Toxics Use Reduction Institute

Switching From TCE
MA & RI EPA Grants

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Presentation Overview

- Introductions of Attendees & Speakers
  - Vendor, consultant, end user, TURA program
- 2006 TURA Amendments & HHS
  - Liz Harriman – Deputy Director, TURI
- MACT
  - Gerry Podlisny - OTA

Presentation Overview cont.

- TURI Lab & HHS work
  - Heidi Wilcox – Field Specialist
- Matching grants
  - Pam Eliason - Industry Research Program Mgr, Senior Associate Director
- EH&S of HHS & Drop-in Substitutes
  - Mary Butow – Research Assistant, TURI
- EH&S screening & performance database
  - Dr. Jason Marshall – Director TURI Lab

Introductions of Attendees

2006 Amendments

Liz Harriman - Deputy Director, TURI

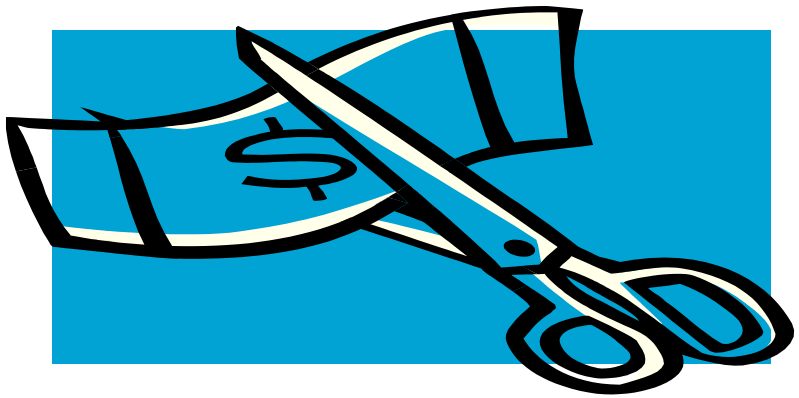
MACT

Gerry Podlisny - OTA

The TURI Laboratory

- TURI established the Surface Cleaning Laboratory
  - Now known as the **TURI Laboratory**
  - Evaluate effectiveness of cleaning chemistries and equipment

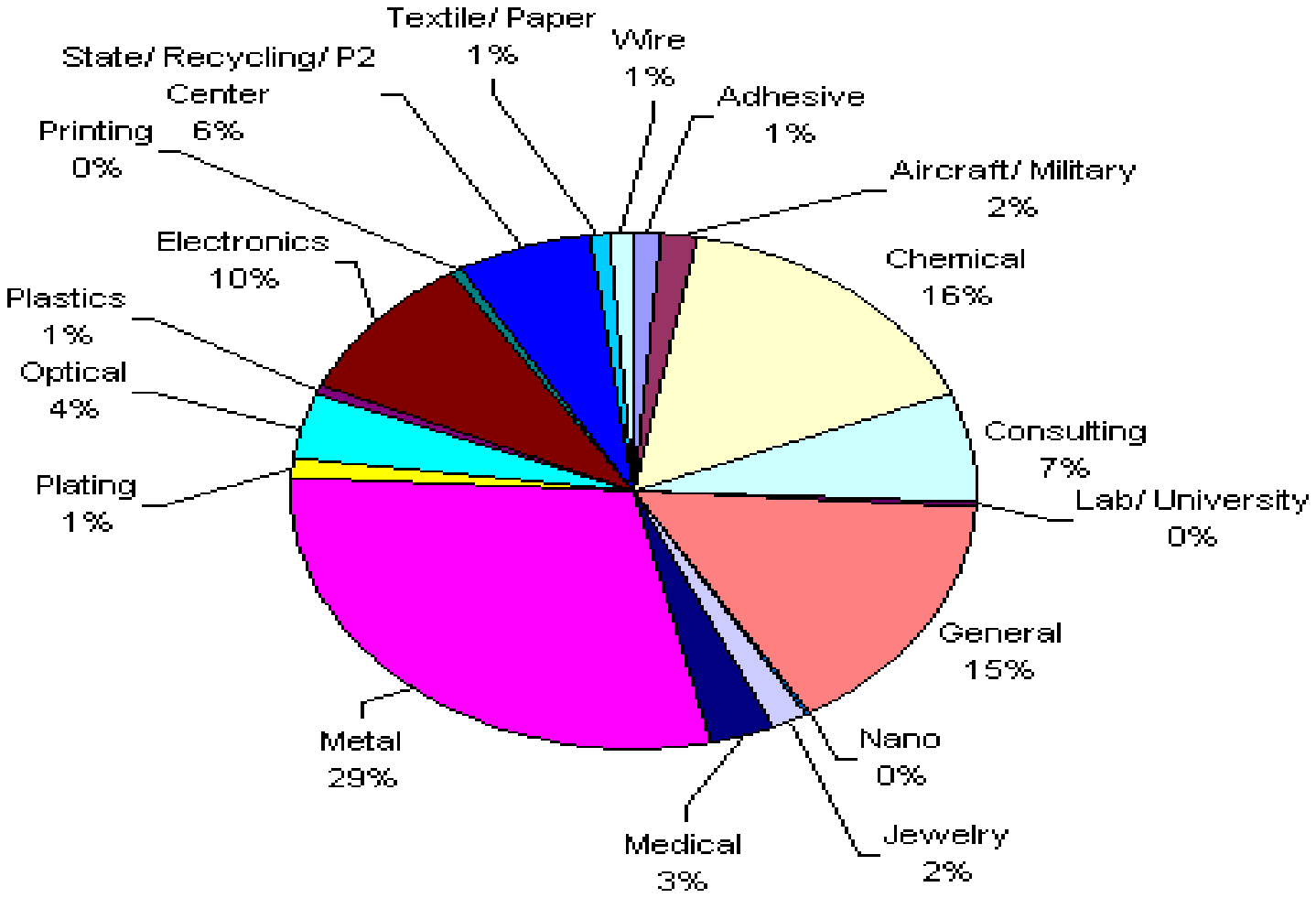
- **Free Services to Massachusetts Companies**
  - On-site walk through
  - Laboratory Testing
  - Piloting
    - Lab
    - On-site
  - Follow Up Assistance



