcleaning Today!

Your cleaner is a professional and may not choose to use Professional Wetcleaning on all of your fine garments.

What cannot be Wetcleaned will be handled with the greatest of care in traditional drycleaning processes.

Your cleaner is a pro!



**Professional Wetcleaning,
It's Clean!**

By combining the most abundant solvent on earth, WATER, with the best technology available, your cleaner keeps you looking your sharpest—naturally!

Look No Further!
Your cleaner can provide you with safe and effective garment care. *Naturally!*

PROCESSED CHLORINE FREE
Contains 20% Post-consumer Waste

C. Technical Training and Operator Certification:

The International Fabricare Institute's CEO, William E. Fisher, stated the following in *National Clothesline*, April 2000, page 22:

Research conducted by IFI found that up to 40 percent of garments can be wetcleaned quite readily. With a serious commitment to proper training, you can wetclean from 60 to 80 percent of all garments. To reach levels approaching 90 percent, a wetcleaner must make an extraordinary commitment to refining his or her skills.

Members of the PWN confirm this reasoning and, therefore, propose field trips to train dry cleaners how to wetclean through certification programs. Certification, then, becomes a recognition of quality control by consumers.

D. Waste Water Recycling:

Wetcleaners use water and then, when it becomes dirty, discharge the waste water to the public sewage system. With about 54% of the nation's available fresh water already in use, and some areas of the country in very short supply, the argument for wastewater recycling strongly argues for the development and installation of waste water filtering and recycling systems. Although these systems do exist, at present they are costly to purchase and install. (As a reference point, one vendor of such systems includes Zero Waste Company, tel: 1-800-467-3888; fax: 1-310-393-5606.)

According to Ali Ramani, a speaker at the PWN Conference, June 2 – 4, 2000, Chicago, IL, a Canadian firm is working with a Japanese company to develop an inexpensive process which, first, filters contaminants from the waste water and, then, distills that water to repurify it for reuse. This new technology could be expedited and installed on a trial basis in significant numbers to validate its conservation of water and its economic competitiveness.

These and additional needs will be identified in CNT's Final Report, again due later this year. Therefore, we add one last "need": to study that Report carefully because of CNT's extensive involvement with the industry and the leverage that could be provided to its successor, the Professional Wetcleaning Network.

APPENDIX

- A. Phase I Executive Summary, July 1995 – June 1997, ES 1 – 13**
- B. CAMP, Inc. Newsletters**
- C. Names of Wetcleaners & Members of the Professional Wetcleaning Network**

Appendix A

Phase I Executive Summary, July 1995 – June 1997, ES 1 – 13

EXECUTIVE SUMMARY

Phase I: Beyond Pollution Prevention Removal of Organochlorines from Industrial Feedstocks and Processes In the Great Lakes Basin

Overview

CAMP, Inc. (formerly the Cleveland Advanced Manufacturing Program) received grants from the Great Lakes Protection Fund and the George Gund and Joyce Foundations for a planning effort to develop long-range strategies to assist industry in voluntarily reducing the release of persistent, toxic organochlorine compounds in the Great Lakes Basin ecosystem.

Successful reduction strategies will result in new economic opportunities for businesses in the eight Basin states and Canada and in improved environmental quality of the Great Lakes themselves. Progress on both fronts will enhance the value of the region as a critical economic and environmental resource.

CAMP recognizes the past polarization in both U.S. and Canadian organizations which, on the one hand, support the reduction of organochlorines in the Great Lakes Basin, and business and industry, on the other hand, which, understandably, resist these changes. As a neutral third-party technology transfer center, serving thousands of manufacturers with its technical and business services, CAMP believes that it can bring these previously polarized parties together into a pollution prevention technology transfer system that will include both environmental and economic benefits.

During July 1995 through June 1997, the 24-month planning phase, CAMP has taken these steps toward long-range organochlorine reduction strategies:

1. Structured a partnership of regional collaborators.
2. Quantified toxic releases by chemical class and industry use, and targeted four widely used organochlorine compounds for reduction.
3. Commissioned a study evaluating the environmental impact of organochlorine releases and predicting their ambient concentrations in the Basin.
4. Collected successful substitution technologies, and selected three application areas in which to test deployment strategies:
 - Industrial metal parts cleaning
 - Dry cleaning of clothing and fabrics
 - Recycling of post-consumer polyvinyl chloride (PVC)

I. Phase One: Organochlorine Project—Planning

A. The Focus

The Great Lakes contains 20% of the world's fresh surface water and 95% of the U.S. supply. It covers more than 94,000 square miles with 10,900 miles of coastline. There are 295,000 square miles in the watershed, which encompasses parts of eight states and two provinces and, in the U.S. alone, 22 million people. The region is North America's industrial heartland; and, it also supports a multi-billion dollar outdoor recreation and tourism industry, a world-class maritime transportation system, and a diverse and extensive agricultural base. The Great Lakes have a major influence on the U.S. and Canadian economies—and, those economies are inexorably linked to the health of the Great Lakes ecosystem.

1. Building a Partnership

Background: CAMP, which was established in 1984, is funded in part by the U.S. National Institute of Standards and Technology (NIST), the State of Ohio, and private industry. CAMP serves as a regional research, development, deployment, and training resource by (1) mobilizing and leveraging academic, government, private, and public resources to help manufacturers grow and improve; (2) fostering innovation in manufacturing enterprises through research, development, technology deployment, business assistance and training; and (3) motivating and helping the manufacturers to develop people, use technology, improve business practices, and modernize products, processes, and facilities.

CAMP recognizes that a broadly based partnership of organizations, business, government, and nongovernmental organizations is critical to managing economic and environmental change in the region. No single entity transcends the boundaries of the two countries, with its eight U.S. states and two Canadian provinces, much less the vast array of industries reporting toxic releases, and the many hundreds of small generators whose releases do not reach reporting thresholds. The retention of jobs and the development of new business opportunities in the region *while reducing pollution* demands new thinking from all parties about the interconnectedness of economic and environmental well being.

Some of the formal actions leading up to CAMP's Organochlorine Project reveal this understanding of and value for a regional collaborative partnership to achieve goals that many hold as diametrically opposed.

- In 1987, 14 countries signed the "Montreal Protocol on Substances That Deplete the Ozone Layer." The protocol bans the production of Ozone depleting compounds (chlorofluorocarbons). This action triggered a worldwide dialogue on substitution technologies.
- In the U.S., the 1990 Clean Air Act Amendments, Title VI, implements the Montreal Protocol and phases out the production of Class I substances (23 chlorofluorocarbons) by January 1, 1996, and Class II substances (33 hydrochlorofluorocarbons) by 2030 (with exceptions for some medical, aviation, and national security applications).

Many case histories now demonstrate how, following these actions, a regulatory strategy created new processes and chemicals to reduce the use of these substances.

- In 1994, CAMP began to examine case histories of successful organochlorine compound substitutions, either by other chemicals or by different manufacturing processes, for these persistent, toxic chemicals. From these studies, CAMP selected three areas in which to

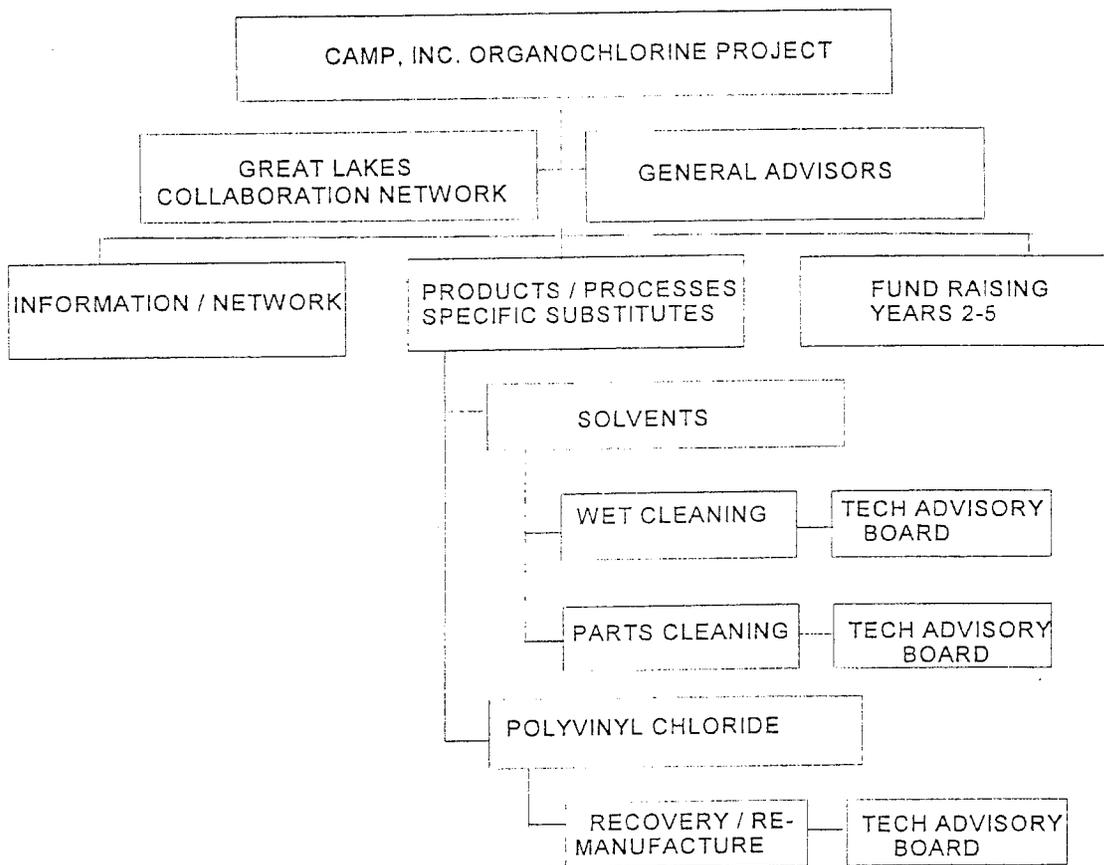
demonstrate approaches to reduce organochlorine emissions: metal parts cleaning, dry cleaning, and polyvinyl chloride post-consumer waste recycling. These three areas became priorities for the first year of the multi-year Organochlorine Project.

2. Organization

With advice from many different sources, both U.S. and Canadian, governmental and nongovernmental, industrial and service agencies, and especially the foundation community, CAMP structured an organizational relationship which would encourage participation in the Organochlorine Project. A schematic of the relationships among CAMP's General Advisors, Technical Advisors and Specialists, and Collaborators is shown in ES-Figure 1, "Organochlorine Organizational Chart."

ES—Figure 1

Organochlorine Organizational Chart



B. Selection of Alternatives to Toxic Chemical Use by Chemical Class and Industry Sector

From an initial study of chemical material flows through the U.S. and the Great Lakes, CAMP identified *classes* of persistent, toxic chemicals consumed and *classes* of industrial processes that used those chemicals. Many of these chemicals are organochlorines; and, of the 11,000 organochlorines in use throughout the world, 100 to 150 have been prioritized by national and international experts. ES-Table 1 titled "Estimated 1990 U.S. Chlorinated Solvent Consumption (000 tons)," for example, illustrates that by weight just *four* of these organochlorine chemicals, trichloroethylene (TCE), perchloroethylene (PCE), methylene chloride (DCM), and 1,1,1-trichloroethane (TCA), used for just *one* industrial process, *parts cleaning*, together comprise almost one third of all U.S. chlorinated solvents consumed in the U.S. And over 70% of one of those *same* chemicals, perchloroethylene, is consumed by just one industry, *dry cleaning*.

