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Final Report

Converting PERC Dry Cleaners to Professional Wet Cleaning: A Pilot Program

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This report was prepared by the Hazardous Waste Management Program in King County, Washington, a coalition of local governments. Our customers are residents, businesses and institutions with small quantities of hazardous wastes. Our mission is: to protect and enhance public health and environmental quality in King County by reducing the threat posed by the **production, use, storage and disposal** of hazardous materials.

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Acronyms and Abbreviations

Ecology	Washington State Department of Ecology
EPA	United States Environmental Protection Agency
Haz Waste Program	Hazardous Waste Management Program in King County, Washington
L&I	Washington State Department of Labor & Industries
lb.	pound
PERC	perchloroethylene / tetrachloroethylene
PID	photoionization detector
ppm	parts per million
PWC	Professional Wet Cleaning
SDS	Safety Data Sheet
TSCA	Toxic Substances Control Act
TURI	Toxic Use Reduction Institute

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Executive Summary

Starting in 2018, the Hazardous Waste Management Program (Haz Waste Program) in King County, Washington established a pilot financial incentive program to help perchloroethylene (PERC) dry cleaners switch to professional wet cleaning (PWC). Dry cleaners were reimbursed \$20,000 after they purchased new equipment and process chemicals.

Because the majority of shop owners were immigrants from South Korea, we invested considerable resources into developing a culturally appropriate approach to the recruitment for and implementation of the financial incentive program. From an equity and social justice perspective, we consider this community to be a vulnerable and underserved population that requires particular protection from the adverse health effects associated with PERC.

Of the 15 PERC shops initially recruited for the program, 11 committed to adopting PWC for the pilot phase.

Transitioning to PWC resulted in several immediate benefits to health and the environment. Once shops switched from PERC to PWC, they no longer used a harmful hazardous solvent to clean fabrics and did not generate hazardous waste. In addition, the process chemicals provided by the PWC vendors (spotting agents, etc.) are less toxic than those used in PERC operations. Although utility data proved difficult to review, two shops that continually flushed cooling water through their PERC machines reduced their water usage and utility bills quite considerably after transitioning to PWC. Most shop owners expressed happiness with their decision to adopt PWC, with some suggesting that their health had improved.

However, transitioning to PWC presented challenges for some shop owners, particularly those who were less knowledgeable about garment construction and stain removal. Shops with inadequate infrastructure and finishing equipment also faced challenges. Consequently, this report makes several recommendations to help ensure the success of all PERC dry cleaners who adopt PWC in the future.

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Introduction

Status of perchloroethylene dry cleaning in the United States

Dry cleaning, which uses non-aqueous organic solvents to clean fabrics, has existed as an industry since the mid-19th century. Historically, solvents such as kerosene, benzene, and gasoline were used as cleaning agents.⁽¹⁾ Currently, the most common solvent used in the United States is perchloroethylene (PERC, PCE, or tetrachloroethylene), which has been classified as a probable human carcinogen by the United States Environmental Protection Agency (EPA)⁽²⁾ and exhibits several other adverse effects on human health and the environment.⁽³⁾

EPA determined that dry cleaning facilities represent the second largest use of this solvent (approximately 15 percent of the total usage) and that approximately 60 percent of dry cleaners nationally currently use PERC as their primary cleaning solvent.⁽³⁾ In 2008, EPA estimated that approximately 28,000 dry cleaners in the United States used PERC,⁽⁴⁾ although this number is likely considerably lower in 2020 because of business closures and the emergence of alternative fabric cleaning solvents.

Recognizing the hazards associated with PERC, EPA identified this chlorinated hydrocarbon as one of the first ten chemicals to be evaluated under the Frank R. Lautenberg Chemical Safety for the 21st Century Act (Lautenberg Chemical Safety Act), which amends the Toxic Substances Control Act (TSCA).⁽⁵⁾ Consequently, the use of PERC in dry cleaning could potentially be banned at the federal level on or about 2021. In addition, all PERC machines must be removed from residential buildings by December 21, 2020 and replaced with non-PERC technology, as stipulated under the Clean Air Act in the Final Amendments to Air Toxics Standards for Perchloroethylene Dry Cleaners.⁽⁶⁾ The existing regulatory environment regarding PERC is summarized in Appendix A.

Previous dry cleaning interventions in King County

In 1996, the Hazardous Waste Management Program in King County, Washington (Haz Waste Program) learned that several local dry cleaners were responsible for contaminating groundwater with PERC. Consequently, between 1997 and 1998, Program staff visited approximately 20 percent of King County dry cleaners to evaluate waste handling practices. This effort was followed by a large technical assistance initiative between November 1998 and July 2000, in which field personnel visited every dry cleaning business in King County (approximately 340 locations at that time). Staff provided guidance on the proper handling, management, and disposal of hazardous materials. During these visits, it was noted that all but a few businesses were using PERC as their primary dry cleaning solvent.⁽⁷⁾ In 2000-2001, the Haz Waste Program provided funding to the two local dry cleaning business associations to recruit shops for our environmental recognition program ("EnviroStars"). Ninety local dry cleaners subsequently joined the EnviroStars Program. The Haz Waste Program continues to provide technical assistance with hazard waste management to dry cleaners in the county.

The Haz Waste Program has provided varying levels of financial assistance to help dry cleaners switch to safer alternatives since 2000. From 2000 to 2013, we provided funds that allowed dry cleaners to adopt systems based on siloxane, liquid carbon dioxide, butylal, and glycol ethers.

In 2010, a Haz Waste Program survey revealed that 69 percent of the approximately 200 remaining dry cleaners in King County were still using PERC.^(8,9) We learned that 21 percent of dry cleaners used a high-flashpoint hydrocarbon, which is typically regarded as a safer alternative to PERC,⁽¹⁰⁾ and the remaining 10 percent used glycol ethers, liquid silicone, or liquid carbon dioxide as their primary dry cleaning solvents. Subsequent to this survey, a new dry cleaning solvent appeared in King County based on butylal, called “Solvon K4,”⁽¹¹⁾ which is also likely a safer alternative to PERC. It is notable that in the 2010 survey, no respondents reported using Professional Wet Cleaning (PWC), which uses water and detergents to clean fabrics, rather than an organic solvent.

Starting in 2011, the Haz Waste Program hosted a workgroup (the Interagency Resource for Achieving Cooperation), with the goal of harmonizing best management practices and interventions across the local dry cleaning industry. This workgroup included representatives from several regulatory agencies with local jurisdiction and occasionally included vendors, shop owners, and others knowledgeable about the industry. This workgroup sponsored and organized meetings of the Korean Dry Cleaning Association, which allowed us to interact with and gather information from many Korean dry cleaning business owners.

From our survey and interactions with dry cleaners via our interagency workgroup, we learned that the principal barrier to shops adopting safer technologies was cost. Consequently, we initiated a new financial incentive program in 2012, where we awarded 11 grants of \$15,000 to \$20,000 in a two-year period. Nine shops transitioned to high-flashpoint hydrocarbon (e.g., ExxonMobil DF2000) and two adopted PWC.

The case for eliminating PERC from dry cleaning in King County

The health and environmental impacts of PERC are well-documented and an extensive literature has been compiled by the EPA in support of its TSCA evaluation.⁽¹²⁾ Most noteworthy are the epidemiological studies that suggest an association between increased risk for various cancers and other adverse health outcomes with occupation in the dry cleaning industry.^(13,14)

In King County, field observations at dry cleaners conducted from 2000 onwards revealed considerable potential for PERC exposures and release to the environment. We routinely measured airborne PERC concentrations in the hundreds of parts per million (ppm) when scanning dry cleaning machines with a photoionization detector (PID). These high PERC levels were typically detected in the vicinity of leaking hoses, gaskets, seals, valves, and filter

housings (see Figure 1). However, we also measured high PERC levels when the drum door was opened after cleaning (unpublished observations). We also observed considerable potential for PERC exposure and environmental contamination when dry cleaners managed the hazardous wastes generated by their machines and other sources.

There is also concern about environmental contamination of shallow aquifers, which provide drinking water for several local communities. For example, the City of Redmond's aquifer is contaminated with PERC from historical dry cleaning operations and PERC levels are routinely monitored. Therefore, the City administers a Wellhead Protection Program to protect their groundwater.⁽¹⁵⁾ Consequently, PERC dry cleaners may no longer be located in Redmond's Critical Aquifer Recharge Areas. The Haz Waste Program provides ongoing technical support to the City of Redmond to ensure that small businesses do not contaminate the aquifer.

According to the Washington State Department of Ecology (Ecology), as of March 2018, 189 cleanup sites in King County were contaminated by PERC from current or former dry cleaners.^a Although no summary data are available to describe local costs associated with environmental remediation of dry cleaners, a 2014 review of the national Dry Cleaners Site Profiles database maintained by the State Coalition for the Remediation of Dry Cleaners⁽¹⁶⁾ revealed that costs ranged from \$29,000 to \$2,000,000; the median cost was \$230,000 (unpublished observations).

Another factor driving the elimination of PERC from dry cleaning is the finding that English is a second language for most of this workforce. Our 2010 survey revealed that over 80 percent of shops in King County were owned and operated by immigrants from South Korea.^(8,9) Subsequent field visits revealed that when shops had employees, they were typically Latinx immigrants (unpublished observations). The survey also revealed that most shop owners would prefer health & safety information in Korean. From an equity and social justice perspective, we consider this to be a vulnerable and underserved population that requires particular protection from the adverse health effects associated with PERC.



Figure 1. Using a PID to detect PERC
The reading of 510 ppm was taken at the still bottom (sludge) waste container next to the still door

^a Personal communication between Donna Musa, Washington State Department of Ecology and Ashley Pedersen, Hazardous Waste Management Program in King County. March 2018.

Emergence of Professional Wet Cleaning

Although PWC has been used as an alternative to PERC in the United States for over two decades, the dry cleaning community has been slow to adopt this technology. In his book chapter from 2001, *“Dry Cleaning’s Dilemma and Opportunity: Overcoming Chemical Dependencies and Creating a Community of Interests,”* Robert Gottlieb described the benefits of PWC and the industry pressures and other factors that have prevented wider adoption of this technology.⁽¹⁷⁾ Other authors have also documented the health and economic benefits of PWC.⁽¹⁸⁻²¹⁾

In King County, interviews conducted with the local dry cleaning community revealed considerable skepticism about the ability of PWC to clean all “dry clean only” fabrics, especially wools and silks. Concerns were expressed about potential shrinkage and the manual labor required to measure garments before cleaning in order to stretch them back to their original dimensions.

However, we became aware of a new generation of PWC technology when several shops in King County adopted this equipment. We witnessed the successful cleaning of wool dress suits and silk garments in three shops. In 2017, interviews with the shop owners who were using PWC and their equipment vendors led us to conclude that PWC had become a viable alternative to PERC dry cleaning and that we would promote PWC because it is the safest alternative.

PERC dry cleaning vs Professional Wet Cleaning

Regardless of the cleaning technology used, stained fabrics may be pre-cleaned or “pre-spotted” with spot treatment products before being placed in the cleaning machine. These products are formulated according to the type of stains to be removed.

PERC dry cleaning

In PERC dry cleaning, spot treatment products are classified as either “wet-side” or “dry-side” agents. Wet-side spotting agents are generally aqueous products that are used to remove water-soluble stains from clothing. Dry-side agents are typically comprised of non-aqueous solvents and alcohols and are used to remove stains comprised of oils, fats, waxes, grease, cosmetics, paints, and plastics.⁽²²⁾ A typical “spotting table” used with PERC dry cleaning and a PERC dry cleaning machine are shown in Figure 2 and Figure 3, respectively. Many of the spot cleaning products used in PERC dry cleaning contain extremely hazardous ingredients^a.⁽²³⁾

^a The term “extremely hazardous ingredient,” as used in this report, refers to chemicals that receive a High Hazard rating when evaluated using SciveraLENS RapidScreen.⁽²³⁾ They include human carcinogens, Persistent Bioaccumulative Toxics, and reproductive and developmental toxicants. Examples used in dry cleaning include some petroleum naphthas, ammonium hydrogendifluoride, PERC, trichlorethylene, and methylene chloride.



Figure 2. Spotting table at a PERC shop



Figure 3. PERC dry cleaning machine

After spotting, fabrics are placed in the dry cleaning machine where they are agitated with PERC. Some shops also use a detergent designed to work with organic solvents. Additives may also be introduced to the machine during cleaning. The most frequently used additives are “sizing” agents, which may be injected into the machine during the cleaning process. Sizing agents are typically comprised of hydrocarbon resins in a petroleum solvent carrier, and are used to restore shape, body, and texture to fabrics.⁽²²⁾ Fabrics that are still stained after cleaning may be “post-spotted” with similar spot cleaning products.

The PERC dry cleaning process generates several PERC-contaminated wastes that must be managed as hazardous waste, including a sludge (also called “muck” or “still bottoms”), separator water (from the physical separation of dry cleaning solvent and water in a water separator), and used filters.⁽⁸⁾

Professional Wet Cleaning

The spotting agents designed for use with PWC are also formulated to remove various types of stains. They are typically water soluble and do not contain chlorinated solvents or other extremely hazardous ingredients.⁽²³⁾ A typical spotting table and PWC machine are shown in Figure 4 and Figure 5, respectively.

In PWC, fabrics are cleaned using a computer-controlled washing machine with multiple fabric-specific cleaning programs. Fabrics are washed in water and detergent, and additional products may be added to the washing drum, depending on the type of fabric being cleaned. These products protect fibers during drying, prevent dye bleeding, provide suppleness to leather, etc. The metering system that dispenses the detergent and other additives into the drum is shown in Figure 6. The washed fabrics are then placed in a specialized dryer, which is equipped with moisture sensors to ensure that fabrics do not shrink after excessive drying. In contrast to PERC and other solvent-based dry cleaning methods, PWC does not generate a hazardous organic solvent waste.



