

# IC2 Webinar: Safer Alternatives to Perchloroethylene in Garment Care

2018-04-03

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- Q&A following the presentations (final 10 – 15 minutes)
- Attendee lines muted during presentation; I will unmute for Q&A
- You may also submit questions using GoToWebinar's questions interface at any time
- Webinar slides will be posted on <http://theic2.org/events>
- Your feedback is important! Please take the post-webinar survey

# Today's Presenters

- Joy Onasch, Business & Industry Program Manager, TURI
- Ashley Pedersen, Policy Liaison, King County LHWMP
- Steve Whittaker, Ph.D.; Research Services Program Manager; King County LHWMP

# Upcoming IC2 Webinars

## IC2-BizNGO Webinar: The Chemical Hazard Data Commons

Wednesday, April 18, 1:00 - 2:00 PM EDT/10:00 - 11:00 AM PDT

<https://attendee.gotowebinar.com/register/5690285324587364097>



# Alternatives to Perchloroethylene In Garment Care

IC2 Webinar - April 3, 2018

Joy Onasch, P.E.

Business & Industry Program Manager

## What is Perc and Why is it a Problem?

**Able to dissolve most organic materials, perchloroethylene (PCE or perc) is the most widely used dry cleaning solvent in Massachusetts and nationally.**

A typical dry cleaning machine...



Though perc machines have improved emissions over time, there is still exposure to workers and the public through co-located residences and clothes taken home.



## Short and long term health effects linked to use of perc include:

- Dizziness, confusion
- Damage to liver & kidneys
- Neurotoxicity
- Reproductive toxicity
- Developmental toxicity
- Cancer



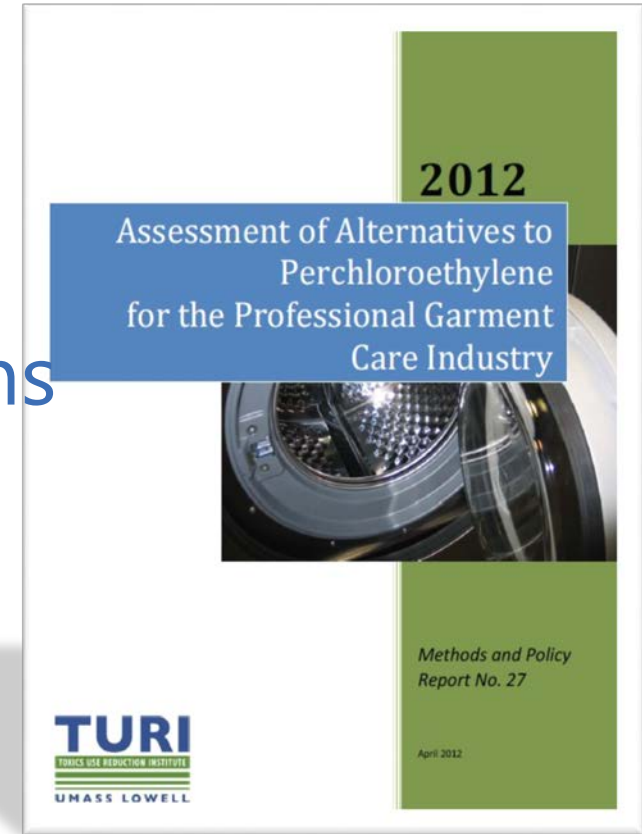
Misuse of perc can lead to soil and groundwater contamination.

75% of drycleaner sites in the US are contaminated.

Many are Superfund sites.

# Alternatives Studied

- Wet cleaning
- CO<sub>2</sub>
- High flash point hydrocarbons
- Acetals
- Propylene-glycol ethers
- Volatile methyl siloxanes
- n-Propyl bromide





# Key Criteria – 1<sup>st</sup> set

## Technical/Performance

- Cycle time and load capacity

- Difficult materials

- Pretreatment and finishing requirements

## Economic

- Equipment costs

- Chemical costs

- Energy costs

Key Assessment Criteria		Perc (reference)	Wet Cleaning <sup>1</sup>	Carbon Dioxide	High Flashpoint Hydrocarbons	Acetal	Propylene Glycol Ethers	Siloxane	n Propyl Bromide
Common Trade Names / Manufacturers of Equipment or Solvents			Wascomat, Miele, Continental, HwaSung, AquaSolo	Cool Clean Technologies, Solvair®	DF2000™ Fluid, EcoSolv®, ShellSol D60, Caled Hydroclene	Solvon K4	Solvair®, Rynex 3®, Impress®, Gen-X®	Green Earth® D5 solvent	Drysolv®, Fabrisolv™ XL
Solvent Chemical Identification [CAS#]		Perchloroethylene [127-18-4]	Solvent: Water Detergents: See full report <sup>1</sup>	Carbon Dioxide [124-38-9]	Naphtha (petroleum) hydrotreated heavy [64742-48-9]; C10- C13 Isoalkanes [68551-17-7]	1-(butoxy methoxy) butane (butylal) [2568-90-3]	dipropylene glycol tert-butyl ether, [132739- 31-2]; di- propylene glycol n-butyl ether, [29911-28-2]	Decamethylcyclo- penta siloxane (D5) [541-02-6]	N Propyl Bromide (nPB) [106-94-5]
Technical / Performance <sup>2</sup>	Cycle time (min)	45	20-40	35-45	60-75	60-65	>45	53-58	45
	Load capacity (lb)	50	20-75	60	35-90	40-90	43	55	50
	Materials system may have difficulty with	Leather, suedes, beads, delicates	Leather, suede and fur	Triacetates, specially dyed acetates	Vinyl appliqués	Appliqués or decorations glued to fabric	None identified	None identified	Leather, suedes, beads, delicates
	Spotting requirements	Moderate	Low	High	Moderate	Low	Low	High	Low
Financial	Equipment	\$40,000 - \$65,000	\$36,000 - \$61,000	\$100,000 - >\$150,000	\$38,000 - \$75,000	\$50,000 - \$100,000	\$56,000	\$30,500 - \$55,000	\$40,000 - \$60,000 or retrofit costs
	Chemical cost per gallon	\$17	\$0.007/gal (water); \$25-\$31/gal (detergent)	\$0.18/lb (CO <sub>2</sub> ); \$40/gal (detergent)	\$14-\$17	\$28-\$34	\$25-\$30	\$22-\$28	\$40-\$64
	Electricity usage <sup>3</sup> (kWh/100 lb)	26.6	9.3	30.9	35.5	Similar to hydrocarbon	Unavailable	54.2	Unavailable
	Typical cost per pound cleaned <sup>4</sup>	\$0.63-\$1.94 avg. \$1.02	\$0.57-\$1.32 avg. \$1.10	\$1.40	\$0.73-\$1.02 avg. \$0.88	Unavailable	\$1.14	\$1.08-\$2.33 avg. \$1.71	Unavailable