ES—Table 1

Estimated 1990 U.S. Chlorinated Solvent Consumption (000 tons)

Industry	Trichloroethylene (TCE)	Perchloroethylene (PCE)	Dichloro-Methane (DCM)	1,1,1-Tri-chloroethane (TCA)	CFC-112	TOTAL
Adhesives	0	0	6	29	0	35
Aerosols	1	3	22	38	1	64
Chemical intermediates	9	7	0	24	6	46
Dry cleaning	0	148	0	0	2	150
Electronics	3	1	18	18	44	84
Flexible foams	0	0	26	3	0	29
Paint stripping	0	0	73	0	0	73
Parts cleaning	53	30	16	181	32	312
Pharmaceuticals	0	0	16	0	0	16
Textiles, coatings, inks, & others	1	20	39	43	1	104
TOTAL	66	209	216	336	86	913
Percent reduction, 1988 to 1991	36.5	51.3	38.2	11.7	43	31.8

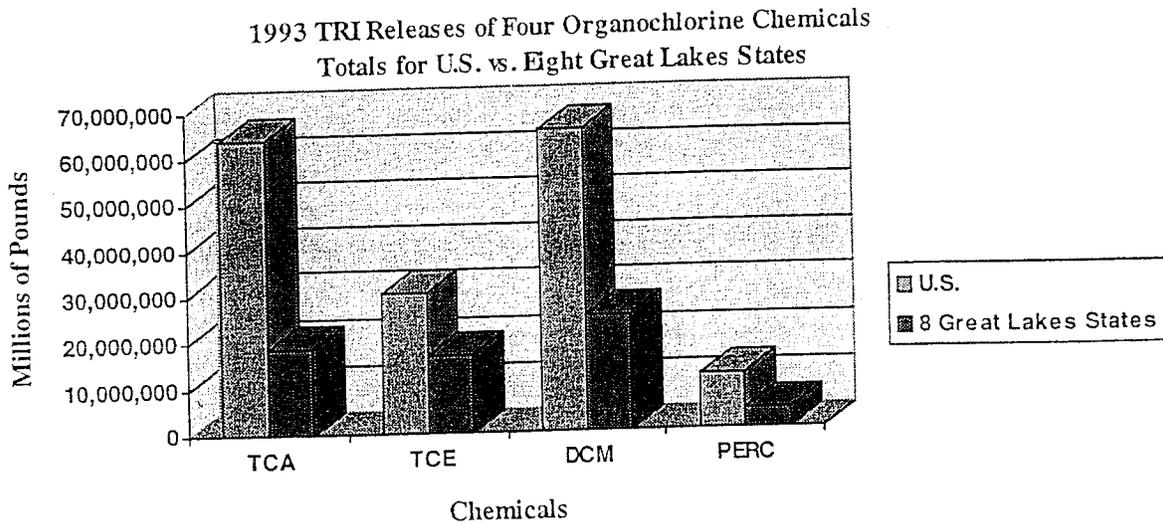
Source: *Potential for Source Reduction and Recycling of Halogenated Solvents: Summary Report and Technical Support Documents* by the Source Reduction Research Partnership, 1988.

C. Organochlorines

Next, CAMP examined industrial *releases* of these four chemicals to air, land, and water. Specific to the Great Lakes Basin, Toxic Release Inventory (TRI) data reveal that the eight Great Lakes border states, released about 40% of the entire U.S. emissions. See ES-Figure 2 titled "1993 TRI Releases of Four Organochlorine Chemicals: Totals for U.S. vs. Eight Great Lakes States."

Then, from a sample study of releases below the TRI reporting thresholds, CAMP extrapolated that *small companies* contribute a very large quantity of these totals, and in some cases even exceed the TRI amounts, as in the case of perchloroethylene used for dry cleaning clothing and other fabrics.

ES-Figure 2



Percent of U.S. total released by eight Great Lakes states (IL, IN, MI, MN, NY, OH, PA, WI): TCA: 29.1%; TCE: 55.2%; DCM: 38.1%; PERC (in this report, "PCE"): 33.3%. Source: U.S. EPA 1993 TRI data

CAMP's findings about the emissions totals for these chemicals in the Great Lakes Basin watershed area *only*—a much smaller geographical area than that comprised by the *political boundaries* of the states—show what a substantial mass small, non-TRI reporting sources contribute—such as PCE by small dry cleaning companies. Table ES-2 reports the findings for the four chemicals.

ES-Table 2

TRI Releases, % of U.S. Total TRI Releases, and Basin Watershed Non-TRI Releases

Chemical	TRI for 8 States (Millions of Pounds)	% U.S. TRI	Watershed Only (Millions of Pounds)
TCA	18,700,000	29.1	12,000,000
TCE	16,600,000	55.2	12,000,000
DCM	24,900,000	38.1	18,000,000
PCE	3,900,000	33.3	20,000,000

Source: David T. Allen & Kirsten Sinclair Rosselot, *Environmental Releases of Chlorinated Organic Compounds in the Great Lakes Basin in 1993*, Table 3. Prepared for CAMP, Inc., February 1997.

D. The Importance of These Four Chlorinated Solvents to the Health of the Great Lakes Basin

After identifying four chlorinated chemicals to target on the basis of total emissions in the Basin states and the U.S. overall, CAMP also looked at the importance of these toxic chemicals to the environment and human health as documented by the Centers for Disease Control (Agency for Toxic Substances and Disease Registry, Atlanta, Georgia). Summaries of their characteristics are detailed below and in ES-Table 3.

1,1,1-Trichloroethane (CAS #71-55-6), also called TCA and methyl chloroform, has been banned from production because of its ozone depletion and global warming potential, but not use. Like TCE, it is used widely to remove oil or grease from manufactured metal parts. It is often used as a solvent to dissolve other substances, such as glues and paints, and in household products such as spot cleaners and aerosol sprays. The eight Great Lakes states released 18,700,000 pounds in 1993, about 30% of the U.S. total. TCA is used in about 63% of all vapor degreasers.

TCA is a colorless liquid with a sweet, sharp odor. When breathed at high levels, it causes dizziness and lightheadedness, and possibly a loss of coordination. These effects disappear with fresh air. Higher levels, though, may lead to unconsciousness, lowered blood pressure, and heart failure. Studies with rats and rabbits show that breathing high levels of it damages the respiratory passages and causes mild effects in the liver, in addition to affecting the nervous system; rat offspring develop more slowly than normal. Exposures to people who work with TCA do not usually cause harmful effects. Available information does not indicate that TCA causes cancer.

Once these total large and small source emissions were known and the toxicological results reviewed, CAMP believed it was crucial to determine the following data to round out the case for targeting these four organochlorine solvents in the Great Lakes Basin ecosystem: what were the environmental impacts of these chlorinated solvents? What could be determined about their fate and transport? And, how did ambient concentration predictions compare to actual measurements?

ES-Table 3

Four Toxic, Persistent Chemicals Targeted by CAMP's Organochlorine Project

Chemical	Also Known As	Environmental Effects
1,1,1-Trichloroethane (TCA)—Production now banned, but inventories may still be used	Methyl Chloroform	✓Ozone depletion and global warming potential
Trichloroethylene (TCE)	Trichloroethene	✓Volatile organic compound ✓Hazardous air pollutant ✓Suspected carcinogen
Dichloromethane (DCM, Meth)	Methylene Chloride	✓Hazardous air pollutant ✓Suspected carcinogen
Perchloroethylene (PCE, Perc)	Tetrachloroethylene Ethylene Tetrachloride	✓Hazardous air pollutant ✓Suspected carcinogen

Trichloroethylene (CAS #79-01-6), also known as TCE and trichloroethene, is a nonflammable, colorless liquid used mainly to remove grease from metal parts. It is also used in paint removers, adhesives, and spot removers. Most of the TCE reported in the 1993 TRI for the eight Great Lakes states—16,600,000 pounds, over 55% of the entire releases for all 50 states—evaporated from manufacturers' degreasing operations. Upon evaporation, it enters the air where about half breaks down within a week; but, it can also remain in the soil and groundwater. TCE breakdown products include phosgene, dichloroacetic acid, trichloroacetic acid, chloral hydrate, and 2-chloroacetaldehyde. TCE breakdown products have been shown to be toxic to animals and are probably toxic to humans. It is also found in some foods, from contamination of water used in food processing or from cleaning the food processing equipment with TCE. U.S. EPA found TCE in 852 of its 1,416 National Priorities List of sites for long-term federal clean-up.

Dichloromethane (CAS #75-09-2) is widely used in parts cleaning, as an industrial blowing agent for foamed products, a solvent in pharmaceuticals production and paint strippers, and it may be found in aerosol and pesticide products as well as spray paints, automotive cleaners, and household products. The CDC's toxicological reports state that breathing DCM may cause dizziness, nausea, tingling or numbness of fingers and toes. Animal studies show that high concentrations can lead to unconsciousness and death, and causes an increase in the incidence of cancer in mice. The U.S. EPA designated DCM as a probable carcinogen in humans; the Food and Drug Administration has established limits of the chemical that can remain in spice, hops extract, and decaffeinated coffee. And, the Occupational Safety and Health Administration recommends the lowering of existing limits in workplace exposure.

DCM is mainly released to the environment in air and, to a lesser extent, in water and soil during industrial and consumer use. Many waste sites containing DCM release additional amounts through spills, leaks, or evaporation. The U.S. EPA found DCM in 746 of its 1,416 sites on its National Priorities List. This chemical evaporates rapidly, mostly to air where it is broken down in 53 to 127 days by sunlight and other chemicals. Small quantities may be found in water, where it is again broken down in 1 to 6 days.

Perchloroethylene (CAS #127-18-4) is used both for industrial parts cleaning and degreasing in large quantities and by big and small companies (and is, therefore, reported on the Toxic Release Inventory as shown in ES-Tables 2 and 3, with releases of 3,900,000 pounds per year by the eight states in 1993). It is also used for dry cleaning fabrics, with total U.S. emissions of 40,000,000 pounds. (Because dry cleaners are small businesses, their releases are below thresholds requiring reports to the TRI and, therefore, their emissions do not appear in TRI totals.)

According to the Centers for Disease Control, PCE is a toxic chemical. It is a known carcinogen in test animals and a probable-to-possible carcinogen in humans. Epidemiological studies have associated occupational exposure to an increased risk of leukemia as well as several types of cancer, including cancer of the esophagus, kidney, liver, bladder, lung, cervix, and pancreas. Additionally, PCE exposure correlates with immunological and lymphoreticular, neurological, reproductive, developmental, and genotoxic effects.

PCE enters environmental pathways mostly by evaporating into the air during use, by discharge or leaks onto soil, and by direct flushing to public water supplies. PCE was found in 38% of 9,232 surface water sampling sites through the U.S. and in 14.5% of 836 ground water sites across Canada. It also has been identified in at least 771 of the 1,416 hazardous waste sites proposed for inclusion on the EPA National Priorities Lists. Remediation of sites contaminated by PCE, either by digging replacement wells or by piping in treated public water, has already cost millions of dollars and will cost more as PCE continues to be used and emitted by small businesses.

E. Evaluating the Environmental Impacts of These Chlorinated Organic Compounds

Therefore, CAMP next sought to combine these *quantitative* releases with their *qualitative* impact in order to prioritize the compounds for their potential harm to human health and the ecosystem. A commissioned study used four different impact assessment methods to arrive at those priorities. Each of the four employed different assumptions, and produced different conclusions—but, all of them yielded pollutant rankings quite unlike those from releases by mass alone.

The four methodologies, chosen from many but each developed independently, present potency factors for many chemical species and generally for releases to multiple media (air, water, soil, sediment, and living things) and many impact categories. Briefly, they are characterized as follows, with selected findings to illustrate their differing conclusions.

1. U.S. EPA, 1997, draft form only: A relative ranking of over 800 chemicals based on persistence in the environment, tendency to bioaccumulate, human toxicity, and aquatic ecotoxicity.
 - Risk to Human Health: PCE, TCA, TCE, and DCM rank 34th, 36th, and 37th, and 45th respectively. Only polychlorinated biphenyls (PCB) have the highest combined risk/release score.
 - Ecotoxicity: Very little change from Risk to Human Health.
2. ICI (Imperial Chemical Industries, headquartered in London), not dated: Considers atmospheric acidification, global warming, human health effects, ozone depletion, photochemical ozone creation, acidification of water, aquatic oxygen demand, and aquatic ecotoxicity. The first five apply to air emissions and the last three to surface water releases.
 - Global Warming: TCA and DCM rank 3rd and 5th.
 - Ozone Depletion: TCA ranks 2nd.
 - Photochemical Ozone Creation: TCE, PCE, DCM rank 1st, 2nd, and 3rd.
 - Aquatic Oxygen Demand: DCM ranks 1st.
 - Aquatic Ecotoxicity: DCM, PCE, and TCE rank 1st, 5th, and 6th.
3. Minnesota Center for Environmental Advocacy, 1996: Compares about 200 chemicals for toxicity to humans, aquatic life, and fish-eating wildlife.
 - Toxicity of Air Emissions: DCM, PCE, and TCA rank 2nd, 6th, and 7th.
4. Netherlands, Guinee *et al.*, 1996: Lists almost 100 chemicals for terrestrial toxicity, aquatic toxicity, and human toxicity.
 - Aquatic Ecotoxicity: PCE, TCA, DCM, TCE rank 6th, 7th, 10th, and 14th.