Figure 4. Spotting table at a Professional Wet Cleaning shop



Figure 5. Professional Wet Cleaning machine



Figure 6. Products used for Professional Wet Cleaning

Promoting Adoption of Professional Wet Cleaning

A safer alternative to PERC

Concurrent with our research work into dry cleaning and PWC, we were developing a “Safer Alternatives Strategy” for the Haz Waste Program. This work laid out a programmatic approach to identifying and implementing safer alternative chemicals, products, and processes for residents and businesses in King County. As part of that work, in April 2018, we worked with the King County Board of Health to pass a Safer Alternative Strategy resolution (see Appendix D). This resolution supports the Safer Alternative Strategy and encourages partnerships and collaboration with state and regional stakeholders. The Board of Health supported transitioning PERC dry cleaners to PWC as the first intervention under the Safer Alternative Strategy.

Selecting a policy strategy

Before launching our intervention, we researched strategies that other jurisdictions in the United States used to encourage dry cleaners to transition away from using PERC. We identified four principal strategies: financial assistance, demonstrations, bans, and signage requirements (see Table 1). These strategies are presented in more detail in Appendix B.

Table 1. Policy strategies used by other jurisdictions		
Strategy	Description	Jurisdiction
Financial Assistance	Grants intended to help dry cleaning shops switch to alternative solvents	• State of California • New York State • Massachusetts • South Coast Air Quality Management District (California) • City of Philadelphia
Demonstrations	Educational or pilot programs that target local businesses	• State of California • New York State • Massachusetts • South Coast Air Quality Management District (California)
Ban	Phase-out or complete ban of PERC at different levels of jurisdiction	• State of California • South Coast Air Quality Management District (California) • City of Philadelphia
Signage	Requires shops to post signage disclosing solvents and types of chemicals used	• Massachusetts • New York City

We evaluated the strategies described in Table 1 against four criteria: 1) human health and environmental impact, 2) financial impact on dry cleaner owners and workers, 3) feasibility, and 4) implementation cost. This evaluation is summarized in Appendix C.

Based on our evaluation, we selected the strategy of financial incentives. This option has a high likelihood of improved human health/environment protection, minimizes the financial impact to dry cleaners, and limits the risk of “regrettable substitutions” if funding is provided for a specific, well-characterized alternative technology. We decided to add demonstration programs, if needed. We chose not to proceed with a ban because EPA is currently reviewing PERC under revised TSCA and its decision will preempt any regulations we may introduce in King County. We also decided that pursuing a signage regulation would be time-consuming, with little impact. Therefore, we initiated a pilot project where we offered \$20,000 grants to dry cleaners to switch from PERC to PWC.

Establishing the Pilot Program

Initial strategy

Our first attempts to recruit PERC dry cleaners for the financial incentive program began in April 2018 and lasted two weeks. Program personnel (none of whom were native Korean speakers) made unannounced visits to 14 shops that were identified as PERC users from our program's field database, a customer list from a local vendor, and a list of registered PERC dry cleaners from the Puget Sound Clean Air Agency.

Upon entering each business, we identified ourselves to the shop owners and handed them two promotional flyers that were written in English and Korean (printed back-to-back). The first flyer was titled "*Thinking about buying new dry cleaning equipment?*" and described our \$20,000 financial incentive initiative, including the program requirements and the benefits of wet cleaning. The second flyer was titled "*Financial help to switch to professional wet cleaning*" and described financial institutions that had expressed interest in providing business loans to this sector.

We then asked if the shop owner was interested in the program and recorded their responses.

One additional owner of multiple dry cleaning business locations was contacted via telephone.

Initial recruitment results

Of the 15 shop owners contacted:

- Three had already switched to a high-flashpoint hydrocarbon machine.
- Two businesses had closed.
- Ten were still using PERC.

Of the ten PERC dry cleaning business owners:

- Two were White/Caucasian and native-English speakers.
- Seven were Korean, with varying English language proficiencies.
- One was Thai, with good English language proficiency.

The level of interest in PWC expressed among the ten PERC dry cleaning business owners was as follows:

- One was interested in PWC and would consider the incentive program.
- Three were somewhat interested but would like more information, time to think about it, or a technology demonstration.

- Six would not consider PWC, for the following reasons:
 - “Don’t know anything about PWC.”
 - “Business closing in a couple of months.”
 - “Retiring in the next five years – not worth the investment.”
 - “Concerned about fabric shrinkage, especially wool.”
 - “PERC is the ideal solvent – cleans much better than hydrocarbon or water.”
 - “PWC can’t be used for all fabrics.”
 - “Customers are used to the cleaning qualities of PERC.”
 - “Concerned about liability if cleaning ‘dry clean only’ fabrics with water.”
 - “There’s nothing wrong with my PERC machine.”
 - “Concerned about cost to buy wet cleaning equipment, including stretchers and tensioners.”

Lessons learned from the initial recruitment

We identified several barriers to the successful recruitment of PERC dry cleaners during this initial attempt. As non-Korean representatives of local government with no Korean language skills, it was difficult to share information with Korean dry cleaners, for the following reasons:

- Lack of familiarity of the shop owner with the Haz Waste Program.
- Lack of ability to engage in meaningful conversation because of language barriers.
- Lack of credibility as a non-dry cleaner.
- Lack of cultural connection.

Several shop owners expressed a preference for high-flashpoint hydrocarbon dry cleaning and asked if the financial incentive could be applied to a high-flashpoint hydrocarbon machine. The owners did not say why they preferred high-flashpoint hydrocarbon, but we subsequently learned that the dry cleaning community believes that this technology can clean all fabrics and is similar to using PERC (so little training is required for owners and staff). By contrast, the community perceives that a transition to PWC requires more training and potential downtime for their businesses.

Enhanced recruitment strategy

While we were considering how to improve our recruitment strategy, we compiled a list of vendors of PWC equipment and contacted them to inform them about our financial incentive program (April-May 2018). We were then contacted by a local Korean-owned vendor, who

told us that they had recently become a dealer for Miele PWC equipment.^a This vendor was established and trusted in the local Korean dry cleaning community because they were already supplying solvents, equipment, and other materials to the industry. The vendor then visited their existing PERC dry cleaning clients to advocate for PWC. We provided the vendor with copies of updated promotional flyers (see Appendix E), which they distributed to the shops.

Once the shop owners expressed interest to the vendor, we visited the business, usually with a Korean vendor representative. The vendor made introductions to the shop owner and provided interpretation help, as needed. We administered an English language “Pre-Switch Survey” to gather information about business operations, work practices, attitudes and knowledge about PERC and PWC, and other information to inform our financial incentive program (presented in Appendix F). We conducted an inventory of the products used at the shops and subsequently evaluated their hazards using an on-line hazard evaluation system (SciveraLENS Rapid Screen©);⁽²⁴⁾ the findings are presented in a previously published report.⁽²³⁾ If the machines were running during our visit, we also used a PID to detect PERC leakage.^b We then gave the shop owner a financial reimbursement voucher form and a tax form, which they were asked to return to us once the PWC equipment was installed.

In order to protect confidentiality, shops were assigned a unique identification number (Shop#) for presentation of results. A crosswalk between Shop# and business name was maintained in a password-protected Microsoft ExcelTM workbook on a secure (King County SharePoint) server. Only the Project Manager and two project personnel had access to the crosswalk file.

^a Personal communication between Susan Kim, S.K.Y. & Company (Auburn, WA) and Steve Whittaker, Haz Waste Program. May 21, 2018.

^b A RAE Systems MiniRAE 2000 PID was first used to determine whether the loading door was leaking while the drum was filling with PERC and during fabric agitation. Leak detection was then conducted at the rear of the machine, with emphasis on other doors and entry points, such as filter housings and the door to the still. If open containers of liquid or solid waste were present, the PID was then used to evaluate the presence of PERC vapors. The PID was also used in areas of visible staining. The PID was calibrated with isobutylene prior to use; a correction factor for PERC was not applied to the ppm reading.

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Evaluation of PERC Shops Before Switching to PWC

Shop recruitment, demographics, and business characteristics

We visited 15 shops that expressed interest in the program between April 2018 and January 2019. Fourteen shops were recruited by the vendor and one shop owner contacted us directly.

All interviews were conducted with the shop owners, 11 of which (73 percent) self-identified as Korean. Two owners self-identified as Vietnamese (18 percent), one was White/European-American (7 percent), and one was Indonesian (7 percent). This demographic breakdown is consistent with our previous findings from a survey of the dry cleaning industry in King County, where we learned that over 80 percent of shops in King County were owned and operated by immigrants from South Korea.^(8,9)

Shops were located across King County, with five (33 percent) located in Seattle, the most populous city (Figure 7).



Only two shops also had a “drop shop,” where fabrics were delivered at another location for cleaning at their dry cleaning facility. Only two shops offered a laundry pick up service.

On the average, shops had 1.3 employees. Four had no employees, five had one employee, three had two employees, and three had three employees.

Dry cleaning equipment used by shops

All shops had one PERC dry cleaning machine per location. Ten had a 35-lb. capacity machine, one had a 40-lb. machine, one had a 45-lb. machine, two had a 50-lb. machine, and one had a 55-lb. machine.

The machine manufacturers are summarized in Table 2. Bowe Permac was the most common manufacturer (4 shops), followed by Realstar (3 shops).

Table 2. PERC machine manufacturer	
Manufacturer	No. shops
Bowe Permac	4
Realstar	3
Union	2
SuperStar	1
Bowe Passat	1
Bergparma	1
VIC	1
AMA Universal	1
Forenta	1
Total	15

The machines were between 14 years old (one shop) and 25 years old (one shop). The median age was 18 years and the average was 18.6 years. Considering that the average lifespan of a PERC dry cleaning machine is 15 years, most of these machines were reaching the end of their useful life.^(8,9)

Only one shop owner reported having problems with the machine: a leaking gasket.

Excluding two shops that had not purchased PERC in the previous year because they were new to the business and did not need to replenish their supply, shops purchased an average of 52.3 gallons per year to top off their machines; the median was 45 gallons and the range was 15 to 120 gallons.

PERC leak detection

All shops reported owning a PERC leak detector, which is a regulatory requirement.

However, when leak detection was conducted by field investigators while machines were running, we found that eight of the ten shops/machines evaluated had detectable leaks. It is noteworthy that the investigator smelled PERC as he was leaving a shop with no detectable PERC from the PID scan, suggesting that leakage may have occurred in a later stage in the cleaning cycle.

PID readings ranged from 1-2 parts per million (ppm) (background) to 100s ppm (moderate leakage) to 1000s ppm (mechanical defects and open containers).

The most common source of PERC vapor release was the seal to the machine's loading door (five shops). See Figure 8 for an example. Leakage also occurred at entry points and doors at the rear of the machine (three shops). One shop had a leaking condenser unit and another had a defective, leaking valve. Two shops had open containers of liquid or solid waste that were also releasing PERC.



Figure 8. PERC leakage at a loading door
Note the visible stains below the door, indicating PERC leakage, and the rag (to the left) used to catch drips. The PID reading is 854 ppm.

Process chemicals used with PERC dry cleaning

We inventoried the process chemicals found in the PERC shops and then reviewed their Safety Data Sheets (SDSs) to evaluate hazards. Through this process, we learned that of the 57 products found at the 15 shops, 22 (39 percent) contained extremely hazardous ingredients and ten (17 percent) did not disclose ingredient information on their SDSs. The findings are described further in “*Hazard Evaluation of Products used in Fabric Cleaning*.”⁽²³⁾

Perceptions about PERC and health concerns

When asked whether they thought PERC could cause health problems, four shop owners answered “none.” Five suggested that PERC can cause headaches; some also mentioned eye irritation/dry eyes and coughing. Other health effects mentioned included “lung damage,” “skin/kidney,” and “cancer.”

In response to: “Do you have any health problems after spending time in your shop?” seven answered “none.” Other responses were:

- “eye irritation when cleaning.”
- “headache, dizziness, eye irritation, breathing problems.”
- “headaches.”
- “headaches, coughing.”
- “smell.”
- “headaches, eye irritation.”

Consideration of PWC

All shops reported that they were considering switching to PWC. When asked why, most suggested they were concerned about health effects in dry cleaners and concerns about the environment. One shop suggested that switching to PWC is a trend and another cited the poor condition of his PERC machine. Only one shop explicitly cited the availability of funding from the Haz Waste Program.

Cleaning loads and times

Shops cleaned an average of 15.2 loads per week, where the average load size was 29.5 lbs. (Table 3). Most wash cycles took approximately 50 minutes. Pre-treating stains by spotting took, on average, 90 minutes. Finishing clothes (pressing and steaming) took the most time – on average, 4.75 hours per day.

Table 3. Number, size, and length of PERC cycles and cleaning steps		
Cycle/Step	Average	Range
No. loads per week	15.2	8–27
Load size (lbs.)	29.5	20-35
Washing cycle duration (minutes)	50.3	15-75
Time spent spotting (minutes/day)	90	15–180
Time spent finishing (hours/day)	4.75	0.5–9

Cleaning issues with PERC

When asked about which fabrics were most difficult to clean, most shops suggested that silk was the most challenging because it is a “sensitive” material that bleeds color, can change texture and is prone to shrinkage. Some shops reported that it is hard to release stains from silk. In order to clean silk successfully, shops suggested that careful spot cleaning is required, and considerable experience is needed to successfully clean this delicate fabric. Other fabrics reported as problematic (due to shrinkage and color changes) included leather, wool, cashmere, leather, and rayon. One shop mentioned that finishing drapes after cleaning was difficult.

Re-cleaning

When asked how often they needed to re-clean a clothing item when using PERC, answers varied depending on if the shop owner interpreted the question to mean they were getting unsatisfactory results, or the customers were returning garments to be re-cleaned. Four shops suggested that no fabrics needed re-cleaning in a year, whereas the remaining shops suggested this was necessary twice a day (one shop) to once per year (one shop).

Utility costs

We attempted to gather information about utility costs by reviewing the shop’s bills from their providers of electricity, gas, and water. However, this approach was abandoned because of lack of availability of bills at the shops and language difficulties when communicating with many shop owners. Although all shop owners gave us permission to contact their utilities to retrieve their billing information, several utilities required resource-intensive procedures before they would release information. Consequently, a review of the utility costs will be included in a separate report that will describe the economic benefits of switching from PERC to PWC.

Other comments

When we asked: “Is there anything else that you would like to tell us?”, we received the following responses:

- “Avoids unsatisfactory results by sometimes cleaning garments twice. Learned about wet cleaning from magazines.”