# Are Alternatives Effective and Affordable?

**All** options are technically feasible

Some may have impact on throughput

Some have limitations on the fabrics they can handle

**Most** options are affordable

CO<sub>2</sub>-based options not economically feasible  
(for majority of smaller MA shops)

# Key Criteria – 2<sup>nd</sup> set

## Environmental

Persistence

Bioaccumulation

Aquatic Toxicity

## Health and Safety

Exposure limits

CNS effects

Carcinogenicity

Repro/developmental toxicity

Flammability

Key Assessment Criteria		Perc (reference)	Wet Cleaning <sup>1</sup>	Carbon Dioxide	High Flashpoint Hydrocarbons	Acetal	Propylene Glycol Ethers	Siloxane	n Propyl Bromide
Environmental	Persistence <sup>5</sup> (water, soil, sediment, air)	M (water), H (soil, sed, air)	L (water, soil, air), M (sed)	NA	L (water, soil, air), M (sed)	L (water, soil, air), M (sed)	L (water, soil, air), M (sed)	L (water), M (soil), H (sed, air)	L (water, soil), M (sed), H (air)
	Bioaccumulation <sup>6</sup>	Low	Low	NA	Moderate	Low	Low	Moderate	Low
	Aquatic Toxicity <sup>7</sup>	Moderate	Low to Moderate <sup>8</sup>	Low	High	Moderate <sup>9</sup>	Low	High	High
Human Health	Recommended Exposure limits <sup>10</sup>	25 ppm	NE	5000 ppm	100 ppm <sup>11</sup>	NE	NE	10 ppm <sup>12</sup>	10 ppm
	Central Nervous System Effects	Yes	No <sup>13</sup>	No <sup>14</sup>	Yes	No data available	Yes	Some evidence	Yes
	Carcinogenicity	IARC Probable human carcinogen	Not classified by IARC	Not classified by IARC	Not classified by IARC	Not classified by IARC	Not classified by IARC	Some evidence	Clear evidence in animal studies by NTP
	Reproductive / Developmental Toxicity	Yes	Negligible <sup>15</sup>	No data available	No data available	No data available	No <sup>16</sup>	Studies indicate concern	Yes
Safety	Flash Point/ Flammability	NA / Not Flammable	NA / Not Flammable	NA / Not Flammable	140-145°F / Combustible liquid	144°F / Combustible liquid	160-212°F / Combustible liquid	171°F / Combustible liquid	NA <sup>17</sup>

# Are the Alternatives Safer than Perc?

**All** are less persistent; HC and Siloxanes are more bioaccumulative and toxic in aquatic environment

**Most** are safer to humans ... **EXCEPT** ...

- nPB is carcinogenic, reproductive toxic and neurotoxic – **NOT** a safer alternative
- **Data gaps** present concern for alternatives that are new to the market (e.g., Solvon K4 acetals)



# Key Criteria – 3<sup>rd</sup> set:

## Applicable Regulations

Hazardous Air Pollutants

Designated VOCs

Massachusetts regulations

- Listed toxics under TURA
- Environmental Results Program

Hazardous waste disposal issues

Wastewater discharge restrictions

Key Assessment Criteria		Perc (reference)	Wet Cleaning <sup>1</sup>	Carbon Dioxide	High Flashpoint Hydrocarbons	Acetal	Propylene Glycol Ethers	Siloxane	n Propyl Bromide
Applicable Regulations	Clean Air Act Hazardous Air Pollutant (HAP)	Yes, HAP	No	No	No	No	No	No	No
	Clean Air Act NAAQS VOC <sup>18</sup>	No, Exempt <sup>19</sup>	No <sup>20</sup>	No	VOC	VOC	VOC	No, Exempt <sup>19</sup>	VOC
	Massachusetts regulated (TURA, ERP)	TURA Higher Hazard Substance, ERP	No	No	No	No	No	No	TURA
	Hazardous waste disposal required	Yes - Listed hazardous waste	No	No	Yes Waste Oil = Hazardous Waste in MA	No	No	No	No; monitor for residual perc if using retrofitted machine
	Wastewater discharge restrictions	No	Discharge to sewer or holding tank <sup>21</sup>	No	No	No	No	No	No

# Are the Alternatives More Regulated than Perc?

**Most** options are combustible or flammable, requiring additional control for safety

**Several** options are VOCs

**Most** options involve industrial waste disposal, though not hazardous waste disposal

**Wet Cleaning** poses issues for facilities on septic

**nPB** newly regulated under TURA and is a higher hazard substance!

**Wet Cleaning and CO2 are considered the most environmentally friendly options. Wet Cleaning technology is the more affordable of the two.**