☐ Terrestrial Toxicity: PCE, TCA, DCM, TCE rank 4th, 5th, 10th, and 12th.

☐ Human Toxicity: TCA, PCE, DCM, and TCE rank 1st, 5th, 6th, and 14th.

Since rankings produced from one method do not match rankings from any of the others, it is difficult to present a single cohesive picture of the impact ranking of the chlorinated organic compounds in this Project. The study identifies eight chlorinated solvents of major interest: carbon tetrachloride, chloroform, chloromethane, 1,2-dichloroethane, DCM, PCE, TCA, and TCE. All but chloromethane were ranked as having high priority by at least one of the comprehensive impact methods, and carbon tetrachloride, chloroform, TCA, and PCE were listed by two methods as having high priority. TCA and carbon tetrachloride account for more than a third of the overall ozone depletion score for compounds studied. And, in the Dutch method, these eight solvents account for almost one half of the overall human toxicity score.

From these eight chlorinated solvents of major interest, CAMP elected to target TCA, PCE, DCM, and TCE—as a group first—for a combination of reasons. By weight, these four chemicals comprise 84% of the total air releases to the Great Lakes Basin. By use, the other four chemicals—chloroform, carbon tetrachloride, 1,2-dichloroethane, and chloromethane—are involved in the production of yet other chemicals, and thus are less susceptible to substitutions. And, by regulation, TCA, PCE, DCM, and TCE at the start of this project were not regulated (TCA is now banned from production, but still not from use), while a number of applications for the other four chemicals are now banned.¹

Clearly, an international standard impact system is required, but in the meantime, these early efforts to prioritize toxicity contribute to proposed action for Phase II.

II. Phase Two: Targeting Industry Sectors

From reports and databases suggested by Project Advisors and Collaborators, CAMP has been gathering case histories of substitutions that meet criteria for potential wide-spread implementation.

Substitution criteria, though varying with applications, include these:

1. Scientific support of the target chemical's toxicity
2. Quantities of its release to the environment: air, land, and water
3. Technology for materials, products, or facilitation change
4. Performance of substitutions

¹Agency for Toxic Substances and Disease Registry, Division of Toxicology, U. S. Department of Health and Human Services, Public Health Service, Atlanta, Georgia. See the Agency's *ToxFAQs* series by individual chemical name (Tel: 404-639-6000; Fax: 404-639-6315).

5. Capital and process costs and availability of materials
6. Impact upon labor
7. Environment and health consequences of substitutions
8. Marketing opportunities, domestic & foreign
9. Influence of current or pending legislation
10. Corporate commitment and motivation to change

CAMP accumulated sufficient evidence to prove there were alternatives to the use of the four large-volume toxic chemicals identified earlier—trichloroethylene, perchloroethylene, methylene chloride, and 1,1,1-trichloroethane in two industry sectors: metal parts cleaning and dry cleaning of clothing and fabrics. And, there was a means by which to reduce the amount of polyvinyl chloride post-consumer waste that might be landfilled or incinerated.

Therefore, after conferring with Collaborators, Advisors, industry representatives, and others, CAMP selected these three priorities for the development of substitution strategies: parts cleaning, dry cleaning, and recycling of post-consumer PVC waste. Support for those decisions rested on successful substitutions in existing commercial applications. One example in each application area follows.

A. Parts Cleaning

The U.S. EPA, in partnership with Tennessee's Center for Clean Products and Clean Technologies and the Calsonics Manufacturing Corporation, demonstrated both elimination of 1,1,1-trichloroethane in Calsonics' automobile radiator and condenser manufacturing lines as well as a substantial net savings by substituting aqueous wash processes for solvent degreasing. By reducing solvent degreasing purchases from 293,000 in 1990 to zero pounds in 1994, savings were made at virtually every stage of handling and use. See ES-Table 4 titled "Summary of Activity-based Costs for the Radiator Manufacturing Line."

ES—Table 4

Summary of Activity-based Costs for the Radiator Manufacturing Line, Calsonics Corporation

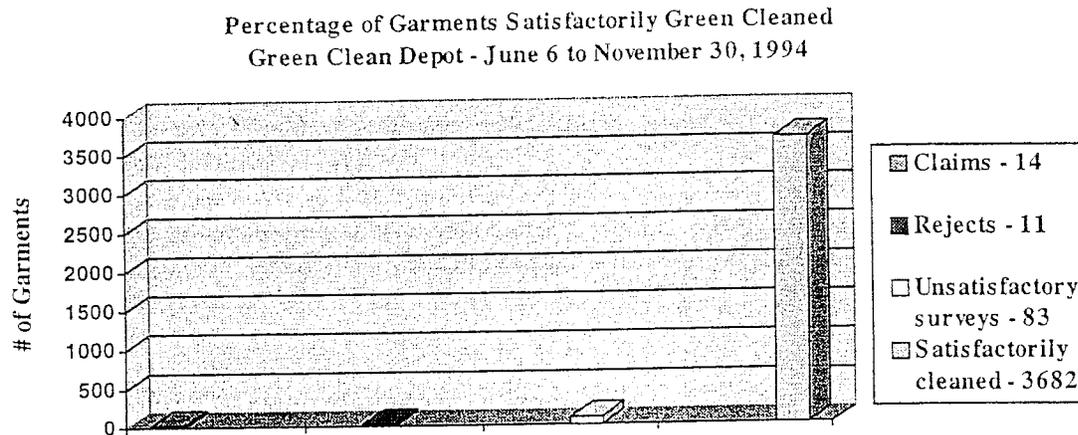
Primary Activities	Cost (\$/yr), Solvent Degreasing Process	Cost (\$/yr) of Aqueous Wash Process
Paperwork for ordering & receiving	\$5,000	\$2,500
Receipt of materials	\$7,000	\$3,500
Assembly & cleaning	\$175,300	\$58,430
Maintenance—daily	\$87,500	\$5,400
Maintenance—yearly	\$32,300	\$29,900
Wastewater treatment	—0—	\$23,600
Permitting & fees (labor)	\$34,000	\$2,000
TOTAL	\$341,100	\$125,330
SAVINGS	—	\$215,770

Source: National Risk Management Research Laboratory, Office of Research & Development, U.S. Environmental Protection Agency, *Demonstration of Alternative Cleaning Systems*, EPA/600/R-95/120 (NTIS, Springfield, VA, August 1995) p. 60.

B. Dry Cleaning

Again, the U.S. EPA funded an experimental substitution of wet cleaning (aqueous-based) for the dry cleaning (perchloroethylene-based) of clothing and fabrics in Chicago, the "Greener Cleaner Project." And, in Ontario, Environment Canada funded the "Green Clean" wet cleaning project. Both projects met CAMP's substitution criteria.

ES—Figure 3



Source: Environment Canada, *Green Clean Project Final Report*, October 1995

As in parts cleaning, wet cleaning performance is critical to customer acceptance. Both U.S. and Canadian projects reported levels of performance at least equivalent to that of dry cleaning. The set of data from the Canadian project showed customers reporting 97.2% satisfaction with their wet washed clothing. See ES—Figure 3 titled "Percentage of Garments Satisfactorily Green Cleaned, Green Clean Depot— June 6 to November 30, 1994."

C. PVC Recycling

With over 10 billion pounds of PVC now produced per year in the U.S. alone, there are many opportunities to build the infrastructure to collect, recycle, and manufacture new products. While the recycling of PVC has applied mostly to scrap generated during production, or pre-consumer waste, CAMP can point to solid examples of recapture, reprocessing, and resale of post-consumer waste material.

Cleveland's Turtle Plastics, for example, collects post-consumer plastics from national sources, pelletizes them, and injection molds new products, such as floor tiling used in machine shops, food handling facilities, shower stalls, truck beds, and veterinarian laboratories; and wedges and cribbing—shaped blocks used to hold damaged vehicles during emergency rescue operations, replacing heavy wood, which splinters easily and absorbs oil and grit and then becomes a hazardous waste.

CAMP has joined with the Cuyahoga County Solid Waste Management District and the Cleveland arm of Shore Bank to form the "Greater Cleveland Recycling Initiative" to create end markets for recyclable materials and new jobs in Northeast Ohio. Modeled after the Clean Washington Center in Seattle, the initiative has been granted start-up funding from the Ohio Department of Natural Resources and the U.S. EPA Region V. Hospital waste plastics collection for remanufacturing began at the Cleveland Clinic in June 1997.

Conclusion

CAMP's Organochlorine Project is a collaborative initiative to reopen dialogue about reducing releases of persistent, toxic organochlorine compounds into the Great Lakes Basin and to develop industry-specific strategies for accomplishing those reductions. Its criteria are to adopt only those strategies that enhance both the economic strength of the region's business base and the environmental quality of the Great Lakes ecosystem. In the first year of a multi-year program, CAMP has targeted four chemicals and their use in metal parts cleaning and the dry cleaning of clothing and fabrics, and the recycling of post-consumer polyvinyl chloride materials.

CAMP's plan is to show that existing, but not widely used, alternative technologies can be deployed through cooperatively developed technology transfer strategies to realize substantial reductions of these chemicals, while maintaining and/or expanding new business opportunities for participating industries.

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Appendix B

CAMP, Inc. Newsletters



Where
Manufacturers
Go For
Answers

Organochlorine Project News

CAMP, Inc

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*Seeking Improved Environmental Quality and
Economic Opportunities in the Great Lakes Basin
through Organochlorine Substitution Technologies*

Volume 2 Issue 2 August 1998

CAMP Pavilion for Cleaning Dirty Parts Draws Attendees & Vendors at CleanTech '98 International Expo

Aqueous Cleaning System Solutions Featured in Hands-on, Shop Floor Format

Over a dozen vendors exhibited state-of-the-art non-toxic parts cleaning equipment at the CAMP Pavilion as part of Witter Corporation's May 19-21 CleanTech '98 International Exposition in Rosemont, IL. Witter estimates that some 2,200 people world wide attended; of those, CAMP reports that over 450 made their way to its parts cleaning area where attendees brought dirty parts for test cleaning. CAMP Pavilion exhibitors and technologies included:

- Bowden Industries (cabinet washer)
- Roto-Finish (rotary drum washer, heated dryer, and vibratory bowl)
- Ingersoll-Rand (belt washer with rinse & blowoff, Millipore test for cleanliness)
- Ingersoll-Rand / Kemac (cabinet washer)
- ARM & HAMMER (aqueous cleaning chemicals)
- Hyde Products (ultrafiltration tramp oil separator)
- JRI Industries (top load spray cabinet)
- RAMCO (two-stage agitation immersion washer)
- Graymills (spray cabinet top loading washer, sink top bioremediation washer)

- Mirachem (20- & 35-gallon circulating washers and a cabinet pressure washer)
- Zero Gravity Filters (automatic filtration systems)

CAMP was joined by the Illinois Small Business Assistance Program, Illinois Department of Commerce and Community Affairs, in promoting the event in Illinois and operating the Pavilion.



CleanTech '98 attendees get a first-hand look at Arm & Hammer's and JRI Industries' cleaning capabilities.

(Continued from page 1)

Attendees brought in a variety of parts to be cleaned, including brake shoes, copper electrical bushings, titanium artificial limb components, adhesive labels on plastic spoolers, and other items.

So successful was the event, that CAMP plans another parts cleaning Pavilion at CleanTech '99, also in Rosemont, IL, and in CleanTech 2000 at a venue yet to be announced by Witter Corporation.