- “Concerned about potential redevelopment in the area and losing lease.”
- “Sizing makes clothing crispy, customers don't like.”
- “Need to change machine.”
- “Still has concerns about switching, but open to it.”
- “Concerned about replacing spot cleaners.”
- “My wife is really pushing transition because she doesn't like the smell of PERC.”

Evaluation of Shops After Switching to PWC

Introduction

Follow-up visits were conducted at shops approximately six months after they installed their PWC equipment. Note that shops were assigned ID numbers based on the order in which they were recruited. Shops #02, #03, #11, and #13 were visited by field staff while they were using PERC, but they did not commit to adopting PWC during the pilot program. Therefore, PWC data for these four shops are not presented in this report.

We typically visited the shop with their trusted vendor and administered an English language “Post-Switch Survey” to learn about their transition to PWC (presented in Appendix G). At this visit, we also provided the shops with several promotional materials, including window display posters of two different sizes (3 feet x 4 feet and 18 inches x 24 inches) and a tabletop display that explained the PWC process (see Appendix H).^a We emphasized that display of these materials was optional.

Washers and dryers purchased by shops

The most common manufacturer of PWC equipment purchased by those participating in the pilot program was Miele. Of the 11 shops, eight purchased the Miele PW818 washer, which has a capacity of 45 lbs.; one shop purchased the Miele PW6207 washer, also 45-lb. capacity, and one shop purchased the Miele PW6321 washer, which has a capacity of 70 lbs. Nine of the 11 shops purchased the Miele PT8407D dryer (45-lb. capacity) and one shop purchased the Miele PT8507D dryer (55-lb. capacity).

One shop (#14) purchased a used Tosei-W machine (50-lb. capacity). This shop also purchased a used dryer – a Cissell CHD30 (35-lb. capacity). Concern was expressed by the vendor who participated in this pilot study that the equipment purchased by this shop did not meet the strict definition of PWC. This vendor’s concerns were heightened when they learned that this shop also installed a high-flashpoint hydrocarbon dry cleaning machine, which they suggested would be used for most fabric cleaning. This shop also purchased consumer-grade detergent and fabric softener, unlike those who purchased new Miele equipment.

Satisfaction with the switch to PWC

Most dry-cleaning shop owners were very happy with their decision to switch from PERC to PWC (see Figure 9 and Table 4). Those that gave lower ratings mentioned that their rating would increase if the more sophisticated form finishers were not as expensive, stain removal

^a Promotional materials were developed in partnership with the Korean vendor and several shop owners. We were asked specifically not to mention “wet cleaning” on the posters because some shop owners were worried that this may cause concern among customers with clothes labeled “dry clean only.” Similarly, shop owners wanted the option to provide the tabletop information on PWC.

was easier, and if the drying time and learning curve were shorter. Five shops mentioned they were not having any problems with PWC. Shrinkage with certain fabrics (wool), color bleeding, difficult grease stain removal, and learning the PWC processes were the most common difficulties noted.

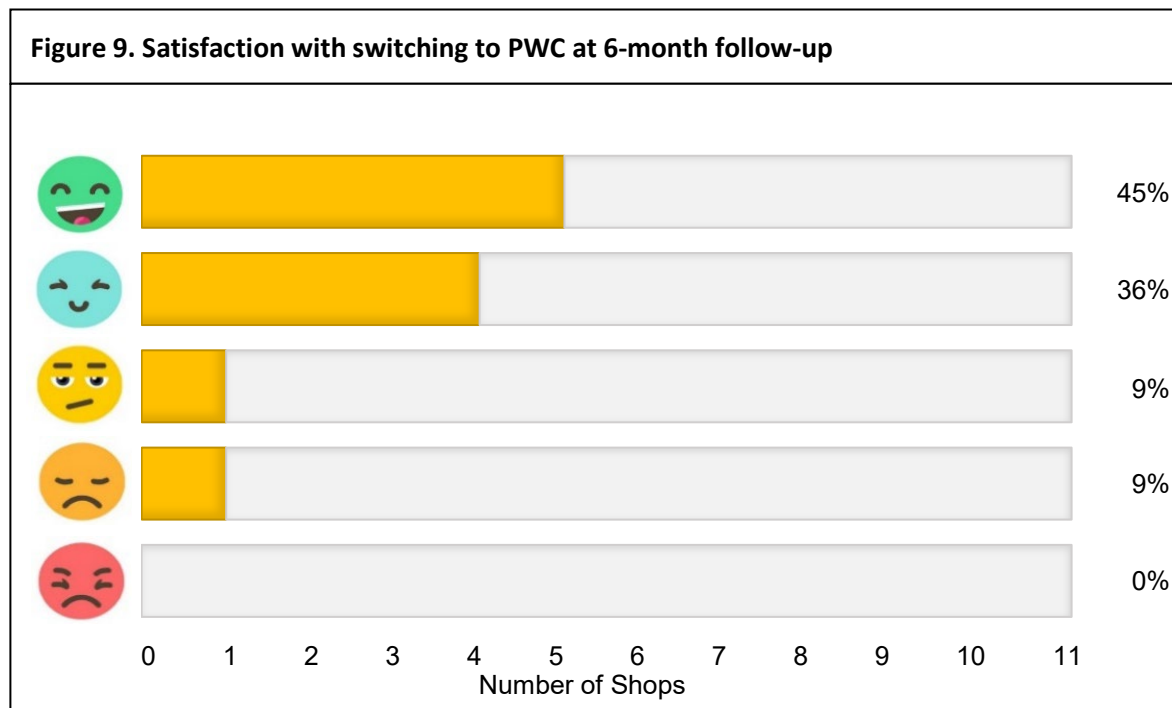
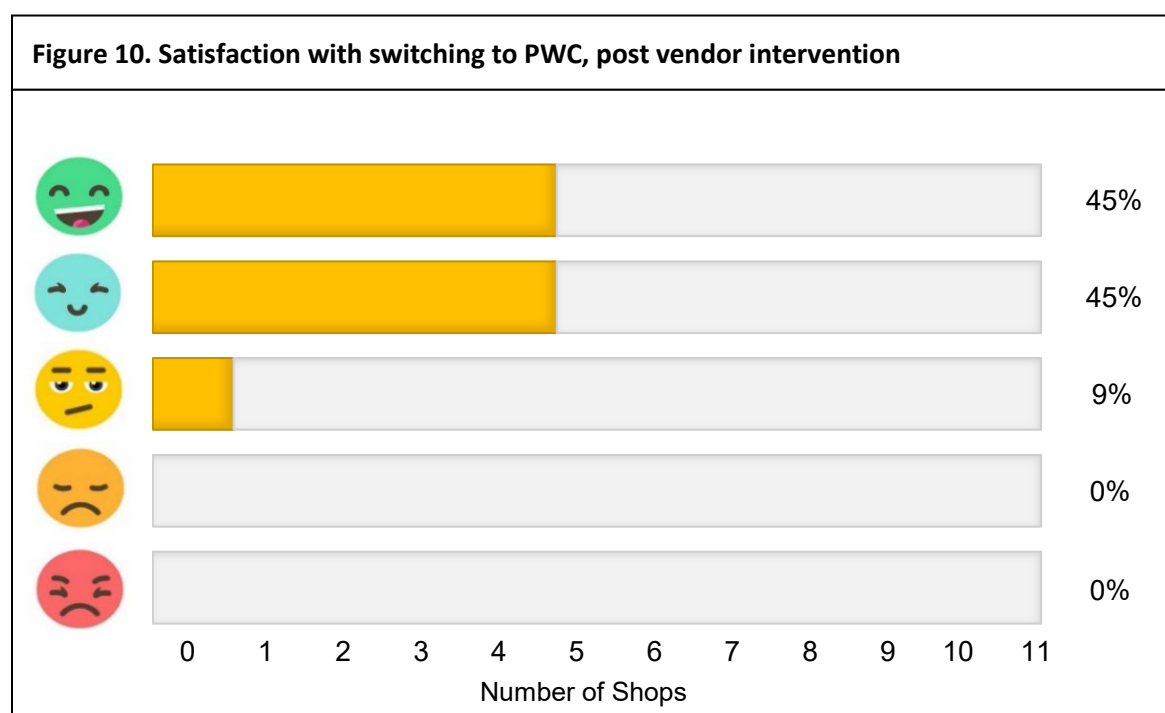


Table 4. Satisfaction with switching to PWC at 6-month follow-up		
Satisfaction level	Shop	Comments
	#01	No problems at all. Noted that a shop without tensioning equipment will likely have difficulties. Willing to share his experience with anybody.
	#04	Very happy. No problems.
	#07	Occasional shrinkage with sweaters but they just need to stretch them out. Not a big issue.
	#10	Clothes are more clean than before. Very safe for them (owners). No smell.
	#12	Machine easy to use (calculations already done for you). Only used PERC ~6 months, mostly used hydrocarbon. Prefer washing to dry cleaning (cleans better).
	#06	Very happy but frustrated because customers want one-day turnaround. Often not possible because of the need for pressing.
	#08	Challenging learning curve - still thinking like a dry cleaner. No alternative to wet.
	#14	Wife was worried about PERC, so happy they switched. Some customers are concerned.
	#16	Deprit 4 doesn't take grease out.
	#05	Stains don't come out of some clothes/more time needed for pressing.
	#15	Color fading. Can't mix colors. Slight under-color to some garments. Couldn't remove stains from silk blouse.
		--

Follow-up visits were made to the two shops that were the least satisfied with the switch to PWC (#05 and #15). During these visits, we realized that these shops would benefit from further instruction on the PWC process. We subsequently notified the equipment supplier, who provided additional training to these shops. We then re-administered the satisfaction survey three weeks after the additional training, and noted considerable improvement in their satisfaction - both moved up one category on the satisfaction scale (Figure 10).



Cost to switch to PWC

The average total cost to switch to new PWC equipment was \$60,000 (range: \$50,000 to \$80,000). Those with the highest costs typically also purchased tensioning equipment (Table 5). The cost for the one shop (#14) that purchased used equipment was \$22,000, including \$3,000 for a used tensioning pants topper.

The shop with the highest total cost (\$80,000) included their estimate of lost business due to difficulties learning the new equipment and processes. It is noteworthy that the infrastructure of this shop was problematic in that neither their spotting table nor boiler were operating correctly. This shop also did not own tensioning equipment and was operated solely by the owner, with no employees. Excluding this shop from the cost summary, the average total cost to switch to new PWC equipment was \$55,000 (range: \$50,000 to \$70,000).

Table 5. Average cost of supplemental PWC equipment			
Equipment	No. shops	Cost – New (range)	Cost – Used (range)
Tensioning Pants Topper	5	\$11,000 (\$10,000 - \$12,000)	\$4,000 (\$3,000 - \$5,000)
Tensioning Form Finisher	1	\$20,000 (NA)	--
NA: Not applicable			

Utility costs

As described above, we were not able to gather reliable information about utility costs in the field nor readily obtain information from the utility companies. Consequently, a review of utility costs will be included in a separate report that will describe the economic benefits of switching from PERC to PWC. However, we learned that two shops that had previously passed cooling water through their PERC machines continuously and discharged it to the sewer saved “several hundred dollars” per month in water bills once they switched to PWC. Other shops, which employed cooling towers and reused their water, did not see this degree of utility savings.

Purchase of hydrocarbon machines

Two shops purchased a separate large-capacity high-flashpoint hydrocarbon machine to supplement their PWC system (#12 and #14). Reasons given for this purchase included accommodating customers who demand one-day service or dry cleaning with an organic solvent. One shop stated that they clean cashmere only in the high-flashpoint hydrocarbon machine.

Adequacy of training by vendors

Only two shops said they did not get the training they needed when switching to PWC; all other shops felt adequately trained. Three shop owners had prior experience with PWC and did not need training (Table 6). One owner was concerned that the focus of the training was on the equipment rather than the washing process. The second owner suggested that it was difficult to contact the vendors, although subsequent conversations with the vendors revealed that they had spent considerable extra time helping this shop.

Table 6. Dry-cleaning shops reporting adequate training on PWC		
Adequate Training?	# Shops	Reason
Yes	9	Had prior experience (3)
No	2	No one came for training; calls not returned.

Cleaning loads and times

Most wash cycles took approximately 25 minutes, and dry cycles took on average ten minutes (Table 7). Pre-treating stains by spotting took, on average, 40 minutes. Finishing clothes (pressing and steaming) took the most time – on average, 6.3 hours per day.

Table 7. Number, size, and length of PWC cycles and cleaning steps		
Cycle/Step	Average	Range
No. loads per week	24.3	15 – 40
Load size (lbs.)	20.6	7.5 – 35
Washing cycle duration (minutes)	25.4	12 – 35
Drying cycle duration (minutes)	10.3	3 – 40
Time spent spotting (minutes/day)	39.8	10 – 180
Time spent finishing (hours/day)	6.3	4 – 12

Cleaning issues with PWC

Certain fabrics were reportedly difficult to clean with PWC, as noted by ten of the 11 shops. Fabrics that presented the most difficulties included wool/cashmere and silk, especially multi-colored silk garments. Other difficult fabrics noted by at least one shop were rayon, sheepskin, cotton, linen, and constructed garments (e.g. suit jackets, sports jackets, and outdoor coats). The reasons cited for the difficulties include shrinkage, issues with colors fading or bleeding, excessive wrinkles, difficult stain removal, and garments being ‘stiff’ after washing and drying. Most shops adjusted for these difficulties by spending more time steaming and pressing, changing the wash and dry cycles (smaller loads, using the delicate/sensitive program, and/or air drying and modifying the dry time), spending more time spotting, or refusing to clean certain fabric types (e.g. rayon).

Changes in health status

Seven shop owners responded they noticed improvements in their health since they switched to PWC. Most of these shop owners mentioned they no longer suffered from a cough or headache, a prior consequence of the strong PERC odor. One owner mentioned a persistent sore on his hand when using the PERC machine that had since healed. Another mentioned having more energy and no longer suffering from eye irritation.

