

An Inquiry into the Alternatives to Perchloroethylene in the Drycleaning Industry in Massachusetts

**Massachusetts DEP
October 13, 2006**

**Yve Torrie, MA
Lowell Center for Sustainable Production
Yve_Torrie@uml.edu**



Perc Facts

- **Prominent drycleaning solvent since the 60's**
- **Environmental and health toxicity known for 20+yrs**
- **In air, soil, sediments and major groundwater contaminant**
 - **Clean Air Act; NESHAP; new changes**
 - **Clean Water Act / Safe Drinking Water Act**
 - **Resource Conservation and Recovery Act (disposal)**
 - **Comprehensive Environmental Response, Compensation, and Liability Act (Superfund)**
- **Neurotoxin, liver and kidney toxin, and possibly developmental and reproductive toxin**
- **Probably carcinogen IARC; NIOSH recommend handling as human carcinogen**



Drycleaning Prominence

- **30-35,000 drycleaners nationally**
- **1,200 drycleaners in Massachusetts**
- **Most drycleaners are located in shopping areas near residential neighborhoods**
- **It is therefore a great potential for public exposure to toxic chemicals**



3 primary questions

- **What alternative technologies are in use in Massachusetts?**
- **What is driving change to alternative technologies?**
- **Are alternative technologies proving successful?**



Massachusetts alternative drycleaners

- **New hydrocarbon technology - DF2000**
- **Liquid silicone - GreenEarth**
- **Glycol ether - Rynex**
- **Liquid CO₂**
- **Wetcleaning**



Drivers to change

- **Environmental concerns and regulations**
- **Health and safety concerns and regulations**
- **Economic concerns**
- **Consumer demand**



Environmental Concerns & Regulations

Summary of Environmental Regulations Related to Alternative Technologies*

	CAA	CWA	RCRA	CERCLA
Perc	Yes	Yes	Yes	Yes
DF-2000	Yes ++	Yes	No	No
GreenEarth	No	No	No	No
CO ₂	No	No	No	No
Rynex	No	No	No	No
Wetcleaning	No	Yes	No	No

Yes or No indicates if a technology is regulated specifically in the statute or not

++ Drycleaner must comply with New Source Performance Standards (NSPS) if the operation has a total manufacturer-rated dryer capacity that is equal to or greater than 84 pounds AND the equipment was installed after December 14, 1982.

*The list of regulations covered in this exhibit should not be considered exhaustive and may not cover all regulated aspects of the fabricare industry.

Source: Adapted from Table ES-1 Summary of Regulations Related to Fabricare Technologies, GTCP 1998a, ES-6



Health and Safety Concerns & Regulations

Summary of OSHA Regulations Related to Alternative Technologies*

	OSHA	Exposure Limit	NFPA 32 Standards	Flashpoint	Boiling point
Perc	Yes	100 ppm (OSHA) 25 ppm (ACGIH)	Class IV	None	250°F
DF-2000	Yes	171 ppm (manufacturer)	Class IIIA	147°F	376-401°F
GreenEarth	Yes	10 ppm (manufacturer)	Class IIIA	170°F	410°F
CO ₂	No	5,000 ppm	No	None	-109°F
Rynex	No	None	Class IIIB	203°F	>400°F
Wetcleaning	No	None	No	None	212°F

NFPA 32 Standards:

- I systems employing solvents with a flashpoint of < 100°F
- II systems employing solvents with a flashpoint between 100 and 140°F
- IIIA systems employing solvents with a flashpoint of 140°F and above
- IIIB systems employing solvents with a flashpoint at or above 200°F
- IV systems employing nonflammable liquids with building requirements of Chapter 4 of the regulations
- V systems employing nonflammable liquids with building requirements of Chapter 5 of the regulations

*The list of regulations covered in this exhibit should not be considered exhaustive and may not cover all regulated aspects of the fabricare industry.

Source: Adapted from Table ES-1 Summary of Regulations Related to Fabricare Technologies, GTCP 1998a, ES-6



Cost – small plant

Small Model Plant Annualized Costs for 40,000 Pounds of Clothing Annually

	Perc	Hydrocarbon	GreenEarth	Wetcleaning	Glycol Ether
Annualized Cost	\$3,022	\$3,467	\$3,467	\$2,427	\$3,467
Solvent	\$600	\$256	\$720	\$0	\$750
Licensing Fee	-	-	\$2,500	-	-
Detergent	\$1,250	\$1,250	\$1,250	\$2,100	\$0
Electricity	\$3,600	\$4,538	\$4,538	\$2,400	\$10,260
Gas	\$3,000	\$3,154	\$3,225	\$4,200	\$8,208
Spotting Labor	\$6,400	\$6,400	\$12,800	\$7,800	\$520
Finishing Labor	\$25,600	\$25,600	\$19,720	\$29,900	\$25,600
Maintenance Labor	\$520	\$520	\$520	\$520	\$9,360
Maintenance Equipment	\$0	\$0	\$0	\$0	\$0
Compliance	\$520	\$520	\$0	\$0	\$520
Hazardous Waste Disposal	\$550	\$550	\$550	\$0	\$550
Total	\$45,062	\$46,255	\$49,290	\$49,347	\$59,235
Cost per pound cleaned	\$1.13	\$1.16	\$1.23	\$1.23	\$1.48