Manufacturers, representatives, and vendors of non-toxic, aqueous-based parts cleaning equipment, chemistries, filtration, and recycling products interested in exhibiting at CAMP's Pavilion at Clean-Tech '99 should contact Joe Chadbourne at 440-543-7303 or by e-mail at << mm_jhchadbourne@compuserve.com >>

Wet Cleaning Update

FabriCare Technology Center Opens for Training in Downtown Cleveland

On July 9, 1998 Cuyahoga Community College (Tri-C) dedicated its FabriCare Technology Center at 2237 St. Clair Avenue, Cleveland, OH 44114. A project of the Small Business Environmental Assistance Center, two-thirds of the 3,000 square-foot facility is a demonstration area filled with state-of-the-art wetcleaning and finishing equipment for hands-on training. A classroom and office complete the facility. The project was made possible by a \$4 million grant to Tri-C from the U. S. Small Business Assistance Center. Described at the dedication as a "technology demonstration and training center located in downtown Cleveland," the Center was "designed by cleaners, regulators, equipment representatives, and educators . . . to provide the [dry cleaning] industry with the resources it needs to stay productive—and profitable—despite growing environmental and regulatory pressures."

Drycleaners wishing to learn about upcoming class offerings, schedules, costs, or who wish to tour the facility can call Christine Kovach at 216-987-3700 or 216-987-3065, or Sharon Fain, director, Small Business Environmental Assistance Center, at 216-987-3060.

Reehorst Cleaners Continues a Successful Introduction of Wetcleaning at Its North Olmsted Plant under CAMP's LEPF Grant

While Tri-C's FabriCare Technology Center focuses on demonstration and training, CAMP's project with Reehorst Cleaners on Cleveland's west side aims at furthering the commercialization of wetcleaning technologies in existing drycleaning facilities.

Officially getting underway last fall by adding two Daewoo wetcleaning washers and three UniMac dryers, the Reehorsts have, on average, wetcleaned about 20% of their total cleaning volume. Their staff has had three training sessions from wetcleaning consultant Ann Hargrove, who taught them the essentials of water-based cleaning of everything from Dockers to fine leathers to wedding gowns.

To date, they regard wetcleaning as an important part of their cleaning capability that, for some items, provides a better quality product than perchloroethylene cleaning, most notably where water-based stains and soils are found in cottons, wools, and delicate fabrics such as silks and rayons.

The Reehorst project, which is funded by a grant to CAMP by the Lake Erie Protection Fund, runs officially from November 1998 through November 1999. A final report will be available the first of the year from CAMP. Those wishing a copy or wanting to learn more about the project in the meantime should contact Mary Chadbourne, project manager, at 440-543-7303, or e-mail her at << mm_jhchadbourne@compuserve.com >>

Other Wetcleaning News

The Center for Neighborhood Technology now sponsors an online wetcleaning list server, "wet-x," where cleaners can sign up and then talk directly by e-mail to each other and industry experts about wetcleaning, interests, questions, and needs. Recent topics included how much wetcleaning detergent to use per load, how to price wetcleaned garments, the economic decision points of becoming a local hotel's cleaner, and ways to minimize excessive wrinkling of garments.

(Continued from page 2)

Anyone wishing to sign on needs a computer with Internet access and must call or e-mail Anthony Star or Sylvia Ewing-Hoover at CNT to register as a member of "wet-x." Anthony and Sylvia can be reached at 773-278-4800 at extensions 117 and 129, respectively, or by e-mail at << astar@cnt.org >> and << sylvia@cnt.org >>

News from CNT-sponsored Wetcleaners Roundtable Held Mid-July in Chicago

Fifty participants interested in the future of wetcleaning attended a CNT-sponsored roundtable to network, to learn more about wetcleaning products and chemicals, and to solidify recommendations in three areas of activity:

1. To continue working with the Federal Trade Commission on the new care label law, including the definition of wetcleaning as a process.
2. To discuss the International Fabricare Institute's recent policy statement supporting wetcleaning. IFI believes that most garment care facilities can process 30-40% of their items through wetcleaning, and as much as 60-80% if they have the proper equipment, chemicals, and training.
3. To learn more about the Professional Wetcleaning Network (PWN). Network literature describes it as "a voluntary membership group dedicated to providing information and education on wetcleaning. [The Network] intends to make services available to people who have a serious interest in using wetcleaning in their business."

Reehorst Cleaners' North Olmsted plant manager, Ed Share, attended for CAMP. He reported how the North Olmsted plant has become a mixed shop with the addition of wetcleaning equipment, chemistries, and training from Ann Hargrove.

Cleaners interested in learning more about the Roundtable should contact Sylvia Ewing-Hoover at 773-278-4800, ext. 129, or e-mail at << sylvia@cnt.org >>

Cleaners and other interested parties can learn more about Professional Wetcleaning Network membership by contacting Ann Hargrove at 708-447-0879 or by e-mail at << Ahargr7630@aol.com >> or by contacting Marilyn Fleming at << Natural@thepark.com >>

Two Publications for Those Interested in Alternatives to Organochlorine Chemicals

☐ *CFPA Today*

The Chlorine Free Products Association publishes a newsletter, *CFPA Today*, reviewing new "processed chlorine free" (PCF) and "totally chlorine free" (TCF) product lines, including paper products, water purification systems, and others; industry news, including legal issues surrounding chlorinated product use and abuse; and updates on pending and new state and national legislation.

For membership information contact the Chlorine Free Products Association at 847-658-6104, by fax at 847-658-3152, and by e-mail at << cfpal@ibm.net >>

☐ *Journal of Industrial Ecology*

Published by the Massachusetts Institute of Technology (MIT) Press, the *Journal of Industrial Ecology* is a quarterly publication which features articles, columns, research, and reviews on the field of industrial ecology. A special series begun in the Winter 1997 issue features "The Life Cycle of Chlorine, Part I, Chlorine Production and the Chlorine-Mercury Connection," by Robert Ayers, and "Chlorine in the Netherlands, Part I, An Overview," by René Kleijn *et al.* Both continue in the Spring 1997 volume, where they are accompanied by an article titled, "Minimizing Chlorine Use: Assessing the trade-offs Between Cost and Chlorine Reduction in Chemical Manufacturing," by Dennis Chang and David T. Allen.

David Allen, a CAMP Organochlorine Project advisor from the University of Texas at Austin, serves as one of the editors of the journal.

"Industrial ecology" is defined by the publication as "a rapidly growing field that systematically examines local, regional and global uses and flows of materials, and energy in products, processes, industrial sectors and economies. It focuses on the potential role of industry in reducing environmental burdens throughout the product life cycle from the extraction of raw materials, to the production of goods, to the use of those goods and to the management of the resulting wastes."

(Continued from page 3)

According to the journal, the field of industrial ecology encompasses these subjects:

“• material and energy flows studies (‘industrial metabolism’)

- dematerialization and decarbonization
- life-cycle planning, design and assessment
- design for the environment
- extended producer responsibility (‘product stewardship’)
- eco-industrial parks (‘industrial symbiosis’)
- product-oriented environmental policy, and
- ‘eco-efficiency.’”

For subscriptions or purchase of back issues, contact the MIT Press Journals, 55 Hayward Street, Cambridge, Massachusetts 02142; tel: 617-253-2889.

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*Seeking Improved Environmental Quality and
Economic Opportunities in the Great Lakes Basin
through Organochlorine Substitution Technologies*

Volume 2 Issue 1 January 1998

Basin-wide "Solvents Alternatives Expositions for Cleaning Dirty Parts" Are Underway

*Aimed at Helping Small Businesses Meet
Increased Federal Air Emissions Regulations*

Small businesses that use toxic chemicals will come under increased federal regulations this year. In response, CAMP, Inc., will co-host with the Great Lakes Basin states' Small Business Assistance Programs (SBAPs) demonstrations and expositions for cleaning "dirty parts." The goal is to help small companies in the parts cleaning and degreasing industries meet these new requirements and protect or improve their bottom line as well.

The first exposition was held at the International Exposition (I-X) Center November 11-13, 1997 in Cleveland, Ohio, in conjunction with the Great Lakes Industrial Show. The next is in Indianapolis, February 11-12, 1998, while the third will be held in Chicago on May 19-21 at the "CleanTech '98" Exposition at the Rosemont Convention Center.

*Targeting Parts Cleaning and Degreasing
Industries with Onsite Industry Experts and Fully
Operational Parts Cleaning Equipment*

The small business parts cleaning and degreasing industry is a major source of toxic emissions. Many of the companies use hazardous solvents, such as those containing chlorine. And, their outdated or aging

equipment does not adequately control emissions of these solvents. The federal government levied tighter restrictions on emissions of these hazardous chemicals on December 2, 1997. As a result, virtually all parts cleaning and degreasing companies will have to comply with the Clean Air Act provision, the National Emissions Standards for Hazardous Air Pollutants (NESHAPs).

*What Small Generators of Air Emissions Are
Affected Under NESHAPs?*

One NESHAP category for "Halogenated Solvent Cleaning" establishes rules for vapor degreaser operators, and applies to owners and operators of solvent-based cleaning machines using a solvent containing 5% or more, by weight, of any one or any combination of these halogenated solvents: perchloroethylene, CAS 127-18-4; 1,1,1-trichloroethane, CAS 71-55-6; methylene chloride, CAS 75-09-2; trichloroethylene, CAS 79-01-6; carbon tetrachloride, CAS 56-23-5; and chloroform, CAS 67-66-3.

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Next CAMP Parts Cleaning Expos Scheduled to Date in 1998: Indiana and Illinois

The second CAMP exposition will be managed by the Indiana Clean Manufacturing Technology and Safe Materials Institute, 2655 Yeager Rd., Suite 103, West Lafayette, Indiana 47906. Contact Alice Smith at 765-463-4749. The Institute is a National Institute of Standards & Technology (NIST) Center, as is CAMP, located within Purdue University. This exposition will be within the Midwest Waste and Environmental Expo at the Indiana Convention Center.

The third exposition will be held in Chicago, May 19-21, 1998. Bissi DiCenso and Annette Lingleo are helping to coordinate plans with CAMP. Like Indianapolis, it will physically be incorporated within a larger exposition in Chicago, the Witter Corporation's "CleanTech '98 Exposition" space at the Rosemont Convention Center. "CleanTech '98" will feature both a precision cleaning section and a parts cleaning section, where the CAMP Pavilion will be featured.

At "CleanTech '98" there are seminars on June 19th, and then open exhibitions, including CAMP's on the 20th and 21st. Seminars also continue on those two days. The open exhibition is free, while seminars are fee-based.

On May 19th, CAMP will present the history and rationale for its Organochlorine Project, while industry representatives from Ingersoll-Rand and Ford Motor Company will present aqueous cleaning overviews on behalf of the CAMP project on May 20th and 21st. I-R's John Laursen (equipment), Scott Beck (testing), Ford's Harish A. Bhatt (chemicals) will be the panelists on both days.

Hands-on Opportunities for Small Businesses to Clean Parts by Testing Vendors' Equipment and Alternatives to Chlorinated Solvents

Businesses can bring in as many different parts as they wish and have them test-cleaned by a host of different vendors, on site. They will also have the opportunity to confer with equipment and chemical experts about their particular cleaning issues.

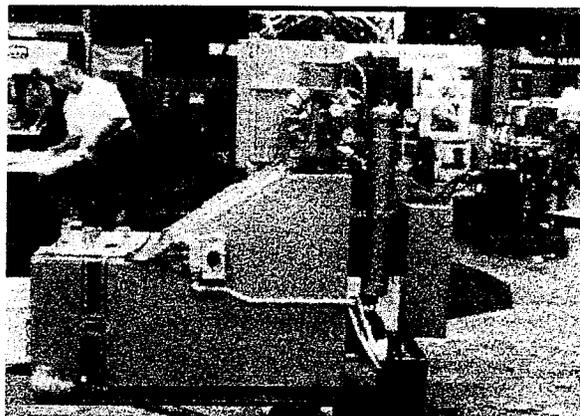
Questions about these and other CAMP parts cleaning expositions to be scheduled should be addressed to project managers Joe and Mary Chadbourne (see contact information, page 4).