Re-cleaning

When asked how often they needed to re-clean a clothing item when using PWC, answers varied depending on if the shop owner interpreted the question to mean they were getting unsatisfactory results, or the customers were returning garments to be re-cleaned. Only a few

shops mentioned customer complaints, ranging from one to ten garments per year. Many shops responded that they often had to re-clean a garment after one round in the machine, between ten times a year to nearly every day.

Process chemicals used with PWC

As described in “*Hazard Evaluation of Products used in Fabric Cleaning*,” of the 24 products found at the 11 PWC shops, four shops (17 percent) contained high hazard ingredients and three (12 percent) did not disclose ingredient information on their SDSs.⁽²³⁾

Waste disposal

Only eight shops paid to dispose of hazardous wastes when they were using a PERC machine; the remaining shops disposed of their waste at no cost at the King County Moderate Risk Waste facility. Average cost for disposal was roughly \$550 per year. Since switching to PWC, none of the shops paid to dispose of hazardous waste.

Informing customers of technology updates

Eight of the shops had not told their customers that they switched to PWC. The most common reason was the difficulty in explaining the new process or concern that customers will not understand that PWC can be used on “dry-clean only” fabrics. We learned that customers with good relationships and trust in the shop were more understanding. Those who chose to disclose to their customers mentioned that they wanted them to know they were not using harmful solvents and were proud of the higher quality of the process.

Cleaning sent elsewhere

Only four shops sent fabrics to another dry cleaner. Reasons included clothing heavily stained with oil, leather (sent to the same specialty service before adopting PWC), and items where the owner was worried about shrinkage and/or could not remove stains.

Customer feedback

Five shops had received feedback from customers after their switch to PWC. Customers mentioned that their wool suits and sweaters felt and smelled better, noting better quality and brighter colors. Two shops received negative feedback regarding shrinkage of wool sweaters.

Other comments about working with King County, vendors, or switching to PWC

Additional comments included many positive notes and suggestions for the financial incentive program. One shop owner was very satisfied and grateful, and noted he would have switched to PWC earlier if the financial assistance had been available. This shop became an ambassador for the program; the Korean owner has been interviewed by media, participated in promotional videos, and is training other cleaners. Another shop owner mentioned saving money - from lower energy bills to not paying a ‘sludge’ disposal fee. Another shop owner stated that his business appears to be increasing since switching to PWC. Most of the shops appeared to be doing well and appeared happy with their decision to adopt PWC.

Several owners noted the high cost of switching to PWC (i.e., washer, dryer, and new pressing/tensioning equipment), saying it may be hard for small dry cleaners to switch even with the reimbursement. Some also complained about the high cost of detergents and other process chemicals.

Another common complaint was the increase in pressing time, especially in those that had not invested in tensioning equipment. Others mentioned that they needed to change their drying process to adjust for increased fabric wrinkles and shrinkage. Several owners said that tensioning equipment is necessary, otherwise it may be too difficult and not worth switching to PWC. One mentioned that a training on how to press garments after using PWC would be beneficial.

Another common concern was that customers do not understand the PWC process and may be concerned that their clothes will shrink; public education (perhaps a website) and advertising were mentioned several times to address this issue.

One shop owner noted that cleaners also need to be fully aware of what the switch to PWC will entail and that a seminar for those thinking of switching would be beneficial.

We noted that one shop had initial problems because the owner did not follow the manufacturer's instructions, especially for drying. Consequently, he had many cotton garments hanging to dry that were very wrinkled. Additional training was provided to the shop and the vendor learned that the owner was making manual changes to the machine. This has largely been resolved, but in follow-up interviews, he still needed advice on how to better hang and dry garments.

Overall, heavily oil-stained garments and shrinkage of wool continue to be a problem.

Conclusions and Recommendations

Benefits of PWC

Adoption of PWC provides several benefits to health and the environment and promotes equity and social justice in our region. Once shops switched from PERC to PWC, they no longer used a hazardous solvent to clean fabrics and no longer generated organic solvent hazardous wastes. In addition, the ancillary process chemicals provided by the PWC vendors (spotting agents, etc.) are less toxic than those used in PERC operations. Although utility data proved difficult to review, two shops that continually flushed cooling water through their PERC machines reduced their water usage and utility bills quite considerably after transitioning to PWC. Other studies have documented significantly lower consumption of natural resources (i.e., gas, electricity and water) when using PWC compared to PERC.⁽¹⁸⁻²¹⁾ Most shop owners expressed happiness with their decision to adopt PWC, with some suggesting that their health had improved.

Although this financial incentive program was not informed using a formal alternatives assessment, it is instructive to evaluate the pros and cons of switching to PWC according to the criteria (i.e., modules) provided in the Interstate Chemicals Clearinghouse (IC2) “*Alternatives Assessment Guide*.”⁽²⁵⁾ Table 8 provides a synopsis of alternatives assessment considerations based on our experience administering this financial incentive program.

Table 8. Alternatives assessment summary for PWC	
Criteria	PWC vs. PERC considerations
Hazard	• Uses water and detergents, rather than PERC • Provided process chemicals are less hazardous, but shops occasionally retained hazardous legacy products from PERC dry cleaning
Exposure	• No exposures to PERC and other hazardous process chemicals when vendor-provided process chemicals are used
Performance	• With proper training and ancillary supplies/equipment, cleans as well as PERC - although some need to modify their cleaning techniques
Cost and availability	• PWC machines and ancillary equipment prohibitively expensive for many • PWC process chemicals can be more expensive • Upgrading of shop infrastructure, presses, tensioning equipment, and other equipment can be prohibitively expensive • Financial incentive programs necessary for adoption. Many shops would prefer high-flashpoint hydrocarbon because of familiarity and ease • Utility bills typically lower • Equipment readily available from multiple manufacturers/vendors
Materials management	• Cleaning operation no longer generates organic solvent hazardous waste • Resource usage typically lower
Social impact	• Eliminates exposures and adverse health outcomes in typically underserved working populations, customers, and surrounding communities

Factors important for success

One of the most important findings from this pilot study was the need to engage the Korean dry cleaning community in a culturally appropriate manner. Even though the Haz Waste Program has been providing financial and technical assistance to this industry for over 25 years, our initial attempts to convince shop owners to transition to PWC were unsuccessful. The ultimate success of this program was largely due to the engagement of a local Korean vendor, who was trusted by the community. We worked closely with the vendor and the community to develop our approach and create promotional materials in Korean using appropriate language and graphics.

We also developed a close working relationship with the principal regional (West Coast) vendor of Miele and Kreussler products, who had previously helped us learn about another alternative to PERC, Solvon K4. This vendor arranged tours and demonstrations at his clients' facilities, which allowed us to develop an in-depth understanding of PWC. He provided extensive training at PWC shops that purchased the Miele-Kreussler package, and periodically checked in with his clients to ensure their operations were successful.

One of our Korean early adopters was very enthusiastic about promoting the pilot program. Consequently, we developed a promotional video with dialog entirely in Korean and optional English subtitles, aimed at educating other dry cleaners in the community (see Figure 11 for a screen shot). This video is available on YouTube at <https://binged.it/39rbDJe>.

This pilot program and other dry cleaning work conducted by the Haz Waste Program garnered considerable media coverage in 2018-2019, summarized in Table 8 (current as of January 2020).



Table 9. Media coverage (as of January 2020)

Title	Source	URL
It's time to get toxic chemicals out of dry cleaning	Environmental Health News	https://www.ehn.org/dry-cleaning-chemical-replacements-2622967905.html?rebellitem=2
Dry cleaning (and its toxic process) is on its way out	KUOW	https://www.kuow.org/stories/dry-cleaning-and-its-toxic-process-is-on-its-way-out-what-s-in-wet-cleaning
Amid concerns over health, dry cleaners look to “wet” alternative	Marketplace	https://www.marketplace.org/2019/06/07/amid-concerns-over-health-dry-cleaners-look-to-wet-alternative/
How Dangerous Are Dry Cleaning Chemicals?	Vice	https://www.vice.com/en_us/article/kzmp7x/how-dangerous-are-dry-cleaning-chemicals
Helping dry cleaners switch to safer alternatives: Towards a PERC-free King County by 2025	Public Health Insider	https://publichealthinsider.com/2018/10/24/helping-dry-cleaners-switch-to-safer-alternatives-towards-a-perc-free-king-county-by-2025/
King County grant program helps dry cleaners switch to non-toxic cleaning systems	International Examiner	https://iexaminer.org/king-county-grant-program-helps-dry-cleaners-switch-to-non-toxic-cleaning-systems/
Dry cleaning is dirtier than you think. Meet the neurotoxin hiding in your winter coat.	Popular Science	https://www.popsoci.com/dry-cleaning-chemicals/
How Sustainable Is Renting Your Clothes, Really?	Elle	https://www.elle.com/fashion/a29536207/rental-fashion-sustainability/
The Wild West of Organic Drycleaning: Demystifying Opportunities for Investors	Karma	https://karmaimpact.com/the-wild-west-of-organic-drycleaning-demystifying-opportunities-for-investors/
Dry cleaning dangers: Cancer-causing solvent remains in use at dozens of Northeast Ohio dry cleaners	WKYC	https://www.wkyc.com/article/news/investigations/dry-cleaning-dangers-cancer-causing-solvent-remains-in-use-at-dozens-of-northeast-ohio-dry-cleaners/95-3982671f-412d-4223-b5c8-9c2e23eb6f14

The success of this program also reflected the support provided by elected officials (i.e., the King County Board of Health) and senior management in the Haz Waste Program and our partner agencies. This ensured the availability of sufficient funds to potentially transition every PERC dry cleaner in King County to PWC. Support for this program was bolstered when Ecology adopted an equivalent financial incentive program throughout Washington state

in September 2019.^a This development had two important consequences. First, it provided assurance to our elected officials and managers in King County that their financial investment was justified. Second, shops in King County also became eligible for a \$20,000 incentive for PWC from Ecology, for a total reimbursement of \$40,000 – substantially lowering the cost burden for transitions.

Federal regulatory factors also contributed to our success, including the recent identification of PERC as a ban candidate under revised TSCA and the requirement to remove PERC dry cleaning machines from residential buildings by December 21, 2020, per the Clean Air Act. This information was shared with the vendors and dry cleaners and provided additional motivation for businesses to move away from PERC.

In addition, other environmental programs, most notable of which is the Toxic Use Reduction Institute (TURI) at the University of Massachusetts Lowell, had previously demonstrated the health and environmental benefits of PWC.^(18,19) This allowed us to share credible information with vendors and shop owners. Ecology also collaborated with us extensively, providing technical assistance and ensuring that all procedures conformed to local environmental regulatory requirements (see below).

Shop-specific factors important for successful adoption of PWC included:

1. A boiler of sufficient capacity to generate enough steam to power the washer, dryer, pressing equipment, tensioning equipment, spotting table, etc.
2. An adequate supply of natural gas and electricity.
3. Modern tensioning equipment - to preclude labor-intensive pressing and ironing of fabrics.
4. Expertise in clothing construction and stain removal. Relatively novice cleaners faced a steep learning curve and required considerable training.
5. Periodic follow-up and training by vendors.

Challenges

Challenges noted with transitioning shops from PERC dry cleaning to PWC included:

1. During the decommissioning of the first PERC shops, we noted the potential for excessive PERC exposures to the workers and potential violations of Ecology's requirements for transportation and waste disposal. We also noted the potential for worker injury from manipulating heavy equipment, electrical components, gas lines,

^a Ecology's program provides reimbursement of \$20,000 for PWC or \$10,000 for high flashpoint hydrocarbon equipment. Details are available at <https://ecology.wa.gov/Regulations-Permits/Guidance-technical-assistance/Dangerous-waste-guidance/Common-dangerous-waste/Dry-cleaners/Replace-PERC>

steam, etc. Consequently, we suspended the financial incentive program while we collaborated with industrial hygienists from the Washington State Department of Labor & Industries (L&I) to monitor worker exposures during machine decommissioning at two shops and developed recommendations for appropriate protective measures. Collaborating with Ecology, we also addressed environmental protection and developed guidelines that must be followed for shops to be eligible for our financial incentive program. A guidance document developed in collaboration with Ecology is presented in Appendix I: *“Decommissioning perchloroethylene (PERC) dry cleaning machines: Guide to proper disposal and worker protection.”*

2. Shops with inadequate infrastructure and lack of modern tensioning equipment faced greater challenges in adopting PWC than those with adequate supplies of gas, electricity, steam, and updated equipment.
3. Shop owners with limited understanding of garment construction and stain removal also found the transition to PWC challenging.
4. As of January 2020, some shop owners were beginning to consider purchasing different process chemicals than those provided by the machine vendor. The principal reason cited was cost. However, it is unclear whether the replacement process chemicals are as safe and effective as those originally provided by the vendor.
5. Although most shops in this pilot study purchased a package comprised of Miele equipment and Kreussler process chemicals, we are beginning to see the appearance of different PWC equipment and supplies as additional vendors promote our financial incentive program. However, we have little information about the safety and effectiveness of these newer PWC packages.

Recommendations

We recommend that other agencies and programs seeking to promote the adoption of PWC consider the following courses of action:

1. Develop the program using an equity and social justice lens. It is vital that interactions with the dry cleaning community be conducted in a culturally appropriate manner. This involves working closely with the communities to hear their needs, solicit ideas, and incorporate their feedback during every step of the process.
2. Ensure that sufficient funding is available to fully implement the program across the relevant jurisdiction. This may be achieved by securing the support of local elected officials and senior managers. Establishing partnerships with other agencies and programs may also be effective.
3. Leverage the existing relationships between vendors of PWC equipment and their customers (i.e., shop owners) to promote the program. These vendors have a financial incentive to ensure the success of the program.

4. Ensure that shops considering PWC have the infrastructure necessary to support the new PWC equipment. This also includes ensuring that the shop owners are aware of the need for modern tensioning equipment, which can cost an additional \$30,000.
5. The vendors providing equipment and process chemicals should provide adequate training in PWC. This is particularly important for less experienced cleaners. Periodic follow-up will also be required.
6. Funding for shops to make the transition to PWC should be contingent upon the removal of products that contain extremely hazardous ingredients, especially chlorinated hydrocarbons, such as PERC, trichloroethylene, and methylene chloride.
7. The process chemicals intended for use with PWC should be reviewed before providing funding, to ensure that none are extremely hazardous.
8. Periodic unannounced inspections should be conducted to ensure that no extremely hazardous products are being used by PWC shops.
9. The vendors of PWC equipment and process chemicals should be notified immediately if any changes to the equipment or process chemicals are noted during inspections.
10. Ensure that PERC machines are decommissioned according to local environmental and health & safety regulations.
11. Develop a recognition program, with promotional materials, to acknowledge the willingness of the cleaner to adopt a safer and environmentally preferable technology.