TURI Laboratory Goal

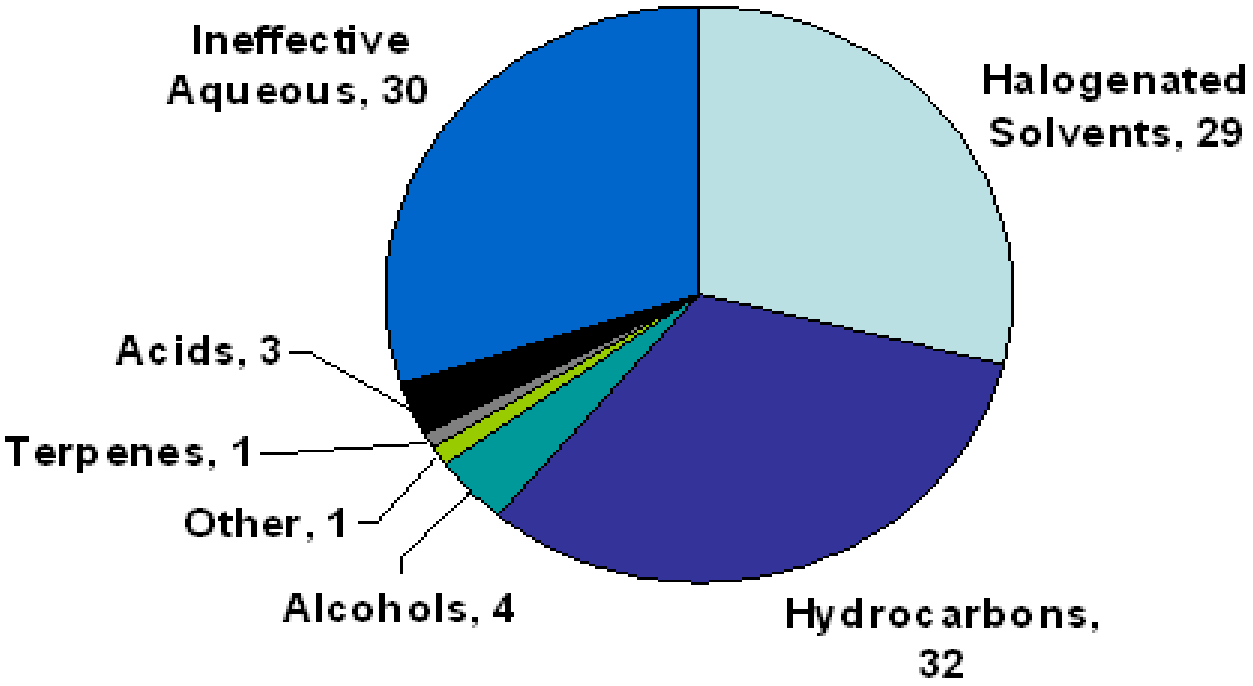
- **To assist industry in the search for cleaning processes that are:**
  - Economically feasible
  - Have as good or better cleaning performance
  - Improve the EH&S profile

TURI Lab Work by Industry (1994-2008)



Focus of the TURI Laboratory

- To replace hazardous solvents **with a special focus on the halogenated hydrocarbons**
  - 30% of trials have been to replace halogenated solvents
  - 30% were conducted to replace other hazardous solvents
    - Toluene, MEK, N-methyl-2-pyrollidone



Types of Cleaning at TURI Lab

- Parts Cleaning
  - Cleaning parts during / after mfring in metal working or tooling industries
  - ***Gross Cleaning Applications***
- Precision Cleaning
  - Cleaning parts during and after manufacturing in Semi Conductor and Medical Sectors
  - ***Critical Cleaning Applications***
- Facility Cleaning
  - Janitorial or housekeeping chores in public/private institutions such as schools or hospitals
  - ***Institutional Cleaning Applications***

Lab's Current Process

- Contacted by company with cleaning related issue (*consultant or other agency*)
- Gather background information on process (The more we understand the better)
  - TURI Lab's Test Request Form (handout)
    - Material of parts to be cleaned
    - Contaminants
    - Current Solvent or other alternatives tested
    - Available Equipment
    - Operating conditions (time, temp, conc.)