Vendors Who Exhibited Equipment & Chemicals at the Cleveland Exposition

A wide variety of equipment and chemical manufacturers exhibited at the I-X Center, with parts cleaning equipment fully operational to demonstrate cleaning capabilities on site. Vendors demonstrated belt, three-stage, cabinet, and other washing equipment as well as ultrasonic units. These companies participated in CAMP's first parts cleaning exposition:

- Aqueous Resource Recovery
- Bowden Industries
- Branson Ultrasonics
- Brulin Corporation
- CAE Blackstone Ultrasonics
- CAMP, Inc., Environmental Services Division
- Finger Lakes Castle Chemical
- Hyde Products, Inc.
- Ingersoll-Rand Corporation
- J R Industries
- Jordan Power & Equipment
- Kemac, Inc.
- Lufran, Inc.
- Magnus Equipment Group
- Non-Haz Alternatives
- Ohio Tool Systems
- Petroferm USA
- Separation Technologies
- Simple Green Midwest
- Sonicor Instrument Corp.
- VESCO, Inc.
- Walsh Manufacturing Corp.
- Waste Water Engineering

The parts cleaning expositions over the next two years in the Great Lakes Basin are made possible by grants to the CAMP Organochlorine project by the Great Lakes Protection Fund and the Joyce Foundation in recognition of the importance of protecting the environmental health and economy of the Great Lakes Basin.



Equipment from J R Industries, Magnus Equipment, Jordan Power & Equipment, Petroferm, Branson Ultrasonics, and Walsh Manufacturing at the Cleveland Parts Cleaning Exposition, November 11-13, 1997

CAMP's Strategy: Simple, Practical Economic and Environmental Solutions Through Its Organochlorine Project

CAMP's strategy—to foster transitions from toxic to benign chemicals—is simply to demonstrate new technologies or substitutions that produce both environmental and economic benefits. By working with the Basin states' Small Business Assistance Programs to put together these expositions, it aims to leverage support for small companies who also happen to be collectively a large sources of toxic air emissions. Each state in the U.S. has its own Small Business Assistance Program created under the federal Clean Air Act of 1990 precisely to address small businesses (fewer than 100 employees) because they “. . . often cannot afford to hire environmental experts to interpret the complex regulations. Because the costs of failing to comply can be quite high, Congress required each state to establish a program to provide small businesses with technical assistance to help them meet air emissions requirements and reduce air emissions. SBAP is a non-regulatory program . . . (that is) a free, confidential, and voluntary service.”

Manufacturers wishing to learn more about how they can substitute benign chemicals and processes for the toxic ones they currently use can contact project manager, Joseph Chadbourne, at 440-543-7303 or by e-mail at <<mm_jhchadbourne@compuserve.com>>.

Organochlorine Project Phase I Final Report Now Available from CAMP

CAMP has completed its final report for the first of two phases of the Organochlorine Project titled *Phase I: Beyond Pollution Prevention—Removal of Organochlorines from Industrial Feedstocks and Processes in the Great Lakes Basin*. This report establishes the background and data for the strategies behind the parts cleaning workshops and wet cleaning commercial demonstrations. Those wishing a copy of the 106-page document should contact Joe and Mary Chadbourne by phone at 440-543-7303, by fax at 440-543-7160 (fax), and by e-mail at:

<<mm_jhchadbourne@compuserve.com>>

Update on the Cleveland-based Wet Cleaning Project at Reehorst Cleaners

Reehorst Cleaners of Westlake, Ohio, is working with CAMP to study, document, and report the impact of adding wet cleaning to their successful commercial dry cleaning firm. The Reehorsts initially have purchased two 25-pound Daewoo wet cleaning machines (in which they run 12-pound maximum loads) and two 30-pound and one 50-pound UniMac dryers for their North Olmsted shop. They also use a conventional commercial Milnor washing machine in their wet cleaning area. Since installation of the equipment and two training sessions with Ann Hargrove, formerly of “The Greener Cleaner” wet cleaning shop in Chicago and now a consultant on the wet cleaning processes, the Reehorsts have been successfully wet cleaning a wide range of items, including fine washables such as silks and rayons. They use Casual Care and Elegant Care wet cleaning detergents, as well as conditioners, sizing, and wet-side pre-spotting as needed.

Results thus far have been impressive. These are just some of the Reehorsts' findings since their first full week of wet cleaning, ending August 9th:

- From the first 100 records of wet-cleaned garments with pre- and post-measurements taken, only 3 items undergoing dimensional change could not be restored to original size during finishing. (One other garment was pulled up, i.e., shrunk, at the customer's request.)
- Men's casual cotton slacks are coming out much softer, with more vibrant colors, and finishing is easier with wet cleaning equipment and chemicals, compared to previous commercial washing machine processing with conventional detergents
- They are wet cleaning many more sweaters than they previously processed in the commercial washer, and with excellent results: cottons, wools, and wool blends all feel much softer than commercially washed counterparts, and wools and blends also exhibit better fiber loft
- They are doing far less hand washing and rack drying than they did when using only a conventional commercial washer and, as a result, they note that workflow has improved through the plant

□ During the week ending November 15th, they processed 27.2%, or 745 pieces, of all garments coming through the North Olmsted facility using the Daewoos and the Milnor (excluding shirts)

□ Even items still processed in the commercial Milnor machine show greater ease in finishing due to the precise cycle controls of the UniMac dryers and the benefits of wet cleaning detergents and conditioners

In the future, the Reehorsts will segregate the piece counts of the Daewoos from the Milnor to learn the maximum capabilities of the Daewoos. Other data will be collected to establish the costs of adding and operating wet cleaning equipment as compared to equivalent costs for dry cleaning. To date, the Reehorsts are very pleased with their results, and the staff is looking forward to its next training session with Ann Hargrove on top-end wet cleaning challenges: tailored suits, winter overcoats, and other highly structured garments.

Questions about the project should be addressed to Mary or Joe Chadbourne at 440-543-7303.

Organochlorine Project

How to Contact Us

Project Director: Stephen J. Gage

Tel: 216-432-5301

e-mail: stephen.gage@camp.org

Fax: 216-361-2900

Environmental Services Program Manager:

Gus Eskamani

Tel: 216-432-5185

e-mail: gus.eskamani@camp.org

Fax: 216-432-5314

Project Managers: Joe & Mary Chadbourne

Tel: 440-543-7303

e-mail: mm_jhchadbourne@compuserve.com

Fax: 440-543-7160



**Where
Manufacturers
Go For
Answers**

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TO:

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Organochlorine Project News

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*Seeking Improved Environmental Quality and
Economic Opportunities in the Great Lakes Basin
through Organochlorine Substitution Technologies*

Volume 1 Issue 2 December 1996

CAMP Awarded Lake Erie Protection Fund Grant for Basin-wide Wet Cleaning Demonstration & Deployment Project

On September 25, 1996 the Lake Erie Protection Fund announced its award of \$98,500 over two years for CAMP to establish a wet cleaning research and instructional laboratory in collaboration with Cuyahoga Community College (CCC) in Cleveland. With development of the two-year project getting underway in January 1997, Greater Cleveland Area dry cleaners will have available a state-of-the-art wet cleaning facility, including finishing equipment, where they can learn the advantages and technologies of using water-based cleaning.

The project targets "dry cleaning," i.e., the use of perchloroethylene (PCE), a toxic, chlorinated compound which harms the human body and also damages other living and nonliving elements of the Great Lakes

ecosystem, including drinking water supplies. In 1993, the dry cleaning industry in the eight Great Lakes states released some 40 millions pounds of PCE into the Great Lakes ecosystem, while the largest companies in those eight states listed 4 million pounds of PCE emissions in their 1993 Toxic Release Inventory (TRI) reports. Thus, one industry, dry cleaning, comprised of many small releasers, emitted 10 times more PCE to the environment than all other industry sources combined.

After the Greater Cleveland Area deployment, CAMP will disseminate the model to other parts of Ohio and to states in the Great Lakes Basin.

Chicago's Center for Neighborhood Technology will consult with CAMP and CCC on a local cleaner needs survey, curriculum design and development, lay out and equipment for the laboratory, and a network with other wet cleaning efforts in the Great Lakes Basin.

In addition to training in wet cleaning and finishing techniques, area cleaners will also receive assistance in small business management practices to improve their professional competitiveness through the CCC's Small

In this issue...

<i>Why Focus on PCE in the Great Lakes Basin?</i>	2
<i>Project Targets Four Chemicals for Basin-wide Substitution</i>	2
<i>Status of the Organochlorine Flows Study</i>	3
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Business Environmental Assistance Center. (For information about the Center, contact Sharon Fain at 216-987-3086.)

Why Focus on Perchloroethylene (PCE) in the Great Lakes Basin?

For orientation, perchloroethylene is used in large quantities for metal parts cleaning and degreasing and greater quantities in the dry cleaning of clothing and fabrics. It is a known carcinogen in test animals and a probable-to-possible carcinogen in humans. Epidemiological studies have associated occupational exposure to an increased risk of leukemia as well as several types of cancer, including cancer of the esophagus, kidney, liver, bladder, lung, cervix, and pancreas. Additionally, PCE exposure correlates with immunological and lymphoreticular, neurological, reproductive, developmental, and genotoxic effects (Agency for Toxic Substances and Disease Registry, 1996).

Exposure to PCE is occurring in all segments of the population through contaminated air, water, and food. Once inhaled or ingested, PCE accumulates in the body and has been found in the blood, fatty tissue, breath, and breast milk of U.S. and Canadian populations. It is transported through the atmosphere where it can then contaminate soils and waters. PCE also may accidentally spill or wittingly be dumped on the ground, flushed in public sewage systems, leak from landfills, and by other pathways contaminate private and public drinking water supplies.

For these reasons, PCE is:

- On the EPA Hazardous Substance List
- Regulated by the Occupational Safety and Health Administration
- Cited by the National Institute of Occupational Safety and Health, Cancer Advisory Group, Agency for Toxic Substances and Disease Registry of the Centers for Disease Control, the Department of Transportation, and the National Firemen's Protective Association
- Specified on the International Joint Commission's secondary track list of chemicals of concern found in the Great Lakes ecosystem.

PCE Contamination in Ohio

There are over 34,000 neighborhood dry cleaning shops in the U.S., 3,500 in Canada, presently using PCE or petroleum chemicals (Unimac, 1995) with 10,700 in the eight Great Lakes Basin states (Chemical Manufacturers Association, 1995). Entering environmental pathways mostly by evaporating into the *air* during use, by discharge or leaks onto *soil*, and by direct flushing to public *water* supplies. PCE was found in 38% of 9,232 surface water sampling sites throughout the U.S. (Agency for Toxic Substances and Disease Registry, 1996), and in 14.5% of 836 ground water sites across Canada (Hough, 1996). It also has been identified in at least 771 of the 1,416 hazardous waste sites proposed for inclusion on the EPA National Priorities List (Agency for Toxic Substances and Disease Registry, 1996), from which PCE can escape to the atmosphere and/or to ground and drinking water sources. Deductively, the relatively ubiquitous presence of PCE in the U.S. and Canada implies that Ohio will receive fallout from down-wind plumes originating in other states and down-stream flows from the upper Great Lakes Basin watershed.

In Ohio, approximately 888 dry cleaning establishments (Chemical Manufacturers Association, 1995) pose a risk of exposure to PCE by inhalation at the workplace and in homes where dry cleaned clothing is stored (Blackler et al., 1995) and ingestion from the contamination of private wells and public water supplies or, rarely, food prepared near air emission sites or with polluted water. The Ohio EPA, the Ohio Department of Health, the Ohio Air Quality Development Authority, and the Occupational Safety and Health Administration report a number of actions directed toward the reduction of releases and the clean-up of contamination for the protection of human health, state-wide air and water resources, and pathways to Lake Erie, the Ohio River, and the Great Lakes Basin. Some examples follow.

□ Ohio EPA has formed the "Dry Cleaning Initiative Team," offering free compliance assistance inspections for a 30-day amnesty period (started August-September 1996). Thereafter, it selected 10% of Ohio's total dry cleaning shops—especially those most likely to be using old equipment that emits substantial quantities of PCE—for required inspections, and violators will be penalized (Ohio EPA, personal conversation).

☐ Ohio EPA's Wellhead Protection Program has identified 17 public water supplies. 14 of which are contaminated with PCE as well as with chemicals formed as PCE breaks down biologically in water to Trichloroethylene, Dichloroethylene, Vinyl Chloride, and Ethylene (Ohio EPA, personal conversation), which again, like PCE's atmospheric degradation products, cause environmental problems.

☐ Ohio EPA's Division of Drinking and Ground Waters samples 2,400-2,500 commercial transient (e.g., gas stations, camp grounds) and fixed or commercial public water stations (e.g., schools) for chlorinated solvents, including PCE, which it finds in 8-10% of them (Ohio EPA, personal conversation).