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Appendix A:
Regulatory Environment regarding PERC

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PERC usage in dry cleaning is heavily regulated at the federal, state, regional and local levels. In Washington State, dry cleaner waste is regulated under Ecology's dangerous waste (DW) regulations. The federal **Resource Conservation and Recovery Act** (RCRA) governs the entire scope of hazardous waste handling, including generation, storage, transportation, treatment and disposal.

Washington State's counterpart to RCRA is the **Hazardous Waste Management Act** (Chapter 70.105 RCW). (See also Chapter 173-303 Washington Administrative Code (WAC)). Dry cleaners who use PERC typically generate dangerous waste. Most dry cleaners are considered small quantity generators because they generate less than 220 lbs. of dangerous waste and/or less than 2.2 lbs. of acutely hazardous waste per month or per batch.

Other state or regional regulatory agencies with jurisdiction over PERC usage include:

- **Puget Sound Clean Air Agency (PSCAA)** has jurisdiction over King, Kitsap, Pierce, and Snohomish Counties in Washington State and requires PERC dry cleaning shops to adopt dry-to-dry machines and perform regular inspections for leaks.¹
- **Washington State Department of Labor and Industries' (L&I's)** Division of Occupational Safety and Health (DOSH) enforces occupational exposure limits for PERC under the Washington Industrial Safety and Health Act (WISH Act).
- **King County Industrial Waste Program (KCIW)** has regulations for sewer discharge.²

Many federal regulations address PERC usage in dry cleaning, as shown in Table 2. In 2006, the U.S. Environmental Protection Agency (EPA) issued their Final Amendments to Air Toxics Standards for Dry Cleaners. Dry cleaning machines co-located in residential buildings will be prohibited from using PERC by 2020.

Table 2. Federal Regulations Pertaining to PERC Use in Dry Cleaning.³

Federal Agency	Regulation
EPA (Environmental Protection Agency)	
Clean Air Act	Listed as a Hazardous Air Pollutant (HAP).
	Urban Air Toxics Strategy: Identified as one of the 33 HAPs that present the greatest threat to public health in urban areas.
Clean Water Act	Effluent Guidelines: Listed as a Toxic Pollutant.
	Water Quality Criteria: Listed as a Priority Pollutant. 0.60 µg/L based on human health, fish/shellfish and water consumption, 3.3 µg/L based on human health, fish/shellfish consumption.

Federal Agency	Regulation
Emergency Planning and Community Right to Know Act	CERCLA Reportable Quantity for spills and accidental releases is 100 lbs.
	Toxics Release Inventory: Listed substance subject to reporting requirements.
Resource Conservation and Recovery Act	Listed Hazardous Waste: Waste codes in which listing is based wholly or partly on PERC include U210, F001, F002, F024, F025, K016, K019, K020, K073, K116, K150, K151
	Characteristic Toxic Hazardous Waste: TCLP Threshold = 0.7 mg/L (D039)
Safe Drinking Water Act	Maximum Contaminant Level (MCL) = 0.005 mg/L Maximum Contaminant Level Goal (MCLG) = zero
OSHA (Occupational Safety and Health Administration)	
Permissible exposure limit	Time-weighted average (8 hr) = 100 ppm
DOT (Department of Transportation)	
Code of Federal Regulations, Title 49, Part 172	Considered a hazardous material and a marine pollutant. Special requirements have been set for marking, labeling, and transporting this material.
FDA (Food and Drug Administration)	
Code of Federal Regulations Title 21, Part 165.110	Maximum permissible level in bottled water = 0.005 mg/L.

References

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Appendix B:
Policy Examples from Other Jurisdictions

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Policy Examples from other Jurisdictions

Table 1. Federal

Policy Strategy	Legislation or Program	What Happened?
Ban (EPA, 2008).	National Perchloroethylene Air Emission Standards for Dry Cleaning Amendments CFR Part 63 Subpart M	<i>For existing dry-cleaning machines in residential buildings:</i> All existing PERC machines must be removed from residential buildings by December 21, 2020. <i>For new dry-cleaning machines in residential buildings:</i> Any new machines in residential buildings are not allowed to use PERC. <i>For relatively new dry-cleaning machines in residential buildings:</i> Any PERC dry-cleaning machine in residential buildings that began operating between 12/21/2005-7/13/2006 must install equipment to control PERC emissions. They must eliminate PERC use within 3 years of this rule.

Table 2. California

Policy Strategy	Legislation or Program	What Happened?
Ban (California EPA ARB, 2007a).	Airborne Toxic Control Measure for Emissions of PERC from Dry Cleaning Operations (Dry Cleaning ATCM) Amended December 2007, issued by California Air Resources Board (CARB)	<i>For existing dry-cleaning machines at co-residential facilities:</i> All existing PERC machines must be removed from co-residential facilities by July 1, 2010. <i>For existing dry-cleaning machines in general:</i> Converted machines, and machines 15 years or older, must be removed from service by July 1, 2010. All PERC machines must be removed from services once they become 15 years old (thus all PERC machines must be removed from service by January 1, 2023). <i>For new dry-cleaning machines in general:</i> Prohibit the installation of new PERC dry cleaning machines beginning on January 1, 2008.

Policy Strategy	Legislation or Program	What Happened?
Financial Incentive (California EPA ARB, 2007c).	Assembly Bill (AB) 998 and the Non-Toxic Dry Cleaning Incentive Program Effective January 1, 2004, issued by California State Legislature.	“California established the <i>Non-Toxic Dry Cleaning Incentive Program</i> to provide financial assistance to the dry cleaning industry to switch from systems using PERC to non-toxic and non-smog forming alternatives. AB 998 requires ARB to impose a three-dollar (\$3) per gallon fee on the importers of PERC for dry cleaning operations commencing January 1, 2004. This fee will increase one-dollar (\$1) per gallon per year from 2005 through 2013. Most funds collected by the fee will be used to provide \$10,000 grants to assist dry cleaners in switching to non-toxic and non-smog forming cleaning technologies such as wet cleaning and carbon dioxide (CO₂) cleaning. The balance of funds will be used to establish the demonstration program.”
Demonstration Program (California EPA ARB, 2007c).	Same as above.	The legislation also requires CARB to establish a demonstration program to showcase non-toxic and non-smog forming technologies statewide, such as water-based and CO ₂ cleaning systems. The program educates dry cleaning businesses on the benefits, costs, and effectiveness of these alternatives. Dry cleaners participating in the demonstration program may receive additional funding.

California’s program

California’s approach will be discussed in detail since this is a potential model for King County. California’s approach – the Non-Toxic Dry Cleaning Incentive Program – consists of a ban, financial assistance, and a demonstration program.¹ So far, California has awarded 196 grants for professional wet cleaning equipment dating back to 2006.² Approximately 350 PERC cleaners are still operating in California as of 2017.²

Grants. The grant program is based on a per gallon fee on every manufacturer of PERC in California and on every person that imports PERC into the state for use in dry cleaning. The fee began at \$3 per gallon sold in 2004 and increased by \$1 per year to \$12 per gallon in 2013. The fee remains at \$12 per gallon. Notably, California’s program establishes a fee on PERC only, not other solvents. However, many other states have imposed a relatively high fee on PERC and a lower fee on other dry cleaning solvents to fund the remediation of dry cleaning sites. California has given 196 grants since 2006, which averages to 8.7 grants per year.

The California fees are paid to the state board, which deposits them into the “Nontoxic Dry Cleaning Incentive Trust Fund.” The grant part of the program began in 2004 and provides \$10,000 grants to eligible PERC dry cleaners. These funds are used to help the businesses transition to dry cleaning systems determined by the state board to be nontoxic and non-smog forming.

The California law requires that the grants be awarded to dry cleaners in areas with the highest exposure to air contaminants, localized contaminants, or both, including communities of minority populations, low-income populations, or both.

Demonstrations. The demonstration program began in 2007. Since its inception, the demonstration program has been administered by outside researchers such as the University of California, Los Angeles. The funding for this program allowed these researchers to effectively demonstrate the approved non-toxic and non-smog forming dry cleaning technologies. The demonstration program allows dry cleaner owners and operators to view the operations of non-toxic technologies. They provide educational and technical resources. Individual dry cleaners may become a demonstration site facility. Financial incentives in the form of a demonstration site grant are available for demonstration sites.

Ban. The ban was passed in 2007 and phased-in restrictions on PERC machines. In California PERC use in dry cleaning will be phased out statewide by 2023.¹ The ban was an essential motivating factor in the success of the California program.

Table 3. New York State

Policy Strategy	Legislation or Program	What Happened?
Signage (City of New York, 2017)	Amendments to Chapter 12 of Title 15 of the Rules of the City of New York Requiring Posting of Notices at Dry Cleaning Facilities Effective 2014, issued by New York Department of Environmental Protection	As of February 2014, all dry cleaners are required to post the type of chemicals they use, following the passage of public “Right to Know” legislation. <i>For Businesses Using PERC as their primary solvent:</i> Dry cleaning establishments that use perc in their cleaning process will be required to post a sign (8 ½ x 11) that includes the name of the store, the manufacturer of the perc product (e.g. Dow Chemical, Vulcan Chemicals), as well as their DEP air permit number and Right To Know ID number. <i>For Businesses Using Chemicals Other Than PERC as their primary solvent:</i> Dry Cleaning establishments using non-PERC solvents will be required to post a sign (8 ½ x11) that includes the name of the store; the primary chemical substance used in the cleaning process, as well as the DEP air permit number (if applicable), and any Right To Know (RTK) ID number if the facility files under the RTK Law. <i>Note:</i> regarding non-PERC cleaners, the signs only require the commercial brand name of the primary chemical used (e.g. DF2000 Fluid, Green Earth SB-32). If your dry cleaning process uses both PERC and non-PERC solvents you will be required to post both signs.

Policy Strategy	Legislation or Program	What Happened?
Demonstration (Winnebeck & Ramchandra, 2011; Winnebeck, 2015)	NYS Professional wet cleaning Program Effective 2010-2016, launched by New York State Pollution Prevention Institute (NYSP2I), Rochester Institute of Technology	There are approximately 1,590 dry cleaning facilities operating in New York State. About 1,030 of these facilities use perchloroethylene (PERC) as a dry cleaning solvent, 540 use an alternative solvent and 20 use both PERC and alternative solvents. NYSP2I's Professional Wet Cleaning Program has three parts: 1) Development of NYS wet cleaning educational materials, 2) Encouraging wet cleaning as an alternative to PERC through conversions, and 3) Demonstration of wet cleaning throughout the NYS garment cleaning industry.

Table 4. Massachusetts

Policy Strategy	Legislation or Program	What Happened?
Signage (Environmental Defense, 2015; Commonwealth of Massachusetts, 2016a; Commonwealth of Massachusetts, 2016b)	Bill H.2068, Bill H.4415 Under consideration in 2016 by State of Massachusetts Legislature (did not pass)	A proposed bill (H. 2068) in the State of Massachusetts Legislature (2006) would have required disclosure of solvents used in dry cleaning and the posting of signage regarding the type(s) of chemical(s) used. There was also a related "study" bill. The bills did not pass.
Demonstration (Toronto Environmental Alliance, n.d.)	TURI Program Launched by The Toxics Use Reduction Institute, University of Massachusetts	The Toxics Use Reduction Institute (TURI) has an extensive program to help the dry cleaning sector in Massachusetts move to Professional Wet Cleaning. The website offers videos, fact sheets and reports documenting the financial, health and environmental benefits of wet cleaning. To date TURI has supported nine Massachusetts dry cleaners to switch from PERC use to dedicated professional wet cleaning.
Financial Incentive (Toronto Environmental Alliance, n.d.; Toxics Use Reduction Institute, 2016)	Grant Program Launched by The Toxics Use Reduction Institute, University of Massachusetts	TURI offers grants of ~\$15,000 to help dry cleaners transition to wet cleaning while providing technical and community support.

Massachusetts's program

Massachusetts' program differs from California's in that it is not a ban and is not funded by fee per gallon of solvent. Massachusetts' program is funded by a fee paid to the state by industries that use toxic chemicals.

Grants. Joy Onasch at TURI stated that the dry cleaning program has operated for 10 years and awarded 16-18 grants of between \$10,000 and \$15,000. Those grants are only for dedicated professional wet cleaning facilities (i.e., with no dry cleaning equipment). Training support is provided after the facility is converted to professional wet cleaning. Grants have been provided to Korean, Hispanic, Vietnamese, and Caucasian-owned shops. The typical total cost to adopt professional wet cleaning is between \$35,000 and \$55,000. The balance usually originates from the business owner's savings and/or financing via the equipment vendor.

Demonstrations. TURI also administers a demonstration program. The TURI program was initially launched with a one-time demonstration at a large facility where equipment was set up and wet cleaning professionals from California were flown out to demonstrate its use. Vendors also participated. Since then, demonstrations had been held at dry cleaning businesses, where hosts are paid \$500 to conduct the training. TURI coordinates the event, such as mailing announcement postcards. Typically, four to ten people attend these "hands-on" demonstrations, which include loading the machine, adding detergents, discussing how the washer and dryer work (such as moisture control), and demonstrating tensioning.

Market trends. In the last ten years the number of PERC dry cleaners in Massachusetts has dropped from ~435 to ~250. However, the program still receives applications for grants and they are still awarded annually.

Lessons learned and general information. Ms. Onasch recommended a tax and defined revenue stream to fund grants (i.e., like the California model).

Regarding the professional wet cleaning/wastewater issue, in Massachusetts wastewater from professional wet cleaning must be discharged to sewer. One professional wet cleaning shop was on septic, not sewer. That cleaner discharged to a holding tank and then trucked the water to a wastewater treatment plant.