Washer and dryer use biodegradable detergents and conditioners



Finishing equipment re-shapes and dries the slightly damp clothes



# MA Conversions to Wet Cleaning

From 2008 through 2018 TURI has given 19 grants to dry cleaners to eliminate the use of perc and switch to dedicated professional wet cleaning

- Cleaners save money on solvent, waste, water, and electricity
- Cleaners are fully satisfied with the process and product; there is less regulatory oversight and risk of contamination
- The work environment is greatly improved
- Customers are very pleased with quality

# KMK Cleaners in Walpole Creates Healthier Workplace



40% reduction in electricity costs

Greater than 50% drop in water use

Saving about \$1,500 per month in operating costs

*"As a family run business, we've been interested in getting away from perc for quite a while, and professional wet cleaning was the right answer. It makes the shop a healthier place for my Dad and me, our employees, and for future generations."* – Kristy Mead, Manager, KMK Cleaners



# AB Cleaners in Westwood Creates Safer Work Environment with Improved Quality



Reduced electric use by almost 30%

Reduced water use by over 50%

Saving over \$400 per month in operating costs

*"We knew that perc was not good for us. I was concerned for the health of my pregnant wife and baby and also for my employees. With wet cleaning, there has been a huge improvement in the way the air smells and the clothes come out cleaner without any shrinkage or the feel of chemicals."* – Joon Han, owner of AB Cleaners

**Business & Industry Program Manager:  
Joy Onasch**

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Email: [joy@turi.org](mailto:joy@turi.org)

Web: [www.turi.org/drycleaning](http://www.turi.org/drycleaning)

# Helping dry cleaners switch from PERC to professional wet cleaning

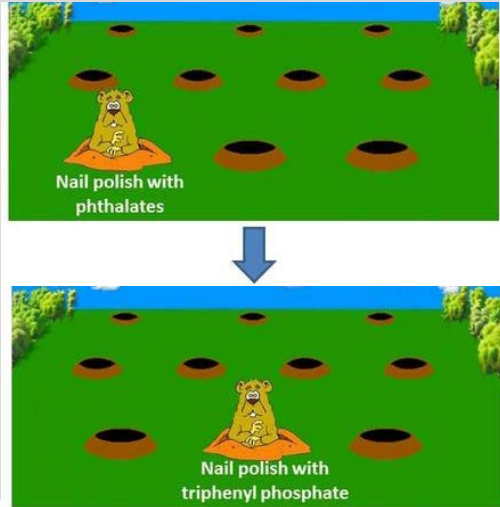
Ashley Pedersen, Policy Liaison

Local Hazardous Waste Management  
Program in King County, WA



**IC2 Presentation**  
**April 3, 2018**

# Federal Changes = Local Opportunities

Federal Changes	Local Risks	Local Opportunities
<p>New chemical review process</p> <p>EPA's final decisions will preempt local and state regulations</p>	<p>Insufficiently protective regulations</p> <p>Regrettable substitution (chemical "whack-a-mole")</p> 	<p>Local review, prioritization, and action on key chemicals of concern</p> <p>EPA creates the 'sticks' and LHWMP creates the 'carrots' for positive change</p> <p>LHWMP is uniquely positioned to work with businesses and residents</p> <p><i>Graphic: nrdc.org</i></p>

# Chemicals being reviewed by EPA

Chemical	Health impacts	Examples of uses
1,4-dioxane	Cancer	Dyes, varnishes, waxes
1-bromopropane	Cancer, developmental and reproductive effects	Foam cushions, dry cleaning
Asbestos	Cancer	Insulation, brake pads
Carbon tetrachloride	Cancer	Industrial uses
Cyclic Aliphatic Bromide Cluster	Developmental effects	Flame retardant, insulation
Methylene chloride	Cancer, developmental effects	Paint stripper
N-methylpyrrolidone	Developmental and reproductive effects	Paint stripper
Pigment Violet 29	Harms aquatic organisms	Dye for paints and plastics
Perchloroethylene (PERC)	Cancer	Dry cleaning, spot removers
Trichloroethylene	Cancer, developmental and reproductive effects	Dry cleaning and degreasers

# EPA Scope of Risk Evaluation

## 2020:

PERC dry cleaning machines prohibited from co-location in residential buildings.

## 2021:

EPA is expected to ban or restrict PERC usage in dry cleaning facilities.

[https://www.epa.gov/sites/production/files/2017-06/documents/perc\\_scope\\_06-22-17.pdf](https://www.epa.gov/sites/production/files/2017-06/documents/perc_scope_06-22-17.pdf)