☐ The Ohio Department of Health's Bureau of Environmental Health and Toxicology has found in Lincoln Fields, near Mansfield, up to 288 parts per billion (ppb) of PCE in 10 community wells, and 74 ppb in 54 residential wells (where 5 ppb is the U.S. EPA maximum contaminate level for public water sources, and remedial action is required at 70 ppb); in Chesterland, 18 community wells had an average of 1,187 ppb, 2 residential wells tested at 370 ppb; and in Bainbridge, 10 community wells had 5,000 ppb and 111 residential wells, 25 ppb; and in Copley 1 residential well contained 70 ppb and 7 more contained PCE breakdown products, among them vinyl chloride (a toxic) at 150,000 ppb. (Ohio Department of Health, personal conversation).

☐ Remediation of the Copley contamination sites (above) cost \$765,000, and the replacement water supply system in Lincoln Fields (also above) will cost an estimated \$4,068,000. CAMP's overall goal in the LEPF project is to help dry cleaners to protect the environment while they improve their own economic competitiveness.

Dry Cleaners Investing in Wet Cleaning Equipment Are Eligible for Ohio Air Quality Development Authority's (OAQDA) Tax Exempted Loan Program

Dry cleaners ready to invest in wet cleaning equipment for their shops should contact the Ohio Air Quality Development Authority (OAQDA) to learn about their eligibility for tax exempt loans. OAQDA offers a program to improve Ohio's air quality, which would include wet cleaning equipment, installation, and

associated costs, by providing financial assistance with the potential for tax benefits. In addition, OAQDA administers a small-grants plan for air quality improvement projects. Applicants may call Mark Shanahan at OAQDA for further information: 614-728-3540.

Small Flows in the Great Lakes Basin: Study Results Identify Organochlorines with Highest Basin Watershed Releases

Last year, CAMP contracted with David Allen, Ph.D., P.E., Department of Chemical Engineering, University of Texas at Austin, and Kirsten Rosselot, P.E., Process Profiles, to map the flows of organochlorines in the Basin. When the third stage of the study is complete, it will describe the environmental impacts of organochlorine emissions in the Basin using a model similar to that used by the government of the Netherlands.

The results of stage two, just completed, determined the organochlorine compounds with the greatest releases to the environment in the Great Lakes Basin watershed, which is comprised of 254 counties in the eight Basin states and Canada. Allen and Rosselot searched records from many different sources, including those small sources reported in the Great Lakes Commission's Southwest Lake Michigan Study. Using the Study data, Allen and Rosselot then projected the releases based on populations in the 254 counties. Excluding already regulated agricultural chemicals and adding 1,2-Dichloroethane because of its high releases to the air alone, CAMP has targeted the following chemicals:

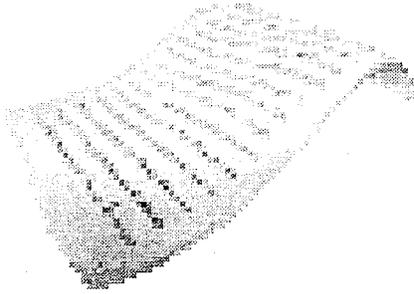
Organochlorines with the Highest Total Environmental Releases in the Great Lakes Basin

Chemical	8-State '93 TRI (millions of lbs)	% '93 US TRI	Watershed Only (millions of lbs)
Perchloroethylene	3.9	33.3	20.0
Dichloromethane	24.9	38.1	18.0
Trichloroethylene	16.6	55.2	12.0
1,1,1-Trichloroethane	18.7	29.1	12.0
Chloroform	1.4	12.0	2.1
Chloromethane	1.4	27.0	3.1
1,2-Dichloromethane	.7	36.0	1.1

The significance? Given that the left column is data from the eight states' TRI reports only, while the right column is from both TRI and small, unregulated sources in the watershed only, it is apparent that where the watershed

quantities are large in proportion to the states' TRI data—as for Perchloroethylene, Chloroform, Chloromethane, and 1,2-Dichloromethane—*small flows* are the primary source of those emissions. Since those emissions are unregulated, they are CAMP targets. Thus, dry cleaning is a CAMP target for reducing Perchloroethylene, and future

reduction targets will include the last three chemicals: Chloroform, Chloromethane, and 1,2-Dichloroethane, which are used principally in the synthesis and production of yet other organic compounds.



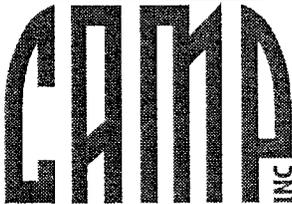
What's Coming Up in the Next Issue:

- ✓ Announcement of the Polyvinyl Chloride Recycling Project
- ✓ Plans for parts cleaning collaborations
- ✓ TRI data update
- ✓ News on the CAMP-Cuyahoga Community College Wet Cleaning Demonstration and Deployment Project

How to Contact Us at CAMP

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Environmental Services Mgr: Gus Eskamani, tel: 216/432-5185; e-mail: gus.eskamani@camp.org
Project Managers: Joe & Mary Chadbourne, tel: 216/543-7303 or 543-6674; fax: 216-543-7160;
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CAMP, Inc. World Wide Web Page address: <http://www.camp.org/>



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*Seeking Improved Environmental Quality and
Economic Opportunities in the Great Lakes Basin
through Organochlorine Substitution Technologies*

Volume 1 Issue 1 June 1996

Transition from Toxic to Benign Chemicals Grows Businesses, Improves Health in Great Lakes Basin

U.S. and Canadian Partners Collaborate on Three Pilot Areas

CAMP, Inc. has received grants from the Great Lakes Protection Fund and the George Gund and Joyce Foundations for a planning effort to develop long-range strategies to assist industry in voluntarily reducing the release of persistent, toxic organochlorine compounds in the Great Lakes Basin ecosystem.

Successful strategies will result in new economic opportunities for business in the eight Great Lakes states (Illinois, Indiana, Michigan, Minnesota, New

York, Ohio, Pennsylvania, and Wisconsin) and two Canadian provinces (Ontario and Quebec) and in the improved environmental quality of the Great Lakes themselves (Erie, Huron, Michigan, Ontario, and Superior). Progress on both fronts will enhance the region's value as a critical environmental and economic resource nationally and globally.

To foster transitions from toxic to benign chemicals, CAMP's approach is to identify, promote, and disseminate new technologies or substitutions that produce both environmental and economic benefits throughout the Great Lakes Basin. During 1996, CAMP is concentrating on (1) aqueous cleaning of metal parts, (2) wet cleaning of clothing and other fabrics, and (3) recycling of post-consumer waste polyvinyl chloride. In subsequent years, CAMP will investigate additional chemicals and industry processes for new technologies or substitutions.

This newsletter will be used to inform manufacturers and others in the region about the progress of the Organochlorine Project. "How to Contact Us at CAMP" (see page four) lists the names of staff to whom you can address questions about the Project.

In this issue...

<i>What Is CAMP?</i>	2
<i>Why Focus on the Great Lakes Basin?</i>	2
<i>Project Targets Four Chemicals for Basin-wide Substitution</i>	2
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What Is CAMP?

Established in 1984, CAMP serves as a regional research, development, deployment and training resource by (1) mobilizing and leveraging private, government, public, and academic resources to help manufacturers grow and improve; (2) fostering innovation in manufacturing enterprises through research, development, technology deployment, business assistance and training; and (3) motivating and helping the manufacturers to develop people, use technology, improve business practices, and modernize products, processes, and facilities.

Why Focus on the Great Lakes Basin?

The Great Lakes contain 20% of the world's fresh surface water and 95% of the U.S. supply. It covers more than 94,000 square miles with 10,900 miles of coastline. There are 295,000 square miles in the watershed, which encompasses parts of eight states and two provinces and, in the U.S. alone, 22 million people. The region is North America's industrial heartland; it also supports a multi-billion dollar outdoor recreation and tourism industry, a world-class maritime transportation system, and a diverse and extensive agricultural base. The Great Lakes have a major influence on the U.S. and Canadian economies—and, those economies are inexorably linked to the health of the Great Lakes ecosystem.

Project Targets Four Chemicals for Basin-wide Substitution

By querying the data in the U.S. EPA's 1993 and 1994 Toxic Release Inventory (TRI), CAMP found that the Basin's Great Lakes states release a significant volume of toxic organochlorine chemicals into the Great Lakes ecosystem. By weight, just four of these organochlorine chemicals used for *one* industrial process, *parts cleaning*, comprise almost one third of all chlorinated

solvents consumed in the U.S. And over 70% of one of those same chemicals, perchloroethylene, is consumed by a second industry, *dry cleaning*.

When CAMP examined the TRI industrial emissions of these chemicals in the Great Lakes Basin, it found that 99% of releases were to air, rather than to water or soils, in the following quantities:

TRI REPORTED RELEASES OF FOUR TOXIC, PERSISTENT CHEMICALS IN EIGHT GREAT LAKES STATES AND % OF U.S. TOTAL RELEASES

Chemical Names	Amt Released in Pounds	% of U.S. Total
1,1,1-Trichloroethane (TCA)	18,652,896	29%
Dichloromethane (DCM)	24,888,666	38%
Trichloroethylene (TCE)	16,637,115	55%
Perchloroethylene (PERC)	3,856,230	33%

Upon examining data that reveal releases of small dry cleaning industries *not* required to file TRI reports, CAMP found that some 10,700 dry cleaners in the eight Great Lakes states release an estimated 40,000,000 pounds of perchloroethylene a year (Charles River Associates, 1993). Therefore, in the TRI table above, adding these small dry cleaners to TRI reporting industries, the total release of PERC is some 44,000,000 pounds. Releases to air often cross into other environmental media, entering water and soils, as well as the ecosystem.

With 1,1,1-trichloroethane production banned as of December 31, 1995, only existing inventories of TCA are available to companies currently using this solvent in applications such as metal parts cleaning. As supplies dwindle, the price of TCA will become prohibitive. Therefore, CAMP is prepared to help manufacturers find effective, benign alternatives to this solvent so that they can maintain and improve their quality levels and profitability.

In addition to the TCA ban, with forthcoming thresholds under the National Emission Standards for Hazardous Air Pollutants (NESHAP), the other three

chemicals from the target list—dichloromethane, trichloroethylene, and perchloroethylene—will be restricted under the terms described below.

Corporations operating existing vapor degreasers and cold immersion cleaning units will have until December 1997 to comply with new emission standards for these and other chemicals.

There are three options for compliance:

1. Install one of several combinations of emission control equipment, and implement automated parts handling and work processes
2. Meet idling mode emission limits, and implement automated parts handling and work practices.
3. Meet a limit on *total* emissions.

(NOTE: Companies wishing details about these NESHAP requirements can contact CAMP's Environmental Services Program manager, Gus Eskamani, at 216/432-5185 or by e-mail at gus.eskamani@camp.org. The tables are "Control Equipment Combinations and Idling Limits" and "Total Emissions Limits for Cleaning Machines with a Solvent/Air Interface.")

With these regulatory realities, manufacturers will be faced with developing new chemical substitutes and/or new processes to continue doing business competitively. CAMP's Organochlorine Project is positioned to help companies make a smooth transition economically and environmentally.

Basin-wide Project Collaborators

CAMP invited the following organizations to collaborate on the project. Their information, advice, research, and referrals have been critical to CAMP's strategies for successful substitutions in metal parts cleaning, dry cleaning, and post-consumer polyvinyl chloride recycling. As the Project adds other areas for organochlorine reduction in the Great Lakes Basin, new collaborators, advisors, and subject area specialists will be invited to share their expertise.