Ms. Onasch also recommended looking into a utility-sponsored dedicated facility to showcase energy efficient equipment, including professional wet cleaning equipment. She toured such a facility in California. She also recommended looking into utility rebates for switching to professional wet cleaning.

Table 5. South Coast Air Quality Management District (SCAQMD)

Policy Strategy	Legislation or Program	What Happened?
Ban	Rule 1421, Control of Perchloroethylene Emissions from Dry Cleaning Systems, adopted 1994, last amended 2002 issued by South Coast Air Quality Management District (SCAQMD)	Any dry cleaner opening after January 2003 is forbidden from using PERC. All PERC machines in the SCAQMD jurisdiction must be removed from service by 2020.
Financial Incentive (SCAQMD, 2014).	Financial Incentive Grant Program, adopted 2013 by SCAQMD	• \$20,000 grants available for: CO2 Machines • \$10,000 grants available for: Professional wet cleaning Systems (water-based system consisting of washer, dryer, tensioning pants topper, and tensioning form finisher; SCAQMD approved equipment only) • Up to \$5,000 grants available for: Incomplete Professional wet cleaning Systems (SCAQMD approved equipment only, contact an SCAQMD representative for details)
Demonstration Program	Same as above.	In 2000, the SCAQMD funded a demonstration project that compared before-and after evaluations of seven dry cleaning businesses that converted from PERC to professional wet cleaning.

Table 6. City of Philadelphia

Policy Strategy	Legislation or Program	What Happened?
Ban (City of Philadelphia, n.d.; Environmental Defense, 2015)	Air Management Regulation XIV, 2010 Effective 2010 by the Department of Public Health, Philadelphia	<i>For co-sensitive facilities:</i> The City of Philadelphia extended the EPA phase-out of PERC in dry cleaning operations located in residential buildings to co-sensitive facilities. These are defined as units that are below, above or next to a hospital, daycare, school, health clinic, community center or recreation area. The regulation forbids the use or emission of PERC by both co-located and co-sensitive facilities after the year 2013.
Financial Incentive (Environmental Defense, 2015)	Same as above.	All co-located facilities are eligible for a \$1,000 grant to purchase a new non-PERC dry cleaning machine.

References

1. "Non-Toxic Dry Cleaning Incentive Program (AB998)." California Air Resources Board (CARB). Retrieved from: <https://www.arb.ca.gov/toxics/dryclean/ab998.htm>.
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Appendix C:

Policy Options Evaluation Process

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Evaluation Criteria	Policy Strategies				
	Option 1 <u>DO NOTHING</u>	Option 2 <u>DEMONSTRATION PROGRAM</u>	Option 3 <u>BAN</u>	Option 4 <u>FINANCIAL ASSISTANCE</u>	Option 5 <u>SIGNAGE</u>
	No local policy action taken. EPA work continues. Possible federal ban in 2021/2022. After EPA issues its determination, review and decide how to proceed.	Establish a demonstration program coupled with EnviroStars recognition. It would showcase safer alternative technologies; educate dry cleaning businesses on the benefits, costs, and effectiveness of alternatives; and focus on professional wet-cleaning.	Phased in ban. In phases, prohibit installation of new PERC machines, then require replacement of co-residential PERC machines, then require replacement of PERC machines that are over 15 years old. Finally, require replacement of all PERC machines	Provide dry cleaners with \$20,000 grants to fund the ~\$50,000 to \$70,000 cost to switch to professional wet cleaning.	Pass regulation requiring disclosure of solvents used in dry cleaning and the posting of signage regarding the type(s) of chemical(s) used.
Benefit human health and environment					
Financial impact on dry cleaner owners and workers					
Feasibility					
Implementation cost					

Policy Options Evaluation Process

Human Health & Environmental Impact
• Will the strategy protect human health and the environment from exposures to PERC through usage in dry cleaning in the next 10 years? • How certain are we about the protectiveness of the strategy? • Will the strategy encourage moving to professional wet cleaning, rather than other alternatives that may be harmful to human health and the environment?
Financial Impact on Dry Cleaner Owners and Workers
• Will the strategy have a negative financial impact on dry cleaner owners and workers? • Does the strategy attempt to mitigate negative financial impacts?
Feasibility
• Has the strategy been successful in other jurisdictions? • Is there significant stakeholder support or opposition for the strategy?
Implementation Costs
• What is the cost of implementing the strategy? • How will the strategy be funded? Is the funding source sustainable?

Appendix D:
King County Board of Health Resolution 18-07

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KING COUNTY

1200 King County Courthouse
516 Third Avenue
Seattle, WA 98104

Signature Report

April 20, 2018

Resolution 18-07

Proposed No. 18-07.2

Sponsors

1 A RESOLUTION supporting collaborative efforts
2 to improve the health and well-being of King
3 County residents and the environment by reducing
4 exposure and use of hazardous chemicals and
5 replacing those used in homes and businesses with
6 safer alternatives.

7 WHEREAS, it is vital to protect and enhance public health by reducing the use of
8 toxic chemicals and increasing the use of safer alternatives, and it is essential for this to
9 be grounded in the principles of equity and social justice, and

10 WHEREAS, the Frank R. Lautenberg Chemical Safety for the 21st Century Act
11 was passed by the United States Congress in 2016, which amends and updates the Toxic
12 Substances Control Act ("TSCA"), and

13 WHEREAS, under the updated TSCA, the Environmental Protection Agency
14 ("the EPA") must assess the 85,000 chemicals allowed for use in the United States
15 against a risk-based health standard and unreasonable risks identified in the risk
16 evaluation must be eliminated, and

17 WHEREAS, international and national health agencies and programs, such as the
18 International Agency for Research on Cancer, the Occupational Safety and Health

Administration, the Centers for Disease Control and Prevention, the Consumer Product Safety Commission and the EPA recognize that many of these chemicals used in commerce and available to the public can have severe health impacts on adults, children, and the environment, and

WHEREAS, the state of Washington has been a leader in reducing exposure to harmful chemicals by phasing out chemicals such as lead, phthalates, highly fluorinated substances, also known as PFAS, and some toxic flame retardants from certain products and King County has supported these efforts, and

WHEREAS, in an effort to comply with environmental regulations, there are several examples of hazardous chemicals being replaced with "regrettable substitutes," and having severe effects on workers, children and others, including vulnerable populations and

WHEREAS, a "regrettable substitute" is a chemical that has unknown, if not more severe, health and environmental impacts than the chemical it replaced, and

WHEREAS, it is vital for the health and well-being of King County residents and the environment that any priority chemical be replaced by a "safer alternative," which is a replacement that has fewer health and environmental impacts and is functional and cost effective, and

WHEREAS, the field of "green chemistry," which is the design of chemical products and processes that reduce or eliminate the generation of hazardous substances, is a burgeoning discipline, and

40 WHEREAS, the Local Hazardous Waste Management Program's mission is to
41 protect and enhance public health and environmental quality in King County by reducing
42 the threat posed by the production, use, storage and disposal of hazardous materials, and

43 WHEREAS, the Local Hazardous Waste Management Program is establishing a
44 Safer Alternative Strategy to assess hazardous chemicals, including those being evaluated
45 by the EPA for restrictions such as perchloroethylene, which is a human carcinogen used
46 extensively in dry cleaning facilities in King County, and ensure that such chemicals are
47 replaced by safer alternatives and not regrettable substitutes, and

48 WHEREAS, the Safer Alternative Strategy will be grounded in King County's
49 principles of equity and social justice, including considerations of cost, availability,
50 performance and other socioeconomic factors that can be barriers to underserved
51 communities adopting safer alternatives;

52 NOW, THEREFORE, BE IT RESOLVED by the Board of Health of King
53 County:

54 A. The Board of Health commends the Local Hazardous Waste Management
55 Program on its leadership in responding locally to the national changes in chemical
56 regulation brought by the Frank R. Lautenberg Chemical Safety for the 21st Century Act.

57 B. The Board of Health encourages the Local Hazardous Waste Management
58 Program to consider, leverage and build upon its Safer Alternative Strategy as it develops
59 future strategies to encourage safer alternatives and green chemistry initiatives in King
60 County.

- 61 C. The Board of Health encourages the Local Hazardous Waste Management
62 Program to collaborate and partner with state and regional stakeholders in its efforts to
63 further reduce the threat posed by the production, use, storage and disposal of hazardous
64 materials.

Resolution 18-07 was introduced on and passed as amended by the Board of Health on 4/19/2018, by the following vote:

Yes: 10 - Dr. Danielson, Ms. Bagshaw, Mr. Dembowski, Ms. Honda,
Dr. Daniell, Ms. Kohl-Welles, Ms. Birney and Ms. Mosqueda

No: 0

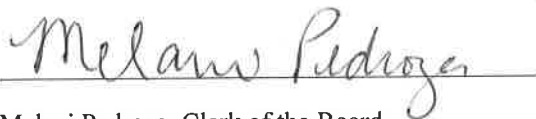
Excused: 3 - Ms. Lambert, Mr. McDermott and Ms. Juarez

KING COUNTY BOARD OF HEALTH
KING COUNTY, WASHINGTON



Rod Dembowski, Chair

ATTEST:



Melani Pedroza, Clerk of the Board

Attachments: None

Appendix E:
Program Promotional Flyers

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Thinking about buying new dry cleaning equipment?



WE ARE OFFERING
\$20,000  **grants**
to help you replace your
perchloroethylene (PERC) dry
cleaning machine with professional
wet cleaning equipment.

"We are very happy with our new machine. The clothes come out clean and I save a lot of time because I'm not cleaning out filters and sludge. My utility bills are lower too. This machine is the future!"

- Tae Park, Owner, Sun Cleaners
Seattle, Washington



Grant Recipients Must

- ✓ Be located in King County and use a PERC dry cleaning machine
- ✓ Clean out and dispose of your PERC machine safely
- ✓ Buy and install a professional wet cleaning system, including new detergents and spot cleaners
- ✓ Dispose of your old detergents, spot cleaners, and other chemicals you used with your PERC machine (we can help you dispose of these for free)
- ✓ Allow us to verify that you have disposed of your old machine and chemicals properly and that your new chemicals are relatively safe

Wet Cleaning Benefits



Safer for the
environment



Safer for
worker health



Savings in
utility costs



Eligibility for
EnviroStars
recognition



 **82%**

of people in King County
prefer environmentally-
friendly businesses



For more information:

 206-477-0660

 drycleanergrants@kingcounty.gov



**Hazardous Waste
Management Program**

Alternative Formats Available

206-263-1650 TTY Relay: 711

LHWMP_0265 09/27/19

Printed on recycled paper. Please recycle. 
1810_9318E_Dry-Cleaning-flyer_Update_and_FAQ.ai

Frequently Asked Questions (FAQs)

Q What type of equipment can I purchase with the grant?

- A** To ensure the best possible cleaning results, we are only providing funds for professional wet cleaning equipment that meets all the following specifications. The new equipment must:
- have a capacity equal to or greater than the PERC machine it is replacing (typically, at least 35lbs.).
 - be capable of cleaning “dry clean only” fabrics in water by using a programmable system to control washing rhythm and speed, water temperature, water level, and extraction speed.
 - include a dryer with residual moisture sensors.

Q Can I buy detergents and conditioners meant for laundry or home washing machines?

- A** No. You must use professional wet cleaning detergents and conditioners designed for use in commercial textile care facilities. Check with the machine manufacturer for a recommended brand.

Q Can I still use the spot cleaners and other products I use with my PERC machine?

- A** No. You must dispose of your old spot cleaners, detergents, sizing, and other chemicals and replace them with products recommended by the equipment manufacturer. We can help you dispose of your old products for free. Your new spot cleaners must not contain harmful halogenated chemicals (like PERC, trichloroethylene, or methylene chloride). Check with your professional wet cleaning detergent provider for a list of approved spotting agents.

Q What is likely to be the total cost of replacing my PERC dry cleaning machine?

- A** The total cost typically ranges between \$45,000 and \$60,000. Costs vary depending on how easy it is to remove your PERC machine and install your new machine, the capacity of the new machine, whether you need to buy pressing and tensioning equipment, and whether you need modifications to your shop, like electrical and ventilation upgrades.

Q How long will my shop have to be closed?

- A** It will take at least two to three days between removing your PERC machine and starting to use your new equipment. Some training may also be required. Check with your vendors.

Q Do I need tensioning equipment?

- A** Yes. You will need a Tensioning Pants Topper and a Tensioning Form Finisher.

Q What is the process for getting the reimbursement?

- A** You must submit the following documentation to the Local Hazardous Waste Management Program: (1) a completed voucher form; (2) receipts (for example, receipts for PERC machine removal and disposal, new equipment, and delivery and installation); (3) an original completed W-9 form with signature. It will take up to three weeks to receive reimbursement after submitting those items. Your reimbursement will be paid by check and mailed through the U.S. Postal Service.

드라이클리닝 장비를 새로 구매하고 싶으신가요?



오래된 퍼클로로에틸렌 (PERC)
드라이클리닝 기계를 전문
웻클리닝 (wet cleaning)
장비로 교체하시면 \$20,000를
보조해 드립니다.



"새 기계에 대단히 만족하고
있습니다. 깨끗하게 세탁되며
시간도 크게 절약됩니다. 필터와
찌꺼기를 청소할 필요가
없으니까요. 전기 요금도
절약됩니다. 미래를 보장하는
기계입니다!"

Tae Park, 워싱턴주 시애틀
Sun Cleaners 오너



보조금 수령 요건

- ✓ 킹카운티 (King County)에 위치해 있으며 PERC 드라이클리닝 기계를 사용하고 있는 업체이어야 합니다
- ✓ 기계안에 남아있는 PERC를 완전히 제거한후 기계를 안전하게 처분합니다
- ✓ 세제 및 스팟 클리너를 포함하여 전문 웻클리닝 시스템을 구매 및 설치해야 합니다
- ✓ PERC 기계에 사용하던 세제, 스팟 클리너 및 기타 화학제품은 처분해야 합니다 (무료로 처분할 수 있게 도와드립니다)
- ✓ 사용하던 기계및 화학제품을 모두 적절하게 처분했으며 새 화학제품이 사용에 안전한지를 카운티 담당관이 확인하는 것에 동의해야 합니다

웻 클리닝의 장점



환경에 더
안전합니다



직원 건강에 더
안전합니다



공과금을
절약해줍니다



인바이어로스타
(EnviroStars)
인증을 받을 수
있습니다



82%

킹 카운티 주민의 82%가
환경 친화적인
비즈니스를 선호하는
것으로 조사되었습니다



더 자세한 정보는 아래로 문의하십시오

☎ 206-477-0660 ✉ drycleanergrants@kingcounty.gov



Hazardous Waste
Management Program

원하시면 다른 형식의 문서 제공이

가능합니다

206-263-1650 TTY Relay: 711

HWMP_0265_KO 09/27/2019

재생 용지에 인쇄되었습니다. 재활용하세요. 1810_9318E_Dry-Cleaning-flyer_Update_and_FAQ_Korean.ai

자주 묻는 질문

Q 보조금으로 어떤 유형의 장비를 구매할 수 있습니까?