United States  
Environmental Protection Agency

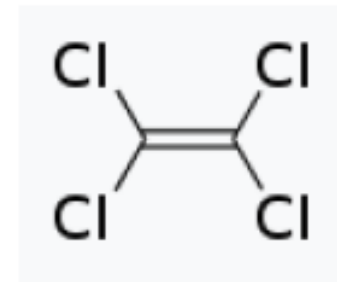
EPA Document# EPA-740-R1-7007

June 2017

Office of Chemical Safety and  
Pollution Prevention

## Scope of the Risk Evaluation for Perchloroethylene (Ethene, 1,1,2,2-Tetrachloro)

CASRN: 127-18-4





# The problem with PERC



- probable human carcinogen
- contaminates groundwater, surface water, and soil

# By the Numbers: PERC in King County

**~90 PERC dry cleaners**

**15 years**

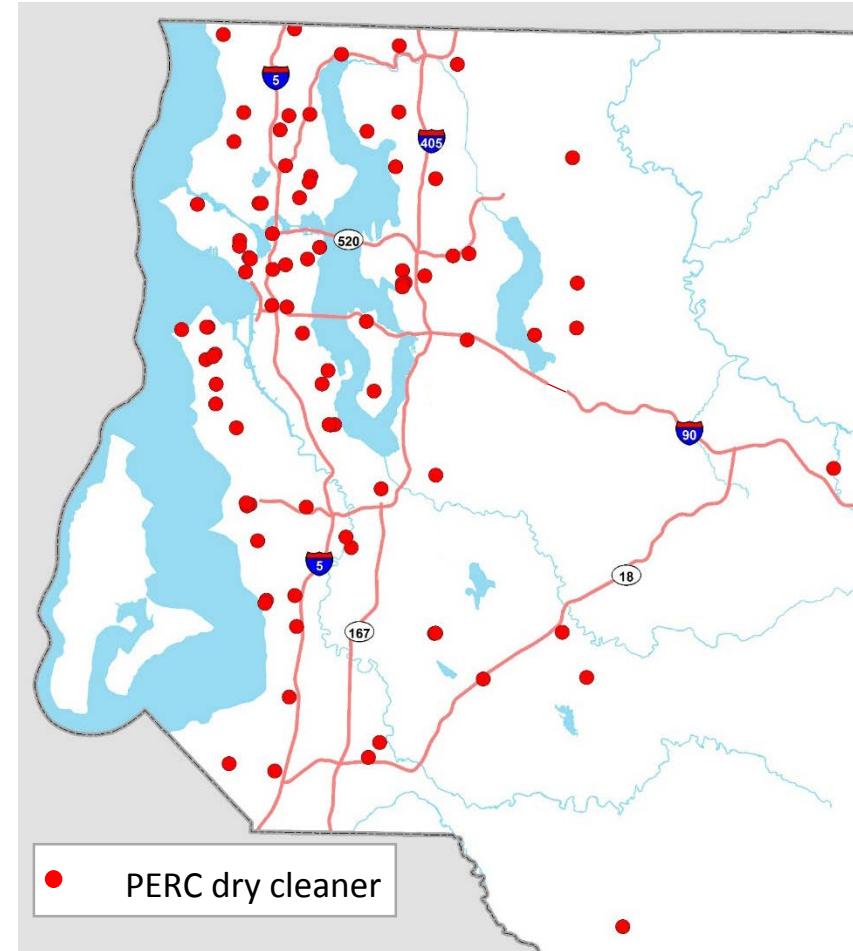
recommended life span of PERC machines

**18 years**

median age of PERC machines in King County

**189 sites**

contaminated by PERC



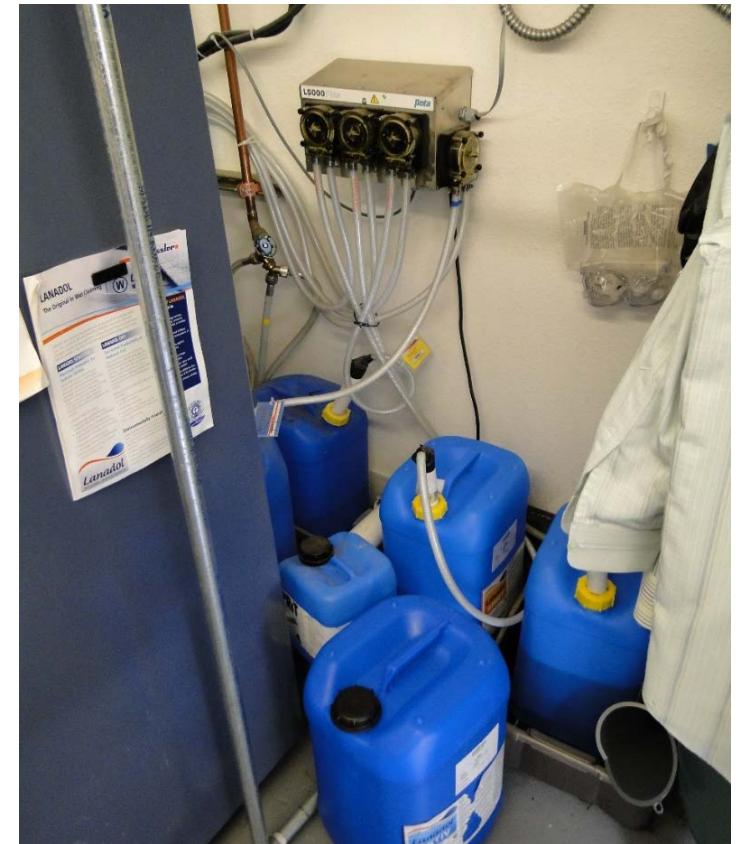
# Professional Wet Cleaning

- ✓ effective
- ✓ safer for workers
- ✓ safer for the environment
- ✓ uses less energy
- ✓ saves money

## Washer Machine



## Metering System



# Policy strategies for shifting away from PERC

Strategy	Description	Jurisdiction
<b>Demonstrations</b>	Educational or pilot programs that target local businesses	California New York Massachusetts South Coast Air Quality Mgmt. Distr. (SCAQMD)
<b>Financial Assistance</b>	Grants intended to help dry cleaning shops switch to alternative solvents	California New York Massachusetts SCAQMD City of Philadelphia
<b>Ban</b>	Phase-out or complete ban of PERC at different levels of jurisdiction	California SCAQMD Philadelphia Minneapolis
<b>Signage</b>	“Right to know” legislation requiring signage of chemical usage in dry cleaning businesses.	New York Massachusetts


# Grant Program

## Goal: A PERC-free King County

- ✓ 2017 Research
- ✓ 2018 Pilot
- ✓ Review and revise
- ✓ 2019 Launch

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 made the switch to wet  
cleaning and are very happy with  
the results. There has been a  
huge improvement in the way the  
air smells and the clothes come  
out cleaner without any shrinkage  
or the feel of chemicals."