Source: Adapted from Table 5-1 Small Model Plant Annualized Costs, Cleaning Volume – 40,000 Pounds, Morris 2005, 57



Cost – large plant

Large Model Plant Annualized Costs for 100,000 Pounds of Clothing Annually

	Perc	Hydrocarbon	GreenEarth	Carbon Dioxide
Annualized Cost	\$3,535	\$4,007	\$4,007	\$12,480
Solvent	\$1,100	\$472	\$1,328	\$2,679
Licensing Fee	-	-	\$2,500	-
Detergent	\$3,125	\$3,125	\$3,125	\$8,704
Electricity	\$7,500	\$9,450	\$9,450	\$10,500
Gas	\$3,400	\$3,876	\$3,655	\$3,173
Spotting Labor	\$13,000	\$13,000	\$26,000	\$26,000
Finishing Labor	\$49,400	\$49,400	\$36,038	\$49,400
Maintenance Labor	\$1,040	\$1,040	\$1,040	\$520
Maintenance Equipment	\$0	\$0	\$0	\$0
Compliance	\$1,040	\$1,040	\$0	\$0
Hazardous Waste Disposal	\$1,400	\$1,400	\$1,400	\$500
Total	\$84,540	\$86,810	\$90,543	\$113,956
Cost per pound cleaned	\$0.85	\$0.87	\$0.91	\$1.14

Source: Adapted from Table 5-2 Large Model Plant Annualized Costs, Cleaning Volume – 100,000 Pounds, Morris 2005, 59



Consumer demands

- Rising costs are decreasing usage – drycleaning is becoming a luxury item
- Convenience rules - 77% customers prefer to use a drycleaner near home, 57% within 2 miles of home or work (IFI 1993)
- 90% quality of cleaning services / performance was most important (IFI 1993)
- Consumer demand important in drycleaners choice to use alternative technology
- Consumers not demanding specific technologies, just want a “green cleaner”



Success

- All viable alternatives are proving successful to some degree
- Each technology has strengths and weaknesses
- None have reached the prominence of perc



Performance

Summary of General Characteristics and Cleaning Performance Related to Alternative Technologies

	Cleaning Capability	KBV- Solvency	Advantages	Disadvantages
Perc	Aggressive	90	Process easy to use	Not good for delicates
DF-2000	Gentle	27	Can clean delicates Good hand	Can have bacteria growth Longer cycle time
GreenEarth	Gentle	13	Can clean delicates Very good hand	Longer cycle time
CO ₂	Gentle	27	Good hand	Detergent issues, Problems with acetate Expensive equipment
Rynex	Aggressive	70	Cleans water soluble and oil based soils	Longer cycle time Water separation difficult Distillation boil over
Wetcleaning	Aggressive	0	Can clean delicates	Finishing more difficult

Source: Adapted from Table 2-1 Comparisons of Alternative Cleaning Processes, Morris 2005, 15



Conclusions

- **Alternative technologies largely motivated by stricter state and federal regulation of perc, as well as increasing evidence of perc's negative impact on human health and the environment**
- **No federal level assessment on alternatives since DfE Garment and Textile Care Program, 2001 (states, local, independent bodies making own assessment e.g. 5 chemicals study)**
- **With no standard assessment, difficult to know if the current alternative technologies being marketed as nonregulated are safe and how they compare to perc**
- **Perc proponents argue “better the devil you know than the one you don’t”**



Recommendations

- **Economic incentives at a state level be offered to drycleaners to encourage them to try new technologies e.g. South Coast Air Quality Management District (SCAQMD)**
- **EPA and OSHA develop method of assessment to include:**
 - **Standards for environmental, health, and safety hazards e.g. TURI study used the Toxic Use Reduction more hazardous chemicals list, carcinogenicity data, and persistence, bioaccumulative, toxicity (PBT) criteria.**
 - **Exposure limits determined by a federal agency and not by a manufacturer, mutagen and reproductive toxicity data, flammability, and other potential dangers posed such as the high pressure in liquid CO₂ machines**



Lowell Center Alternatives Assessment Framework

- **Creating an open source framework for the relatively quick assessment of safer and more socially just alternatives.**
- **“Open source” means the collaborative development, sharing, and growth of methods, tools, and databases that facilitate decision making.**
- **“Relatively quick assessment” means that the process results in robust decisions informed by the best available science, while avoiding paralysis by analysis.**



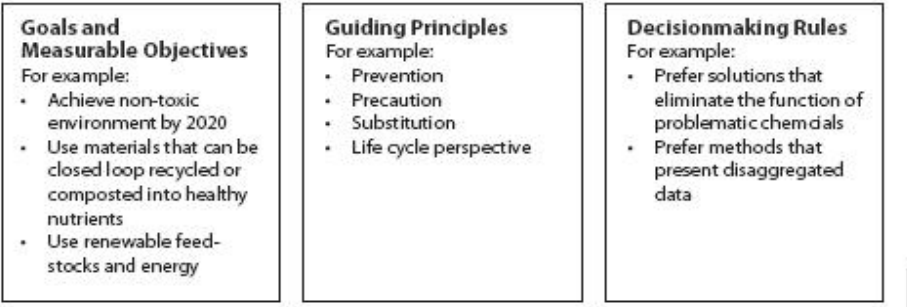
Parts of the Lowell Center Alternatives Framework