- A** 최상의 클리닝 효과를 거둘 수 있도록 다음 기준에 모두 부합하는 전문 wet cleaning 장비에 한해 보조금을 지급하고 있습니다. 새 장비는,
- 용량이 교체 대상인 PERC 기계의 용량과 동일하거나 더 커야 합니다(보통 35lbs 이상).
 - 세탁 동작 및 속도, 수온, 수위, 탈수 속도를 제어하는 프로그래밍이 가능한 시스템을 사용하여
 - 잔여수분(residual moisture) 센서기능이 있는 건조기(dryer)를 포함해야 합니다.

Q Laundry 또는 가정용 세탁기용으로 시판되는 세제와 컨디셔너를 구매할 수 있습니까?

- A** 아닙니다. 상업용 섬유 케어 시설에서 사용하기 위해 고안된 전문 습식 세정 세제 및 컨디셔너를 사용해야 합니다. 장비 제조사에 권장 브랜드를 확인해 보십시오.

Q PERC 기계에서 사용하던 얼룩 제거제 및 기타 제품을 계속 사용할 수 있습니까?

- A** 아닙니다. 기존 얼룩 제거제, 세제, 풀덱임제, 기타 제품은 폐기하고 장비 제조사가 권장하는 제품으로 바꿔야 합니다. 기존 제품 폐기 무상 지원 서비스를 이용하실 수 있습니다. 새 얼룩 제거제는 유해한 할로젠화 화합물(예: PERC, 트리클로로에틸렌, 염화메틸렌) 성분이 없어야 합니다. 전문 물세탁 세제 공급업체에 연락하여 승인된 얼룩 제거제 목록을 받으십시오.

Q PERC 드라이클리닝 기계를 wet cleaning system으로 교체하는 총비용이 얼마나 됩니까?

- A** 일반적으로 \$45,000 ~ \$60,000가량 듭니다. PERC 기계를 철거하고 새 기계를 설치하는 작업의 용이성, 새 기계의 용량, 프레싱 및 텐서닝 장비 구매 필요성, 매장 보수 필요성(예: 전기 공사, 환기구 공사)에 따라 비용이 달라집니다.

Q 얼마동안 영업을 중단해야 합니까?

- A** 기존 PERC 기계를 철거하고 새 전문 장비를 사용하려면 최소한 2일 ~ 3일은 걸릴 것입니다. 또한 교육이 필요할 수도 있습니다. 벤더에 확인해보십시오.

Q 텐서닝 장비가 필요합니까?

- A** 네, 텐서닝 팬츠 토퍼(Tensioning Pants Topper) 및 텐서닝 폼 피니셔(Tensioning Form Finisher)가 필요합니다.

Q 비용을 상환받으려면 어떤 절차를 거쳐야 합니까?

- A** Local Hazardous Waste Management Program에 (1) 완전히 작성하고 서명한 바우처(voucher) 양식 원본, (2) 영수증(예: PERC 기계 철거 및 폐기 영수증, 새 장비 영수증, 배송 및 설치 영수증), (3) 완전히 작성하고 서명한 W-9 양식 원본을 제출해야 합니다. 위의 모든 자료를 제출하면 3주안에 상환금 수표를 우편매일로 받을 수 있습니다.

재정 지원을 받아 상업용 웻클리닝 (wet cleaning) 기기로 전환하세요



다음은 소규모 비즈니스에 용자를 제공하는 대출 기관 목록입니다

Business Impact Northwest

비즈니스 임팩트 NW (Business Impact NW)는 비영리 대출 기관 및 리소스 제공 기관으로 소규모 비즈니스에 용자, 카운셀링 및 트레이닝을 제공합니다. 용자금은 \$5,000에서 \$250,000까지 지급합니다.

Christopher Stone
christophers@businessimpactnw.org
206-324-4330 ext. 105
businessimpactnw.org

Craft 3

크래프트3 (Craft3)는 운전 자본, 재고, 기기 및 상업용 부지 구매 등을 위한 자금을 제공하는 기관입니다. 용자금은 비즈니스 구조 및 규모에 따라 \$25,000에서 \$5백만 달러까지 지급됩니다.

Che Wong
cwong@craft3.org
888-231-2170 ext. 116
craft3.org

Mercy Corps Northwest

머시 코퍼레이션 노스웨스트 (Mercy Corps Northwest)는 은행 및 신용 조합과 같은 전통적인 금융 기관에서 용자를 받지 못하는 소규모 비즈니스 소유주에게 최대 \$50,000까지 대출금을 지급하는 기관입니다.

Edwin A. Rios
erios@mercycorpsnw.org
206-939-2590
mercycorpsnw.org

Ventures Nonprofit

업체 소유주는 기존 비즈니스를 위해 최대 \$35,000까지 용자를 신청할 수 있습니다. 벤처스 (Ventures) 용자를 신청하려면 소득 자격 확인 및 8주 비즈니스 트레이닝 과정을 완료해야만 합니다.

programs@venturesnonprofit.org
206-352-1945
venturesnonprofit.org

이상의 목록은 사전 검사를 거쳤거나 순위에 따라 제공된 것이 아니며 지역 유해 폐기물 관리 프로그램 (Local Hazardous Waste Management Program)의 후원이나 추천을 의미하지 않습니다. 이 목록에 포함된 기관을 이용하고자 하는 분들은 각 회사에서 제공하는 서비스를 주의 깊게 평가해야 합니다. 이 목록에 포함되지 않은 기관은 본 부서에 연락하여 추가를 요청할 수 있습니다.



**Hazardous Waste
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206-263-1650 | TTY Relay: 711

LHWMP 0269-KO (Oct. 2019)
재생 용지에 인쇄되었습니다. 재활용하세요.

Financial help

to switch to professional wet cleaning



The following organizations provide loans to small businesses.

Business Impact Northwest

Business Impact NW is a nonprofit lender and resource provider, offering small business loans and free business counseling and training. Loans range from \$5,000 to \$250,000.

Christopher Stone
christophers@businessimpactnw.org
206-324-4330 ext. 105
businessimpactnw.org

Craft 3

Craft3 provides financing for working capital, purchase of inventory, equipment, and commercial real estate. Loans range in complexity and size from \$25,000 to \$5 million.

Che Wong
cwong@craft3.org
888-231-2170 ext. 116
craft3.org

Mercy Corps Northwest

Mercy Corps Northwest provides loans up to \$50,000 to small business owners who cannot access funding from traditional resources, such as banks and credit unions.

Edwin A. Rios
erios@mercycorpsnw.org
206-939-2590
mercycorpsnw.org

Ventures Nonprofit

Entrepreneurs can apply for loans up to \$35,000 for existing businesses. Income eligibility and completion of 8-week business training course is required to apply for Ventures loans.

programs@venturesnonprofit.org
206-352-1945
venturesnonprofit.org

This list is not screened or ranked and does not imply Local Hazardous Waste Management Program endorsement or recommendation of any kind. Users of this list should carefully evaluate offerings from companies on this list. Companies not listed here may contact us and request to be added.



**Hazardous Waste
Management Program**

Alternative formats available
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LHWMP_0269 (Oct. 19)
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Appendix F: Pre-Switch Survey

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PERC Fabric Cleaning Questionnaire

[DO NOT RECORD SHOP NAME OR CONTACT DETAILS ON THIS FORM]

Interview Date:	
Interviewer	
Interpreter	
Shop ID#:	
Interviewee Position:	
Manufacturer of Machine:	
Model of Machine:	
Machine capacity (lbs.)	

Please tell me your race and ethnicity (optional)

☐ I would prefer not to answer this question.

- ☐ American Indian and Alaska Native
- ☐ American Indian / Native American
- ☐ Alaska Native
- ☐ Other (please list): _____

- ☐ Asian
- ☐ Asian American
- ☐ Asian Indian
- ☐ Chinese
- ☐ Filipino
- ☐ Japanese
- ☐ Korean
- ☐ Vietnamese
- ☐ Other (please list): _____

- ☐ Black or African American
- ☐ African American
- ☐ Ethiopian
- ☐ Somali
- ☐ Other (please list): _____

- ☐ Hispanic or Latino
- ☐ Mexican or Mexican American
- ☐ Puerto Rican
- ☐ Other (please list): _____

- ☐ Native Hawaiian and Other Pacific Islander
- ☐ Guamanian
- ☐ Native Hawaiian
- ☐ Samoan
- ☐ Other (please list): _____

- ☐ White
- ☐ European American
- ☐ Russian
- ☐ Ukrainian
- ☐ Other (please list): _____

- ☐ Some Other Race
- ☐ Iranian
- ☐ Iraqi
- ☐ Other (please list): _____

- ☐ Other (please list): _____

Attempt to **at least** answer all questions in gray portion on first data gathering visit

1. Who is your dry cleaning solvent distributor/supplier?

___ Don't know

Contact name: _____ Business name: _____

Mailing address: _____

Telephone number: _____ Email: _____

2. Have you considered switching to professional wet cleaning? Yes / No

a. **If yes**, why are you thinking about switching to professional wet cleaning: (circle all that apply)

1. Marketing reasons
2. Concerns about the health effects on dry cleaners
3. Pressure from the landlord or property owner,
4. Concerns about the environment
5. Liability for contamination
6. Concern that PERC might be banned
7. other: _____

b. **If no**, what is stopping you from switching to professional wet cleaning?

3. Are you having any problems with your machine? Yes / No

If yes, please describe the problems you are having _____

4. How old is your machine? _____ years

5. How many loads of dry cleaning do you do in a week? _____ loads per week

6. What is the approximate size of each load? _____ lbs./load

7. What is the approximate cycle time per load? _____ minutes/load

8. How much time do you or your employees spend on the following tasks?

a. Spotting (average hours/day): _____

b. Finishing (average hours/day): _____

9. How many drop shops collect clothing and other fabrics to be cleaned at this facility? _____

10. Do you offer a laundry pick-up service? Yes / No

11. Do you have a PERC leak detector? Yes / No

12. How many employees do you have? _____

13. How much dry cleaning solvent do you buy per year to top off your machine (gallons)? _____

14. Do you think that PERC can cause health problems? Yes / No

If yes, what type of health problems? _____

15. Which cleaning products do you use?

On the table, circle the products that you use the most.

Type of chemical	Manufacturer	Product name
Pre-spotting product	1 _____	1 _____
	2 _____	2 _____
	3 _____	3 _____
	4 _____	4 _____
	5 _____	5 _____
Post-spotting product	1 _____	1 _____
	2 _____	2 _____
	3 _____	3 _____
	4 _____	4 _____
	5 _____	5 _____
Detergent	1 _____	1 _____
	2 _____	2 _____
Sizing	1 _____	1 _____
	2 _____	2 _____
Other	1 _____	1 _____
	2 _____	2 _____

16. Which fabrics are most difficult to clean? _____

a. Why are they difficult to clean? _____

b. How do you clean them? _____

17. Do you have any of the following health problems after spending time in your shop? (circle all that apply)

- headaches
- dizziness
- nausea
- eye irritation
- skin irritation
- breathing problems
- other, please describe _____
- none

18. How much do you spend on the following operational costs per year?

- a. Machine maintenance: \$_____ per year
 - b. Filters \$_____ per year
 - c. Hazardous Waste disposal: \$_____ per year
- Regulatory/permitting \$_____ per year

19. Would you be willing to share with us your average monthly cost for utilities? Yes / No

If yes, would you prefer that we review your utility bills or contact the utilities?

On-site review of utility bills:

Gas	\$_____ per month
Water	\$_____ per month
Electricity	\$_____ per month
Wastewater	\$_____ per month

Contacting utilities:

Water _____

Gas _____

Electricity _____

Wastewater _____

20. How often do you need to re-clean a clothing item or respond to a customer claim, due to unsatisfactory results, after one round in the machine? _____ times/year

21. Is there anything else you would like to tell us?

22. Interviewee notes to inform Evaluation. Consider Grant Flyer, Financial Resources Flyer, Grants, Professional wet cleaning technology, Hydrocarbon or other technology, Customers, Other Shops, Utilities, Labor, Vendors, Disposal of their PERC machine, How their business is doing, Other.

PID Scan of PERC Dry Cleaning Machine

Is the machine running? Yes / No

Location on machine	Measured ppm

Overall conclusions on state of machine

Appendix G: Post-Switch Survey

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Post-PERC Switch Questionnaire

[DO NOT RECORD SHOP NAME OR CONTACT DETAILS ON THIS FORM]

Interview Date:	
Interviewer	
Interpreter	
Shop ID#:	
Interviewee Position:	
Date switched to wet cleaning (Month/Year)	
Manufacturer of Washer:	
Model of Washer:	
Capacity of Washer (lbs.)	
Manufacturer of Dryer:	
Model of Dryer:	
Capacity of Dryer (lbs.)	

Please tell me your race and ethnicity (optional)

☐ I would prefer not to answer this question.