- Joon Han, Owner, AB Cleaners,  
Westwood, Massachusetts



### 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 contact Patrick Hoermann:

📞 206-263-1658

✉ Patrick.Hoermann@kingcounty.gov

# Thank You!

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**Ashley Pedersen**

Local Hazardous Waste Management  
Policy Liaison

ashley.pedersen@kingcounty.gov | 206.477.3761  
[www.hazwastehelp.org](http://www.hazwastehelp.org)





# **What do we know about “hydrocarbon” dry cleaning solvents?**

Steve Whittaker, Ph.D.  
Research Services Program Manager  
Local Hazardous Waste Management Program in  
King County, WA



**Local Hazardous Waste  
Management Program  
in King County**

**IC2 Presentation**

**April 3, 2018**

# Outline



- LHWMP's survey & field work
- What are "hydrocarbons"?
- Hazard evaluation
- Classification systems
- Manufacture
- Specifications
- Chemical analysis
- The Good and The Bad

# LHWMP's survey & field work (2010-2012)

킹 카운티 드라이클리닝  
사업자 대상

보다 나은 사업 환경을 위한  
유익한 제안



킹 카운티 지역 유해 폐기물 관리  
프로그램의 자발적 설문 조사

반송 주소:  
Gilmore Research Group  
2101 4<sup>th</sup> Avenue; 8<sup>th</sup> Floor  
Seattle, WA 98121

 Local Hazardous Waste  
Management Program  
in King County

- 69% dry cleaners in King County using PERC
- 21% using “hydrocarbon”:
  - The alternative of choice
  - Usage increasing
  - Separator water may be discharged to sewer (with permit)
- Still bottoms are Dangerous Waste (DW) in WA (but not EHW)

# What are “hydrocarbon” dry cleaning solvents?



- C10-C13 isoparaffinic naphthas / isoalkanes
- Class IIIA liquids (flash point 140-150 °F)
- Products:
  - Exxon Mobil DF-2000 – most common in WA & MA
  - Chevron Philips EcoSolv
  - Technichem Calypsol
  - Others – but not available in King County



# Hazard evaluation of “hydrocarbon” solvents

DF-2000:

CAS# 64742-48-9
















**Pharos** Building Products Chemicals and Materials Certifications CompAIR Dashboard Logout

Dashboard / Chemicals and Materials / [64742-48-9] HYDROTREATED HEAVY NAPHTHA (PETROLEUM)

[64742-48-9] HYDROTREATED HEAVY NAPHTHA (PETROLEUM)

General Information Hazards Compound Groups Process Chemistry Research GreenScreen C2C

Direct Hazards:

PBT	 EC - CEPA DSL - Persistent, Bioaccumulative and inherently Toxic (PBITE) to the Environment (based on aquatic organisms) +1
	 EC - CEPA DSL - Persistent, Bioaccumulative and inherently Toxic (PBITH) to humans
CANCER	 EU - Annex VI CMRs - Carcinogen Category 1B - Presumed Carcinogen based on animal evidence +3
	 EU - GHS (H-Statements) - H350 - May cause cancer
	 EU - REACH Annex XVII CMRs - Carcinogen Category 2 - Substances which should be regarded as if they are Carcinogenic to man
	 Australia - GHS - H350 - May cause cancer
GENE MUTATION	 EU - Annex VI CMRs - Mutagen - Category 1B +3
	 EU - GHS (H-Statements) - H340 - May cause genetic defects
	 EU - REACH Annex XVII CMRs - Mutagen Category 2 - Substances which should be regarded as if they are Mutagenic to man
	 Australia - GHS - H340 - May cause genetic defects
BIOACCUMULATIVE	 EC - CEPA DSL - Bioaccumulative
PERSISTENT	 EC - CEPA DSL - Persistent
MAMMALIAN	 EU - GHS (H-Statements) - H304 - May be fatal if swallowed and enters airways +1
FLAMMABLE	 Québec CSST - WHMIS 1988 - Class B3 - Combustible liquids
RESTRICTED LIST	C2C Certified™ - v4 RSL (DRAFT) - Children's Products +5
MULTIPLE	 ChemSec - SIN List - CMR - Carcinogen, Mutagen &/or Reproductive Toxicant +3