PROJECT COLLABORATORS

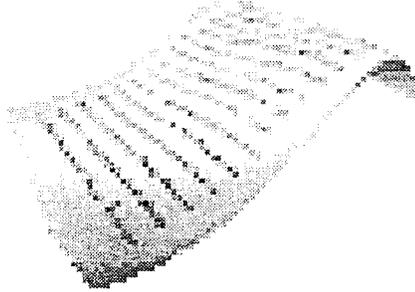
- Center for Neighborhood Technology
- Great Lakes Pollution Prevention Centre (GLPPC), CANADA
- Hazardous Waste Research & Information Center (HWRIC)
- Institute for Agriculture & Trade Policy
- Institute for Local Self Reliance
- Solid & Hazardous Waste Education Center
- Waste Reduction Institute for Training & Applied Research (WRITAR)
- Wastewater Technology Centre (WTC), CANADA
- Clean Washington Center

Subject Area Specialists

In addition to these organizations, several subject area specialists have joined the Organochlorine Project:

- Chemical engineering, material flows, and flows modeling:** David Allen, Ph.D., P.E., University of Texas at Austin; and Kirsten Rosselot, P.E., Process Profiles
- Wet Cleaning:** Jo Patton, Center for Neighborhood Technology, and Ken Geiser, Toxic Use Reduction Institute, University of Massachusetts at Lowell
- Solvents:** Katy Wolf, Institute for Research & Technical Assistance, and David Liebl, Solid & Hazardous Waste Education Center
- Paper pulping & bleaching:** Ted Garver, Ph.D., Lakehead University, CANADA

**What's
Ahead in
Our Next
Issue,
September
1996**



In the fall issue of the *Organochlorine Project News*, watch for:

- ✓ Announcement of the Project's World Wide Web address on the Internet
- ✓ Plans for wet cleaning training and demonstration in the Great Lakes Basin
- ✓ Metal parts cleaning demonstrations and case histories
- ✓ Post-consumer waste polyvinyl chloride recycling and case histories
- ✓ Questions and answers about manufacturing with benign chemicals and processes

How to Contact Us at CAMP

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Environmental Services Program Manager:
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Fax: 216/432-5314

Project Managers: Joe & Mary Chadbourne
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e-mail: joseph.chadbourne@camp.org
e-mail: mary.chadbourne@camp.org
Fax: 216/543-7160

To receive a set of the CAMP Organochlorine Project descriptive materials, contact Joe or Mary Chadbourne at the above numbers.



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TO:

Appendix C

Names of Wetcleaners & Members of the Professional Wetcleaning Network

Names of Wetcleaners

This list was downloaded from The Professional Wetcleaning Network Website on July 6, 2000. Cleaners marked by an asterisk (*) are members of The Professional Wetcleaning Network.

Alabama:

Aladdin Cleaners
112 N. 55th Place
Birmingham, AL 35212
(205) 592-7425

Watkins Cleaners
1484 Montgomery Highway
Birmingham, AL
35216
(205) 823-0874

Watkins Cleaners
1715 28th Ave. S.
Birmingham, AL 35206
(205) 879-7951

Alaska:

The Cleaners
636 Stedman
Ketchikan, AK 99901
(907) 247-6771

Snow White
300 E. 5th Ave.
Anchorage, AK 99501
(907) 258-4200

One Hour Martinizing
2042 East Northern Lights
Anchorage, AK
99508
(907) 279-8041

Arizona:

Delia's Cleaners
1320 Priest St.
Tempe, AZ 85283
(602) 897-2576

Arkansas:

Schickel's Cleaners
11609 Hwy 10
Little Rock, AR
72212
(501) 227-9463

Schickel's Cleaners
201 Bowman Rd.
Little Rock, AR
72211
(501) 228-9954

Schickel's Cleaners
5427 Dreher Ln.
Little Rock, AR
72209
(501) 562-5437

California:

Cypress Plaza Cleaners
9947 Walker St.
Cypress, CA 90630
(714) 827-3210

Cleaner By Nature *
2407 Wilshire Blvd.
Santa Monica, CA 90403
(310) 315-1520

Cleaner by Nature *
11919 Wilshire Blvd.
Los Angeles, CA 90049
(310) 914-4504

Forever Treasured *
10049 Rubio Ave.
North Granada Hills, CA 91343
(818) 360-9943 (Wedding Gown Service by
appointment only.)

Union French Cleaners
1718 Union St.
San Francisco, CA 94123
(415) 923-1212

Fazio Cleaners
11702 San Vicente Blvd.
Los Angeles, CA 90039
(310) 820-0469

Porteranch Cleaners
19450 Rinaldi St.
North Ridge, CA 91326
(818) 368-7474

Vouge Cleaners
77 Miller Ave
Mill Valley, CA 94941
(415) 388-3035

Miramonte Cleaners
171 E. El Camino Real
Mountain View, CA 94040
(650) 965-9333

Norge Cleaners
398 San Pablo Ave.
Albany, CA 94706
(510) 526-3850

Classic Cleaners
609 Soquel Ave.
Santa Cruz, CA 95062
(831) 423-2630

Garden Cleaners
1509 Webster Ave.
Alameda, CA 94501
(510) 522-8299

Spotless Cleaners
32 Redhill Ave.
San Anselmo, CA 94960
(415)454-1422

Valley Cleaners
2676 Castro Valley Blvd.
Castro Valley, CA 94546
(510)537-9777

Fairmont Cleaners
7533 Fairmont Blvd.
El Cerrito, CA 94530
(510)528-5527

Cruse Custom Tailors
10131 Riverside Dr.
Toluca Lake, CA 91610
(818)766-5008

The Cleaning Store
1225 N Pacific Ave
Glendale, CA 91202
(818)507-8834

Colorado:

Papa Joe's *
728 S. Main St.
Walsenburg, CO 81089
(719) 738-2044

**Avenue Cleaners/Morrison Suede and
Leather**
401 E. 17th Ave, Unit C
Denver, CO 80203
(303) 894-9911

Paradise Cleaners
6460 E. Yale Ave.
Denver, CO 80222
(303) 753-1513

Paradise Cleaners
400 E. 7th
Denver, CO 80203
(303) 832-5187

Paradise Cleaners
2358 E. 3rd Ave.
Denver, CO 80206
(303) 388-7149

Paradise Cleaners
780 S. Colorado Blvd.
Denver, CO 80222
(303) 756-4232

Paradise Cleaners
3310 E. Colfax
Denver, CO 80206
(303) 399-0507

Paradise Cleaners
7150 Leetsdale Dr.
Denver, CO 80224
(303) 394-2177

Paradise Cleaners
1635 17th St.
Denver, CO 80202
(303) 292-4644

Paradise Cleaners
8223 S. Quebec
Highlands Ranch, CO 80126
(303) 771-1899

Paradise Cleaners
5119 S. Yosemite
Englewood, CO 80110
(303) 770-2063

Paradise Cleaners
6826 S. Yosemite
Englewood, CO 80110
(303) 741-1075

Paradise Cleaners
14799 W. 6th Ave.
Golden, CO 80401
(303) 279-9403

Paradise Cleaners
7500 S. University
Littleton, CO 80122
(303)741-2475

Connecticut:

Pure Elegance
1240 Post Road East
Westport, CT 06880
(203) 221-7448
(two other drop-off sites)

Florida:

Orange Blossom Garment Care *
9835 SW Sunset Dr.
Miami, FL 33173
(305) 271-8233

Acme Cleaners
600 N. Westmoreland
Orlando, FL 32805
(407) 841-2301

ECO-Store
2441 Edgewater Dr.
Orlando, FL 32804
(407) 426-9949

Rainbow Cleaners
5505 College Dr.
Graceville, FL 32440
(904) 263-1010

Dryclean Doctor
1899-7 N. Congress Ave.
Boynton Beach, FL
(561) 735-3636

Dryclean 2000 *
2262 N. Congress Ave.
Boynton Beach, FL 33426
(516) 737-1114

Platinum Coast Dry Cleaners
5492 Rattlesnake Hammock Rd.
Naples, FL 34113
(941) 775-5110

Platinum Coast Dry Cleaners
3633 Tamiami Trail N.
Naples, FL 34103
941-263-1104

Earth Safe Cleaners
4850 Hancock Bridge Park #1
North Fort Meyer, FL 33903

Georgia:

21st Century Cleaners *
4305 State Bridge Rd.
Apharetta, GA 30022
(770) 521-0221

Professional Cleaners
6018 Sandy Springs Circle
Atlanta, GA 30328
(404) 255-2146

McAbee Cleaners
320 East 1st St.
Rome, GA 30161
(706) 291-0001

Pleasant Hill Cleaners
4300 Pleasant Hill Rd #F
Duluth, GA 30136
(770) 418-1131

K.S. Personal Touch *
2014 Powers Ferry Rd.
Atlanta, GA 30339
(770) 690-0304

Idaho:

Family Cleaners
163 Main St.
Gooding, ID 83330
(208) 934-5892

Illinois:

Greener Cleaner *
5312 N. Broadway
Chicago, IL 60613
(773) 784-8429

Lansing Cleaners
18210 Torrence Ave.
Lansing, IL 60438
(708) 474-2459

Reed's Cleaners
7659 S. Ashland Ave.
Chicago, IL 60620
(773) 994-1289

Regent Cleaners
3000 N. Broadway
Chicago, IL 60613
(773) 348-5510

Smart Look Cleaners
10301 S. Roberts Rd.
Palos Hills, IL 60465
(708) 599-8059

Debmar*
15014 S Page Ave
Harvey, IL 60426
(708) 333-7540

Indiana:
Sunrise Cleaners
634 N. Hallek St.
DeMotte, IN 46310
(219) 987-2281

Finished Look
5560 N. Illinois
Indianapolis, IN 46220
(317) 254-8795

Peachey's Cleaners
114 E Williams St.
Kendalville, IN 46755
(219)347-0454

Iowa:

Nature's Way Cleaners *
500 Blairs Ferry Road NE
Cedar Rapids, IA 52402
(319) 395-6777

Wagner's Cleaners
1723 State St.
Bettendorf, IA 52722
(319) 355-1241

Wagner's Cleaners
2525 18th St.
Bettendorf, IA 52722
(319) 355-5659

Colfax Cleaners
23 E. Howard St.
Colfax, IA 50054
(515) 674-3583

Huxley Cleaners
109 S. Main - Old Town
Huxley, IA 50124
(515) 597-2331

Kansas:

Family Laundry Center *
808 W. 4th Ave.
Hutchinson, KS 67501
(316) 665-5870

Lee's Cleaners
1110 W. 31st St.
Wichita, KS 67217
(316) 522-2391

Kentucky:

Highland Cleaners
2455 Bardstown Rd.
Louisville, KY 40205
(502) 454-4641

Louisiana:

Russell's Cleaners
3401 Tulane Ave.
New Orleans, LA 70119
(504) 482-3153

Sutton's Cleaners
3724 Government St.
Baton Rouge, LA 70806
(225) 344-4968

#1 Cleaners
5038 W. Esplanade Ave.
Metairie, LA 70006
(504) 455-0096

New Concept Cleaners
401 Focis St.
Metairie, LA 70005
(225) 835-6531

Maryland:

Prestige . . . Exceptional Fabricare
9420 Georgia Ave.
Silver Spring, MD 20910
(301) 588-0333

Admiral Cleaners
4 N. Taylor Ave.
Annapolis, MD 21401
(410) 295-0234

Massachusetts:

Nature's Cleaners*
1105 Osgood St
North Andover, MA 01845
(978) 975-9995

Utopia Cleaners
1370 Massachusetts Ave.
Arlington, MA 02174
(781) 648-4783

Panda Cleaners
155 State St.
Newburyport, MA 01950
(978) 499-1735

Panda Cleaners
13 1/2 Pawn St.
Newburyport, MA 01950
(978) 465-8081

Panda Cleaners
174 Turnpike
Rawley, MA 01905
(508) 948-3530

Panda Cleaners
435 Newberry St.
Danvers, MA 01923
(978) 777-6567

Corner Cleaners
1301 Washington St.
Newton, MA 02162
(617) 969-1711

Moonie's Cleaners
233 Bowdoin St.
Dorchester, MA 02122
(617) 282-1046

Natick Cleaners
13 Watson St.
Natick, MA 01760
(508) 655-8200

Kelly Green Cleaners
266 Hyde Park Ave.
Jamaica Plain, MA 02130
(617) 522-5961

Michigan:

Curtis Cleaners
1410 W. Main St.
Lowell, MI 49331
(616) 897-9809

Executive Cleaners
28829 Hoover Rd.
Warren, MI 49331
(810) 574-0959

Curtis Cleaners
1266 Madison SE
Grand Rapids, MI 49507
(616) 451-4908

Jan's Professional Cleaners
130 Griffest St
Clio, MI 48420
(810) 687-7590

Master Dry Cleaners
725 E 8th St
Traverse City, MI
(231) 946-5620

Minnesota:

Temple Cleaners*
628 11th St. E
Glencoe, MN 55336
(320) 864-7677

Double Dimension *
313 N. Minnesota S.
New Ulm, MN 56073
(507) 359-7630

Waconia Cleaners & Laundry
209 West 1st St.
Waconia, MN 55387
(612) 442-2105

Colonial Cleaners
3701 Lyndale Ave. South
Minneapolis, MN 55408
(612) 823-8095

Clean 'N' Press
1183 Geneva Ave. N.
St. Paul, MN 55128
(651) 738-6572

St. Joe's Cleaners
13 E. Minnesota St.
St. Joseph, MN 56374
(320) 363-7581

Missouri:

The Launderer *
309 N. One Mile Rd.
Dexter, MO 63841
(573) 624-2766

Lee's Summit Cleaners
316 S. Douglas
Lee Summit, MO 64063
(816) 524-3544

Lee's Summit Cleaners
11561 E 63 St.
Kansas City, MO 64133
(816) 353-8939

Lee's Summit Cleaners
805 NE Lakewood Blvd.
Lee's Summit, MO 64064
(816) 478-8442

Banner Cleaners
500 S Brentwood Blvd
St. Louis, MO 63105
(314) 725-4500

Montana:

Persnickety Cleaners
2020 W. Babcock St.
Bozeman, MT 59715
(406) 586-7682

Nebraska:

Fashion Cleaners
3031 Leavenworth St.
Omaha, NE 68105
(402) 342-3491

Globe Quality Cleaners
2101 G St.
Lincoln, NE 68510
(402) 435-3217

Globe Quality Cleaners
1301 L St.
Lincoln, NE 68508
(402) 476-8554

Globe Quality Cleaners
3201 South Street
Mail Plus at Rathbone Village
Lincoln, NE 68502
(402) 434-5315

Globe Quality Cleaners
70th & Vine
Mail Plus at Meadow Lane
Lincoln, NE 68505
(402) 434-5317

Globe Quality Cleaners
5641 S. 56th St.
Lincoln, NE 68516
(402) 423-7281

Globe Quality Cleaners
2068 S. 16th St.
Lincoln, NE 68502
(402) 475-3217

Globe Quality Cleaners
6900 O St. Suite 118
Meridian Park Shopping Center
Lincoln, NE 68510
(402) 464-4090

Globe Quality Cleaners
2840 S. 70th St., Suite 4
Lincoln, NE 68506
(402) 488-5374

Globe Quality Cleaners
2600 O St.
Lincoln, NE 68510
(402) 477-9010

Globe/ Fabricare Center
4831 Normal Blvd.
Lincoln, NE 68506
(402) 488-5374

North Dakota:

C&R Cleaners and Laundry
1010 5th St. N.
Grand Forks, ND 58203
(701)775-5336

New Jersey:

Royal Cleaning Specialist*
65 W. Somerset St.
Raritan, NJ 08896
(908) 707-8383

Linders French Cleaners
130 Morristown Rd.
Bernardsville, NJ 07924
(908) 766-6404

Valet Cleaners
6012 Park St.
W. New York, NJ 07093
(201) 854-0392

New Mexico:

Valet Cleaners
13160 Central SE
Albuquerque, NM 87123
(505) 292-7676

New York:

Larry's Model Cleaners
247-15 Jamaica Avenue
Bellerose, NY 11426
(718) 343-4676

Ecomat*
837-9 Union St.
Brooklyn, NY 11236
(718) 857-2990

Sunny Hi-Tech Cleaners*
800 Montauk Hwy.
Shirley, NY 11967
(516) 281-1666

Meurice Garment Care
20 Park Ave.
Manhasset, NY 11030
(516) 627-6060

Meurice Garment Care
225 E. 57th St.
New York, NY 10022
(212) 759-9057

Meurice Garment Care
31 University Pl.
New York, NY. 10003
(212) 475-2778

Manhattan Valet West
230 W. 76th St.
New York, NY 10023
(212) 721-2480

Crown Cleaners
627 Columbia Tpk.
E. Greenburgh, NY 12061
(518) 477-4607

Embassy Cleaners
1895 Palmer Ave.
Larchmont, NY 10538
(914) 834-2700

Hollywood Cleaners
7910 Flatlands Ave.
Brooklyn NY 11236
(718) 251-3063

Leary's Cleaners
3256 Monroe Ave.
Rochester, NY 14618
(716) 586-4403

Baris Cleaners
48 St. Paul St.
Rochester, NY 14604
(716)325-2286

Kan Cleaners
429 Merrick Rd.
Oceanside, NY 11572
(516) 763-1077

New Scotland Fabricare
273 New Scotland Ave
Albany, NY 12208

North Carolina:

1 Hour Koretizing
202 Falls Rd.
Rocky Mount, NC 27801
(252) 446-0920

Wilmington Cleaners
56 Darlington Rd.
Darlington, NC 28403
(910) 763-7695

Quality Laundry & Cleaners
238 Tarboro St.
Rocky Mount, NC 27801
(252) 446-7116

A Cleaner World
2321 Davis Dr.
Cary, NC 27511
(919) 461-1722

Meddlin Davis
2021 Smallwood Dr
Raleigh, NC 27605

Ohio:

London Cleaners
26163 Chardon Rd.
Cleveland, OH 44142
(216) 731-3344

Widmer's Dry Cleaning Specialists
2016 Madison Rd.
Cincinnati, OH 45208
(513) 321-5100

Bowser Cleaners
8600 Glenwood Ave.
Youngstown, OH 44512
(330) 758-7456

Swan Cleaners
6241 Perimeter Center
Columbus, OH 43201
(614) 760-1900

Reehorst Cleaners
23459 Lorain Rd.
North Olmstead, OH 44070
(440) 777-1400

Creed The Cleaner
93 S Bridge St.
Struthers, OH 44471
(330) 755-2106

Oklahoma:

Northside Laundry & Cleaners
402 S. Main St.
Stillwater, OK 74074
(405) 372-0644

Oregon:

Campus Cleaners
1465 Siskiyou Blvd.
Ashland, OR 97520
(541) 482-2281

Campbell's Cleaners
1120 NW 9th St.
Corvallis, OR 97330
(541) 753-3794

Town & Country Cleaners
7561-C Crator Lake Hwy.
White City, OR 97503
(541) 826-5484

Prestige Cleaners
2345 NW Stewart Pkwy.
Roseburg, OR 97470
(541) 440-1533

Hubbard Cleaners
3362 D St.
Hubbard, OR 97032
(503) 982-0524

Norwood's Cleaners and Laundry
4552 Commercial SE
Salem, OR 97302
(503) 585-4210

Norwood's Cleaners and Laundry
1526 Broadway NE
Salem, OR 97303

Norwood's Cleaners and Laundry
Lancaster Mall
Salem, OR 97301
(503) 581-7896

Central Oregon Dry Cleaners
415 SE 3rd St.
Bend, OR 97701
(541) 389-2140

45th Ave Cleaners
4400 SW Multnomah Blvd
Portland, OR 97219
(503) 244-9707

Pennsylvania:

Michael's Cleaners *
1126 S. Broad St.
Philadelphia, PA 19146
(215) 546-8171

Lionville Cleaners
140 Eagleview Blvd.
Lionville, PA 19353
(610) 524-0661

Oxford Valley Custom Cleaners
148 N. Flowers Mill Rd.
Langhorne, PA 19044
(215) 750-7870

South Carolina:
Dixie Cleaners
407 Gardner Blvd.
Holly Hill, SC 29059
(803)496-3424

Custom Dry Cleaners
1619 W Palmetto St.
Flurene, SC 29501
(843) 662-8833

South Dakota:

Queen's Wash & Dry
712 Caryon
Spearfish, SD 57783
(605) 642-3132

Tennessee:

Crescent Cleaners
6685 Quince St. #101
Memphis, TN 38119
(901) 753-7334

Pinecrest Cleaners, Inc.
1018 Tusculm Blvd.
Greeneville, TN 37745
(423) 639-1407

Texas:

Ecomat *
2915 Guadalupe St.
Austin, TX 78705
(512) 236-8645

Atomic Cleaners
1395 Franklin St.
Beaumont, TX 77701
(409) 835-5555

Gorman's Cleaners
8901 Katy Freeway
Houston, TX 77024
(713) 468-43333

Utah:

Raindance Laundry * 430 S. Main St.
Cedar City, UT 84720
(435) 586-6964

Virginia:

Row Cleaners
1321 Memorial Blvd.
Martinsville, VA 24112
(540) 632-5572

McLean Drapery & Rug Cleaning
1407 Chain Bridge Rd.
McLean, VA 22101
(703) 356-5321

Imperial Gown Restoration Co.
2814-C Merrilee Dr.
Fairfax, VA 22031
(703) 573-8989

The Cleaners
790 Hawthorne Dr.
Norton, VA 24273
(540) 679-1500

The Laundry Club*
20134 James Monroe Hwy
Leesberg, VA 20175
(703)771-8283

Presto Valet of Virginia, Inc
1623 Quaker Lane
Alexandria, VA 22302
(703) 998-6464

Washington state:

The Cleaners *
3415 W. 17th Ave
Seattle, WA 98119
(206) 285-1875

Washington DC:

District Fur Storage *
33 Patterson St. NE
Washington DC 20002
(202) 898-4160

Wisconsin:

Natural Cleaners
5442 S 108 St.
Hales Corner, WI 53130
(414) 529-5388

Natural Cleaners
865 N. Mayfair Rd.
Wauwatosa, WI 53226
(414) 475-1905

Bayside Natural Cleaners
8828 N Port Washington Rd.
Bayside, WI 53217
(414) 352-7610

Leather Rich
1250 Corporate Center
Oconomowoc, WI 53066
(800) 236-6996

Valet Cleaners
3825 Durand Ave.
Racine, WI 53405
(262) 554-6966

Judge's Cleaners
2150 Maple Dr
Plover, WI 54467
(715) 343-1769

Fabricare of Waukesha
2140 Silvernail Rd
Pewaukee, WI 53072
(262) 549-0600

Wyoming:

Elite Cleaners and Tailors
1026 E. Pershing
Cheyenne, WY 82001
(307) 638-8901

Australia:

Diamond Valley Laundry Service
17 Sherbourne Rd
Greenborough, Victoria, Australia 3088
Member of The Professional Wetcleaning
Network

Canada:

Blondie Cleaners
909 Riverside Dr. E.
Windsor, ONT
N9A 2T5
(519) 254-4364

Buttons and Bows
3850 Finch East
Toronto, ONT
(416) 754-2136

Careful Hand Laundry
120 Tycos Dr.
North York, ONT
(416) 789-3247

Finchdale Cleaners
2578 Finch Ave. W.
Weston, ONT
(416) 741-2536

Heritage Cleaners
21 Wooten Way N.
Markham, ONT
(905) 294-9105

Langley Parisian Cleaners *
679 Mohawk Rd. E.
Hamilton, ONT
L8V 2K6
(905) 522-4651

Master Garment Care
3145 Dundas St. W.
Mississauga, ON
(905) 608-1373

Vogelson's Green Clean Depot *
Royal York Hotel, Front St.
Toronto, ONT
(905) 891-0197

Roop's Cleaners
8 King St.
Truro, NS
B2N 3K6
(902) 895-8044

Nelson Cleaners
35 Waddillo
Truro, NS
B2N 4A3

Roch Chatel Cleaners
8245 Boul. Tashereau Ouest
Brossard, PQ
(514) 676-3528

Miss Brown's Cleaners
67 Provo St.
Lachine, PQ
(514) 637-6741

Fabtech Cleaners
Unit 690
3147 Douglas St.
Victoria, BC
(604) 477-8323
(plus two drop-off stores)

Appendix C-14

**Our Fabricare Center
Unit 690
180 Innisfi St.
Berrie, Ontario**

**Natural Cleaners
550 Roseberry St.
Winnipeg, MB**

**Carriage Trade Cleaners
1271 Simcoe St. North
Oshawa, Ontario
CANADA, L1G 4X1
tel. 905-576-7500
fax 905-576-0398 email
carriage@idirect.com
www.carriagetrade.on.ca**

**Fresh 'N Press Cleaners
405 Wharncliffe Rds
London, Ontario, Canada N6J 2M3
Contact name: Dennis Peckham**

**Palmer Cleaning Center
80 Woodlawn Rd W
Guelph, Ontario, Canada N1H 1B2**