- ☐ American Indian and Alaska Native
- ☐ American Indian / Native American
- ☐ Alaska Native
- ☐ Other (please list): _____

- ☐ Asian
- ☐ Asian American
- ☐ Asian Indian
- ☐ Chinese
- ☐ Filipino
- ☐ Japanese
- ☐ Korean
- ☐ Vietnamese
- ☐ Other (please list): _____

- ☐ Black or African American
- ☐ African American
- ☐ Ethiopian
- ☐ Somali
- ☐ Other (please list): _____

- ☐ Hispanic or Latino
- ☐ Mexican or Mexican American
- ☐ Puerto Rican
- ☐ Other (please list): _____

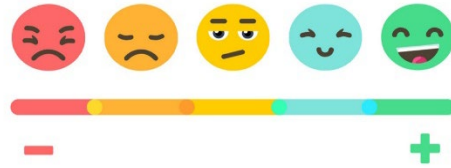
- ☐ Native Hawaiian and Other Pacific Islander
- ☐ Guamanian
- ☐ Native Hawaiian
- ☐ Samoan
- ☐ Other (please list): _____

- ☐ White
- ☐ European American
- ☐ Russian
- ☐ Ukrainian
- ☐ Other (please list): _____

- ☐ Some Other Race
- ☐ Iranian
- ☐ Iraqi
- ☐ Other (please list): _____

- ☐ Other (please list): _____

1. On the scale below, please indicate how happy you are with your decision to switch from PERC to PWC?



Please tell us why/why you are not happy.

What would make you move one point up the happiness scale?

2. Are you having any problems with PWC? Yes / No

If yes, please describe the problems you are having _____

3. Who is your Professional Wet Cleaning (PWC) vendor?

Contact name: _____ Business name: _____

Mailing address: _____

Telephone number: _____ Email: _____

4. Apart from the washer and dryer, what other equipment did you have to buy, and how much did it cost?

- Tensioning Pants Topper. Cost \$ _____
- Tensioning Form Finisher. Cost \$ _____
- Other: _____. Cost \$ _____

5. What was the total cost for you to switch to PWC? \$ _____

6. Did you get the training you needed when you switched to PWC? Yes / No

If no, how could the training be improved? _____

7. How many loads of cleaning do you do in a week? _____ loads per week

8. What is the approximate size of each load? _____ lbs./load

9. What is the approximate cycle time per load?

- a. Washer _____ minutes/load
- b. Dryer _____ minutes/load

10. How much time do you or your employees spend on the following tasks?

- c. Spotting (average hours/day): _____
- d. Finishing (average hours/day): _____

11. Which fabrics are most difficult to clean with PWC?

- _____
- c. Why are they difficult to clean? _____
 - d. How do you clean them? _____

12. Which cleaning products do you use with PWC?

On the table, circle the products that you use the most.

Type of chemical	Manufacturer	Product name
Pre-spotting product	1 _____ 2 _____ 3 _____ 4 _____ 5 _____	1 _____ 2 _____ 3 _____ 4 _____ 5 _____
Post-spotting product	1 _____ 2 _____ 3 _____ 4 _____ 5 _____	1 _____ 2 _____ 3 _____ 4 _____ 5 _____
Detergent	1 _____ 2 _____	1 _____ 2 _____
Sizing	1 _____ 2 _____	1 _____ 2 _____
Other	1 _____ 2 _____	1 _____ 2 _____

13. Since switching to PWC, do you have any of the following health problems after spending time in your shop? (circle all that apply)

- headaches
- dizziness
- nausea
- eye irritation
- skin irritation
- breathing problems
- other, please describe _____
- none

14. Have you noticed any changes in your health since you switched to PWC? Yes / No

If yes, please describe _____

15. Did you purchase a separate hydrocarbon machine to supplement your PWC system? Yes / No

If yes, which fabrics do you only clean in hydrocarbon, and why?

16. Are you willing to share with us your average monthly cost for utilities? Yes / No

If yes, do we have your permission to contact the utilities? Yes / No

On-site review of utility bills:

Gas \$_____ per month

Water \$_____ per month

Electricity \$_____ per month

Wastewater \$_____ per month

Contacting utilities:

Water

Gas

Electricity

Wastewater

17. How often do you need to re-clean a clothing item when using PWC or respond to a customer claim, due to unsatisfactory results, after one round in the machine? _____ times/year

18. How much did you pay per year to dispose of hazardous wastes when you were using PERC?
\$_____

19. How much have you paid to dispose of hazardous wastes generated by the PWC machine?
\$_____

20. Have you told your customers that you have switched to PWC? Yes / No

Why / Why not?

21. Do you send any fabrics to another dry cleaner to be cleaned? Yes / No

If yes, why?

22. Have your customers given you any feedback after you switched to PWC? Yes / No

If yes, what did they say?

23. Is there anything else you would like to tell us about your experience working with King County, your vendors, or switching to PWC?

24. Interviewee notes to inform Evaluation. Consider Grant Flyer, Financial Resources Flyer, Grants, Professional wet cleaning technology, Hydrocarbon or other technology, Customers, Other Shops, Utilities, Labor, Vendors, Disposal of their PERC machine, How their business is doing, Other.

Appendix H:
Promotional Materials Distributed to Shops

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Environmentally-Friendly CLEANING



Traditional dry cleaners use toxic chemicals to clean delicate garments.

Our machines use water and specialized professional detergents to wash “dry clean only” fabrics. It’s safe for you and the environment.



And, it works! No shrinkage, no color fading, and no chemical smells. Just clean clothes every time!

2018 KING COUNTY PROGRAM PARTICIPANT

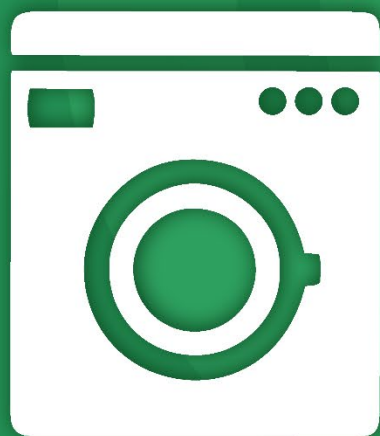


King County



Hazardous Waste
Management Program

SAFER CLEANING



Eco-friendly
cleaning!

2018 KING COUNTY PROGRAM PARTICIPANT



King County



Hazardous Waste
Management Program

Appendix I:
Decommissioning perchloroethylene (PERC) dry cleaning machines:
Guide to proper disposal and worker protection

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Decommissioning perchloroethylene (PERC) dry cleaning machines

Guide to proper disposal and worker protection



Worker prepares PERC machine to decommission. Photo Stephen G. Whittaker

About this guide

King County Hazardous Waste Management Program and Washington State Department of Labor and Industries contributed significantly to the development of these recommendations.

[These recommendations are based](#) on observations made at two businesses where PERC dry cleaning machines were decommissioned.

Contact information

Jeffrey Gutschmidt
425-649-7140
jeffrey.gutschmidt@ecy.wa.gov

ADA accommodations

To request materials in another format, call Ecology at 360-407-6831, Relay Service at 711, or TTY at 877-833-6341. Visit ecology.wa.gov/accessibility or email ecyadacoordinator@ecy.wa.gov.

What is decommissioning?

Decommissioning a PERC dry cleaning machine involves “clean closure” and removal of the machine.

- **Clean closure:** The process of cleaning the machine to a standard where it will be accepted by a scrap metal recycler. This process ensures no hazardous waste remains in or on the machine and that the machine is safe to transport.
- **Removal:** The process of disconnecting and physically removing the machine from service and transporting it to a recycling facility.

How to get started

Request a consultant

We highly recommend you [request a consultation](#)¹ from the Washington State Department of Labor & Industries (L&I) to ensure you and your workers are protected from PERC during the decommissioning process. This service is free and confidential.

Follow appropriate safety regulations

During the decommissioning process, you or your workers will need to handle different aspects of a PERC dry cleaning machine: electrical, gas lines, PERC itself. To ensure safety and minimize risk, follow these guidelines.

Know the levels of PERC

Check [Permissible Exposure Limits \(PEL\)](#)² of PERC when transferring fluids and cleaning out tanks. Consider using a calibrated photoionization detection meter to determine these levels:

- Time-weighted average PEL is 25 parts per million (ppm)
- Short-term exposure limit is 38 ppm for any 15-minute period

Handle electrical equipment carefully

Follow safety protocols and regulations when handling electrical equipment. Use L&I's [Lockout/Tag-out \(LOTO\)](#)³ regulations.

¹ www.lni.wa.gov/Safety/Consultation/default.asp

² apps.leg.wa.gov/WAC/default.aspx?cite=296-841-20025

³ www.lni.wa.gov/Safety/Topics/AToZ/LOTO/Default.asp

Prepare to handle plumbing and gas lines

- Be sure you understand the safety protocols related to connecting and disconnecting water lines. Follow L&I's guidance for [plumbing work](#).⁴
- Use safety protocols when connecting or disconnecting gas lines. Read OSHA's [natural gas safety regulations](#).⁵

Wear proper safety gear at all times

Anyone removing PERC from a dry cleaning machine should wear the following personal protective equipment (PPE):

- Splash-proof safety glasses or face shield
- Chemical-resistant apron or suit
- Extended cuff, chemically-resistant gloves designed for use with PERC.
For example, [Nitrile green unlined PERC glove](#) from Cleaner's Outlet.⁶
- Chemical resistant, steel-toed boots (recommended).
- Respirator (refer to [Permissible Exposure Limits \(PEL\)](#)⁷):
 - If your machine has **PERC levels higher than PEL**, contact L&I for a recommended respirator.
 - If your machine has **PERC levels within PEL**, use an R95 particulate respirator with nuisance level organic vapor relief (i.e., with a carbon layer).

For example: [3M™ Particulate Respirator 8247, R95, with Nuisance Level Organic Vapor Relief 120 EA/Case](#).⁸

Clear a path for removal

Make sure there is enough space to remove the machine from the shop without taking it apart. You may need to deconstruct or remove things such as:

- Clothing racks, chairs, and other objects.
- Countertops.
- Doors.
- Windows.
- Other fixtures.

Prepare to clean out your PERC machine

- Allow the machine to cool overnight before cleaning it out.
- You will need the following items:
 - Rags and absorbent pads
 - Long-handled rod or similar
 - 5-gallon drum for PERC-soaked rags
 - 55-gallon drum for PERC from the machine
 - At least two box fans per worker.
- Set up proper ventilation. Use two box fans to direct fresh air to the workers and direct PERC vapors away from them. Ideally, vapors should be directed outside of the building.



Figure 1. Box fans set up to remove PERC vapors.
Photo by Stephen G. Whittaker, King County

⁴ www.ini.wa.gov/Safety/Topics/AtoZ/PlumbingWork/rules.asp

⁵ www.safetyservicescompany.com/industry-category/construction/safety-when-working-with-natural-gas/

⁶ www.cleanersoutlet.com/products/nitrile-green-unlined-perc-glove/1609#ProductDescription

⁷ apps.leg.wa.gov/WAC/default.aspx?cite=296-841-20025

⁸ www.3m.com/3M/en_US/company-us/all-3m-products/~/3M-Particulate-Respirator-8247-R95-with-Nuisance-Level-Organic-Vapor-Relief-120-EA-Case/?N=5002385+3294780242&rt=rud

Clean out the PERC machine

1. Place absorbent pads on the floor around the machine before opening the tank to catch any spills.
4. Remove the front cover to the PERC tanks.

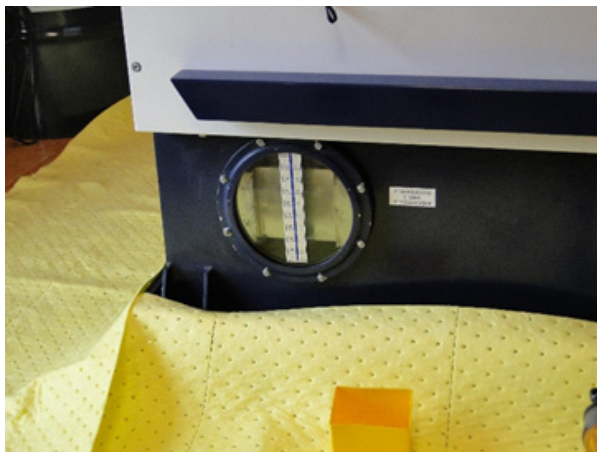


Figure 3. Place absorbent pads around PERC tanks prior to opening. Photo by Stephen G. Whittaker, King County

2. Working one tank at a time. Remove still bottoms and separator water. Place them in a waste drum.
3. Remove PERC from the machine by pumping it directly into a 55-gallon drum from the PERC tank.



Figure 2. Pumping PERC from tanks.
Photo by Stephen G. Whittaker, King County

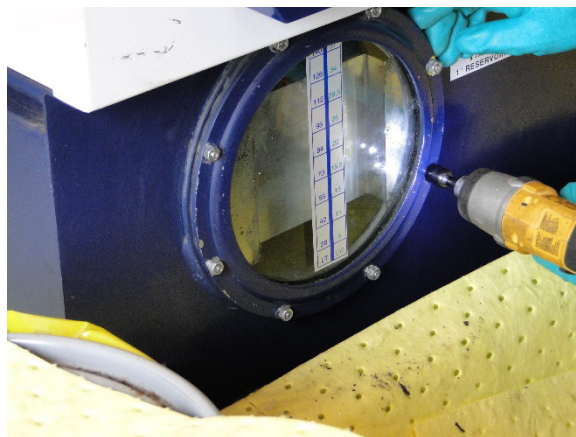


Figure 4. Remove front cover of empty PERC tanks.
Photo by Stephen G. Whittaker, King County

5. Clean out the inside of the tank using:
 - a. Absorbent pads to mop up PERC inside.
 - b. A long-handled rod or similar item to reach the back of the tanks.
 - c. A mechanical pump if several gallons of PERC are left in the tanks.



Figure 5. Clean out PERC tanks with rod and absorbent pad.
Photo by Stephen G. Whittaker, King County

6. Wipe all surfaces in each tank. All metal surfaces must be clean to the sight.
7. Ensure all liquid PERC has been removed.
8. Replace the cover plate on the tank.

Manage dangerous waste

All PERC-soaked rags and absorbent pads used to clean the machine, still bottoms, or “sludge” must be properly managed as dangerous waste.



*Figure 6. Place spent absorbent pads in a waste drum for proper disposal.
Photo by Stephen G. Whittaker, King County*

Remove equipment for disposal

1. Disconnect the gas, electricity, steam, and any other connections.
2. Remove it from your facility.
3. Transport it to an off-site recycling facility for disposal and scrapping.
Note: It is illegal to self-transport PERC or PERC waste on the highway.