# How toxic are “hydrocarbon” solvents?

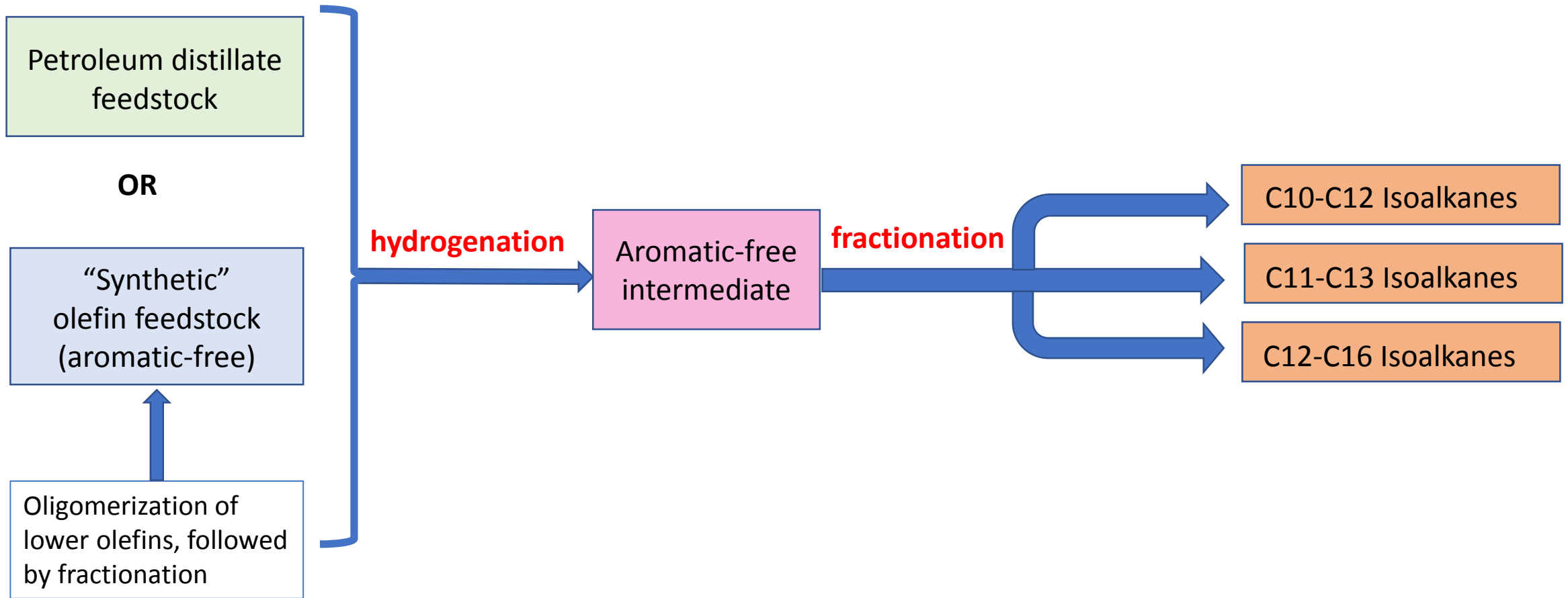
- Mckee et al. (2015):
  - 64742-48-9: “...consists of hydrocarbons having carbon numbers predominantly in the 6–13 range and boiling in the range of approximately 65 to 230°C.”
- US EPA (2010):
  - “The composition and physical properties of this substance can vary considerably, depending on the raw material and the production processes”
- Official Journal of the EU (2006):
  - “The classification as a carcinogen need not apply if it can be shown that the substance contains less than 0.1% w/w benzene”

# Classifying products: CAS# vs. EC#



- CAS#
  - Non-specific
  - May reflect feedstock, *not product*
- EC#
  - Designed by API for EU REACH
  - Specific to final product
  - EC# 920-901-0 = Hydrocarbons, C11-C13, isoalkanes, <2% aromatics

# Manufacturing Isoalkane Dry Cleaning Solvents (High Flash “Hydrocarbons”)





## DF-2000™ Fluid Dry Cleaning Fluid

Properties	Minimum	Maximum	Unit	Test Method
Appearance	Pass		-	VISUAL
Aromatic Content		0.02	wt%	AMS 140.31
Odor, Bulk	Pass		-	BTQAL 018
Color, Saybolt	30		-	ASTM D6045 ASTM D156
Flash Point	60		°C	ASTM D56
Specific Gravity @ 15.6/15.6 C	0.760	0.775	-	ASTM D4052





## Chevron Phillips Chemical Company Issued Sales Specification

### Name of Product

**ECOSOLV DRY CLEANING FLUID**

### Revision Date

**3/26/2012**

Chevron Phillips Chemical Company LP  
10001 Six Pines Drive  
The Woodlands, TX 77380  
800-858-4327  
Technical Service: 832-813-4862

Chevron Phillips Chemicals International N.V.  
Brusselsesteenweg 355  
B-3090 Overijse, Belgium  
+32 (0) 2 689 12 11

Chevron Phillips Chemicals Asia PTE Ltd.  
5 Temasek Boulevard  
05-01 Suntec Tower Five  
Singapore 038985  
+65 6337 9700

Test	Units	Method	Typical	Minimum	Maximum	Qualitative	Note
Acidity of Dist Residue	---	ASTM D-1093	Neutral	---	---	Neutral	---
Appearance	---	Visual	Clear with no particulate matter	---	---	Clear with no particulate matter	---
Aromatics	ppm	ASTM E-169	40	---	100	---	---
Distillation - DP	FAH	ASTM D-86	406	---	410	---	---
Distillation - IBP	FAH	ASTM D-86	374	355	---	---	---
Flash Point, TCC	FAH	ASTM D-56	145	142	---	---	---
Odor	---	Smell	Pass	---	---	Pass	---
Saybolt Color	SAY	ASTM D-6045	30	30	---	---	---
Specific Gravity 60/60	---	ASTM D-4052	0.7635	0.7580	0.7680	---	---



Local Hazardous Waste  
Management Program  
in King County



TECHNICHEM

## TECHNICAL DATASHEET: CALYPSOLV™ HC

### SPECIFICATIONS

Property	Unit	Method	Value	Qualitative/Notes
Appearance	---	Visual	---	Clean with no particular matter
Paraffins	%	GC	>99	---
Aromatics	ppm	ASTM E169	40	Typical
Benzene	ppm	GC	<3	---
Sulfur	ppm	ISO 20846	<0.5	---
Bromine Index	mg Br/100g	ASTM D1159	0.01	---
Corrosion (3hrs@ 100 °C)		ASTM D130	1A	---
Distillation, Initial Boiling Point	°C/°F	ASTM D86	189/372	---
Distillation, Dry Point	°C/°F	ASTM D86	210/410	---
Flash Point	°C/°F	ASTM D56	61/142	---
Aniline Point	°C/°F	ASTM D611	85/185	---
Odor	---	Smell	---	Pass
Color	Saybolt	ASTM D156	+30	---
Relative Evaporation Rate (nBuAc=1)	---	ASTM D3539	0.08	---
Vapor Pressure @20 °C	kPa	Calculated	0.11	---
Kauri-Butanol Value	---	ASTM D1133	26	---
Viscosity @ 25 °C	mm <sup>2</sup> /s	ASTM D445	1.9	---
Specific Gravity	---	ASTM D4052	0.7632	Typical
Molecular Weight	g/mol	Calculated	171	---