- **Foundation**, where values are made explicit by clearly articulating the Principles, Goals, and Rules that guide decisions made during the assessment of alternatives.
- **Assessment Processes** -- The methods, tools, and criteria used to evaluate which chemicals, materials, or products are safer and socially preferable.
 - The Comparative Assessment Process
 - The Design Assessment Process
- **Evaluation Modules**, which evaluate the economic feasibility, technical performance, human health and environment impacts, and social justice impacts of alternatives.

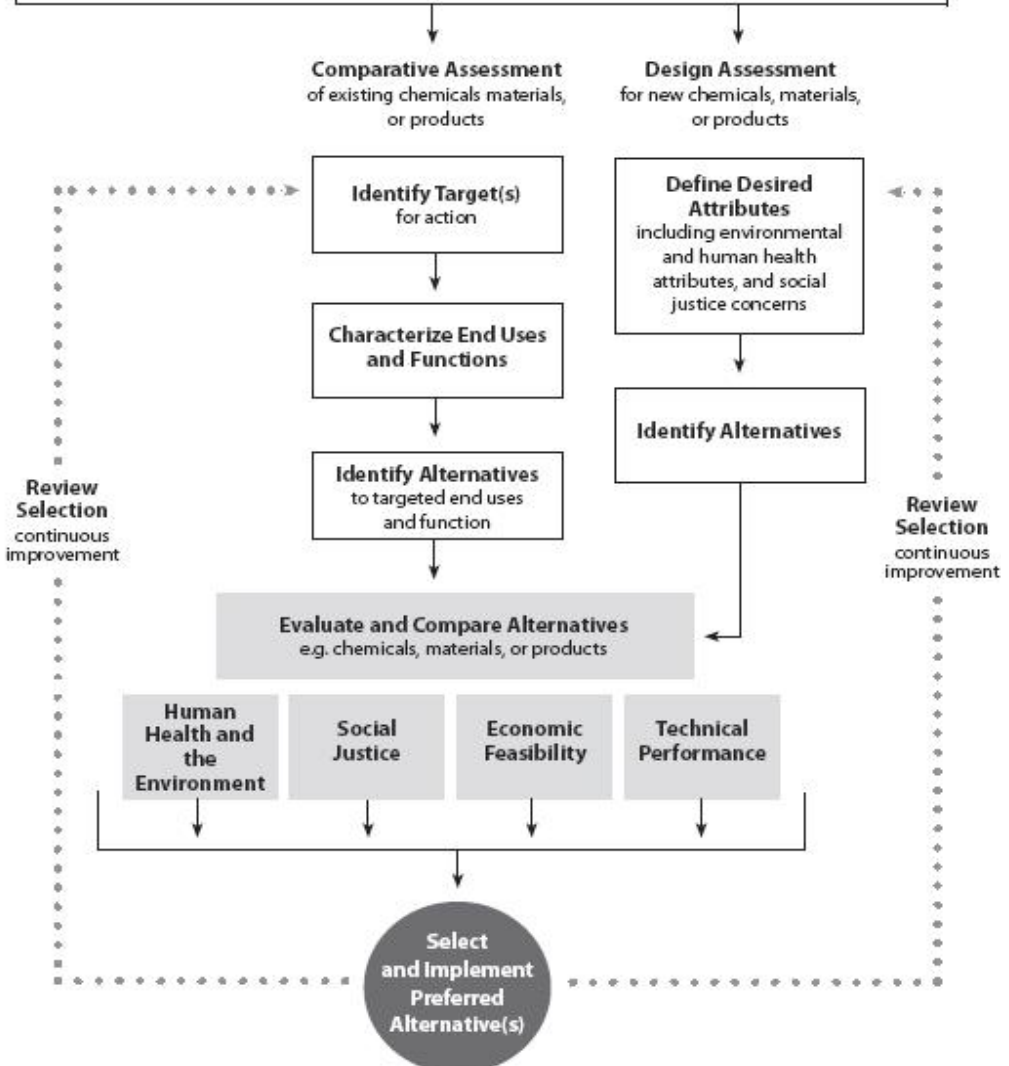


Lowell Center Alternatives Assessment Framework

1 Alternatives Assessment Foundation



2 Alternatives Assessment Processes



3 Evaluation Modules

-
- **“All new technology introduced over the last ten years has either raised costs, lowered productivity, lowered quality or a combination of those. There is just now some new technology that has potential to actually increase productivity – but it’s still very expensive. I think it’s critical to the survival of so many of the drycleaning companies (especially the smaller family owned companies) that better cleaning machines are developed” (Hagearty 2006).**



Questions?