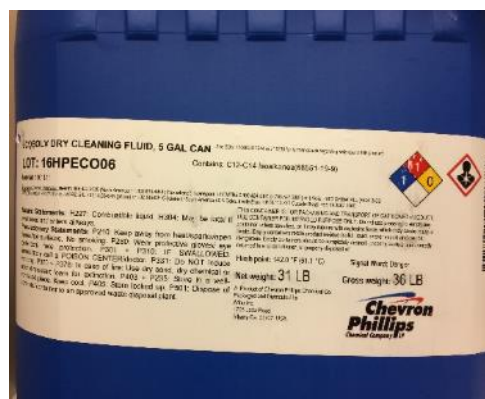


Local Hazardous Waste  
Management Program  
in King County

# Chemical analyses (2018)



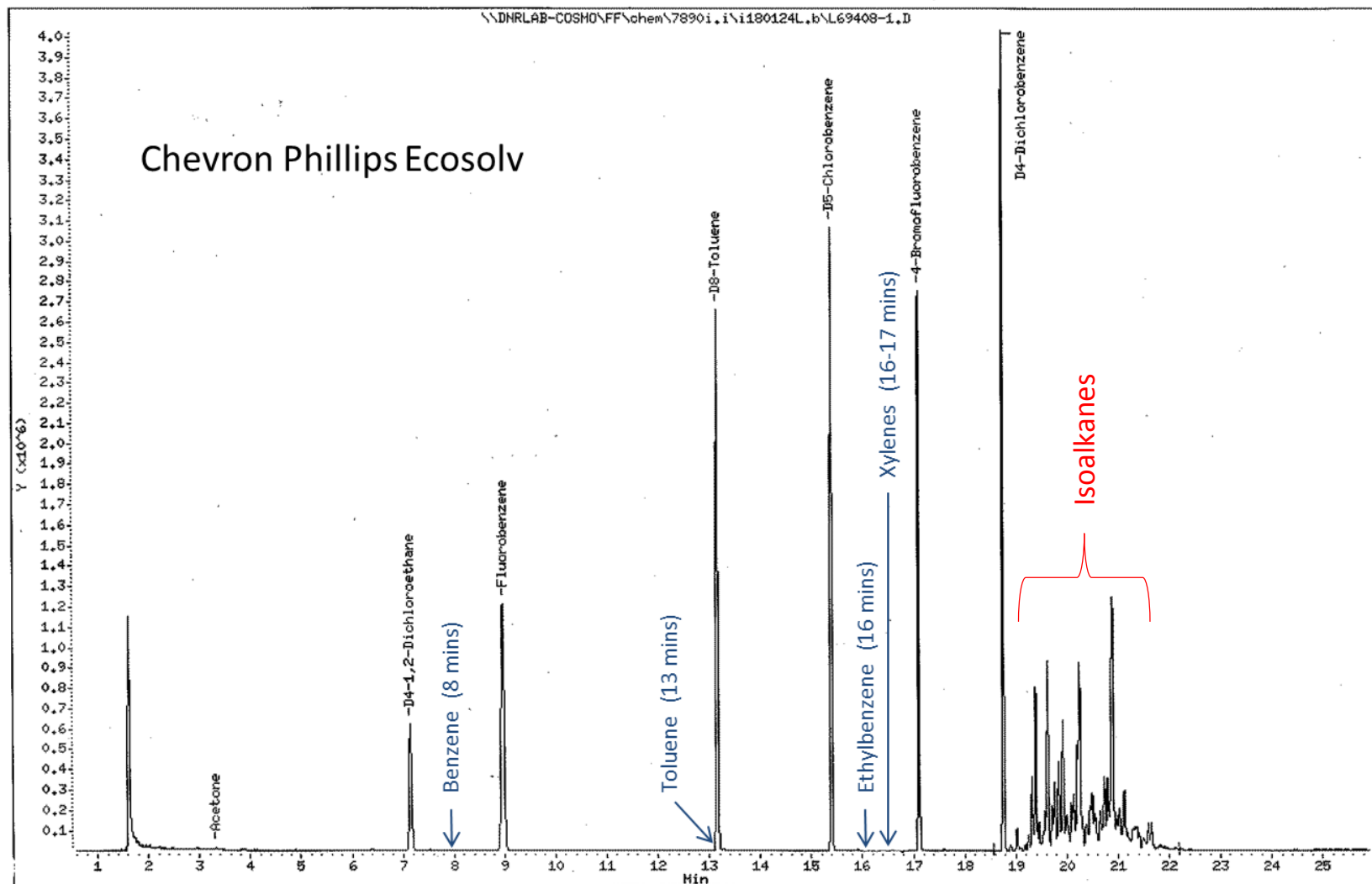
- Purchased multiple 5-gallon lots of DF-2000 and EcoSolv from local supplier
- One sample of Calypsolv donated
- EPA Method 624 - GC/MS for VOCs
  - Determine presence of BTEX (MDL = 1  $\mu\text{g/L}$ )
  - Identify isoalkane peaks



Data File: \\DNRLAB-COSMO\FF\chem\7890i.i\i180124L.b\L69408-1.D  
Date : 24-JAN-2018 11:17  
Client ID: 421193-130  
Sample Info: Dry Cleaning Ecosolv\_17HPEC005-1 manual 10X  
Purge Volume: 5.0  
Column phase:

Instrument: 7890i.i  
Operator: Lily K.  
Column diameter: 2.00

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Local Hazardous Waste  
Management Program  
in King County

# The Good



- Sampled solvents BTEX-free
- Manufacturers specify low aromatic hydrocarbon content, including benzene
- Not toxic to fish
- Largely immiscible with water
- Separator water may be discharged to sewer in King County (with permit)
- Filtration (rather than distillation) available
- Cleans well – less aggressive than PERC
- Low odor
- Very low airborne exposures
- Community acceptance



# The Bad



- They are petroleum hydrocarbons
- Flammable (Class IIIA solvent)
  - Fire suppression systems may be needed
- Bacterial growth
- Used with PERC spot cleaning products
- Occasionally use PERC process chemicals
- Generate a hazardous waste (still bottoms)
- Volatile Chemical Products - air quality impacts
- Expensive (compared to wet cleaning)
- Greenwashing

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**DRY CLEANING**  
[Home](#) >> [Health](#) >> Dry Cleaners

**Healthy Workers**

Healthy Nail Salons

Cleaning with Caution


Dry Cleaners

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**Dry cleaners**

We work with King County dry cleaners to help them use less toxic chemicals. Dry cleaners use many chemicals that can harm the people who use them as well as the environment.

- Spot cleaning products can contain powerful acids and hazardous organic solvents.
- The most commonly used dry cleaning solvent is perchloroethylene (or "PERC").
- PERC is believed to cause cancer and can harm the nervous system, the liver, and the kidneys.



**Survey results**

In 2010, we sent a questionnaire to every dry cleaner in King County. Here are highlights of the survey. Of the people who filled out the questionnaire:

- 84% were Korean.
- 81% wanted technical information in Korean.
- 69% used the chemical perchloroethylene (PERC) and 21% used an alternative hydrocarbon solvent.
- 75% did not know that PERC is harmful to their health.
- 76% of those who used PERC machines said costs prevent them from replacing their PERC machines.
- 61% did not adequately protect their lungs when cleaning out still bottoms.
- Of PERC machine users, less than 40% used a leak detector. Environmental Protection Agency regulations require the use of a leak detector.
- 98% disposed of their still bottoms as hazardous waste. This suggests that most comply with hazardous waste regulations.
- 69% shared a building with a business that sells or serves food. This is a concern because fatty foods absorb PERC.

100%

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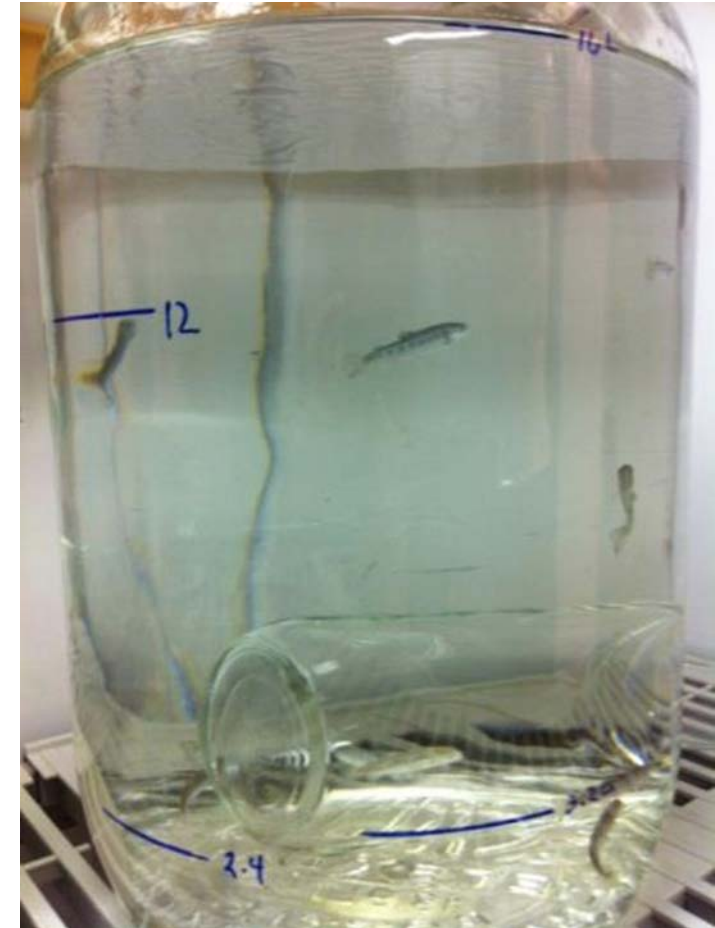
# Fish bioassays: LC50s (2018)

- DF2000: >5,000 mg/L
- Ecosolv: >100 mg/L
- Calypsolv: >100 mg/L



(PERC: 3.6 mg/L)

(Solvon K4: 46 mg/L)



# Exposure monitoring with NIOSH (2013)

**Evaluation of Occupational Exposures at Drycleaning Shops Using SolvonK4 and DF-2000**

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**HealthHazard**  
Evaluation Program

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Report No. 2012-0084-3227  
January 2015



Table E4. Results of personal air samples collected over the work shift, DF-2000 drycleaning shop A, May 2–3, 2013

Main tasks			DF-2000 concentration (mg/m <sup>3</sup> )
Owner/Operator	Unloading and loading	Day 1	1.4
		Day 2	0.99

Table E5. Results of personal air samples collected during short-term work tasks, DF-2000 drycleaning Shop A, May 2–3, 2013

Main tasks			Duration of task (minutes)	DF-2000 concentration (mg/m <sup>3</sup> )
Owner/Operator	Loading, washing cycle, and unloading	Day 1	235	2.8
		Day 2	8	Not detected*
Employee A	Pressing and ironing shirts	Day 1	133	7.9

\*For this sample, the MDC was 3.8 mg/m<sup>3</sup>.

Occupational Exposure Limit: 300 mg/m<sup>3</sup> (DFG MAK)

The Training Workgroup continues to plan additional webinars intended to inform and engage. Let us know if you have ideas for future webinar topics or presenters.

Please give us your feedback through the post-webinar survey.

Thank you for attending.