Lab's Current Process

- **On-Site visit**
  - Meet key players & walk through (overview)
  - Complete/collect Test Request form
  - Gather samples and MSDS
    - Contaminants
    - Current Solvent
    - Dirty Parts
  - Identify possible adjustments to process & what they will & wont do
  - **Talk about costs they are willing to absorb**

Selecting an Alternative

- **Process is Challenging!**
  - Thousands of products
    - **(have ~ 600 in lab)**
  - What is right for some may not work for others
  - Cleaning Varies from Case To Case, Process Specific

- **The Cleaner(s) MUST be Assessed for;**
  - Ability to remove the contaminants
  - Compatibility with the surfaces to be cleaned
  - Works with equipment that will be used

Our Tool For Alternative Selection

- CLEANERSOLUTIONS DATABASE
  - www.cleanersolutions.org
  - TURI Lab Database of Testing & Vendor supplied information
- Used to identify safer & effective products
  - Safety Scores
    - VOC, ODP, GWP, HMIS/NFPA, pH
  - Matching Performance
    - Contaminant, substrate, equipment, current solvent

Selecting an Alternative

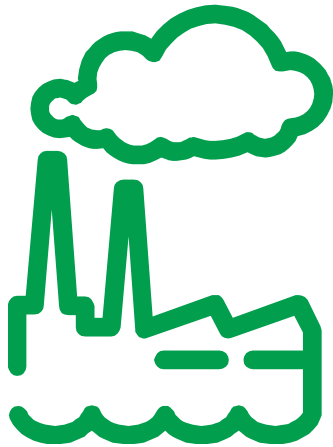
- When choosing an alternative – IMPORTANT

Don't shift the risk!

- From worker to environment

OR

- From environment to worker



- Want to select a product that is safer for one or the other or both (best)

- ***New step*** *– EH&S & price comparisons to current cleaning system.*
  - ***Price as big a concern as performance now***

EH&S Comparison Example

EH&S Comparison of most Efficient Cleaners Found at the TURI Lab vs IPA									
Manufacturer	Product	VOC	GWP	ODP	HMIS H	HMIS F	HMIS R	pH	General pricing
Clorox	Green Works Glass	40	0	0	1	0	0	10.5	12 pk case of 32 oz spray bottles 43.71 (approx 14.50/gal) less for bulk
Dysol	DS 144	828	0	0	1	2	0	N/A	4x1 gal cases $125 or $31.35 gal
Gemtek	SC Actisolv	900	0	0	0	0	0	9.7	sold in 5 gal pails, depending on how many pallets gal price is $81- $49
Kyzen	Ionox HC2	50	0	0	2	1	0	10.2	$74-$39 gal (gal bottle to drum)
	IPA	800	0	0	2	3	2	N/A	$7.25 gal

Testing an Alternative Phase 1

- CHEMISTRY ONLY ISSUE
  - **Basic Chemistry ONLY**
  - Minimal conc. if aqueous
  - Short time
  - Little agitation or mechanical energy
- **Standard steps**
  - Using coupons matching part substrate
  - Using supplied contaminants
  - Compare with current solvent for a baseline (if possible)

Testing an Alternative Phase 2

- CLIENT SPECIFIC CONDITIONS
  - Driven by what client will change or accept
- Work with TACT
  - Time
  - Agitation – match current equipment
  - Concentration
  - Temperature
- Then same standard steps as in Phase 1

Testing an Alternative Phase 3

- Pilot cleaning in lab setting
  - Client specific operating conditions
  - Client supplied parts
    - Geometry matters
- Send / bring parts to client for assessment
    - Client-worker feedback is the ultimate
    - THEY ARE the EXPERTS

Testing an Alternative Phase 4

- Pilot testing at facility
  - Using best alternative cleaning products found (2-4)
  - Set up piloting off-line from current system

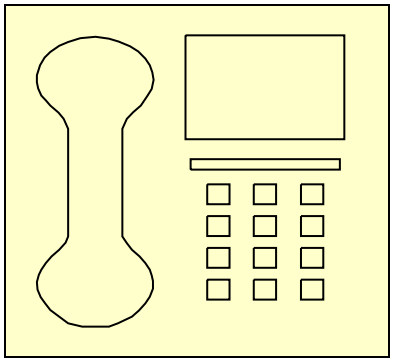
OR

- Loan equipment
  - See results first hand in their process
  - Gives time to research equipment purchases

New Phases to Process

- Average of 4 visits vs. 1 previously
- EH&S Comparison
- Cost evaluation

- Loan equipment or pilot onsite with client
- Follow-up & update calls throughout project



- Connect clients with chemical & equipment vendors

New Process, New Implementation Rate (IR)

- In 2007 lab set out to try to raise IR to 50%
  - Learned from RI grant, more contact works
- Before 2008, IR was ~ 33%
  - 3x national average for tech assistance providers, national average of 10% for similar technical assistance programs

    (William Nelson, Waste Management Resource Center (WMRC), Champaign, IL, http://www.wmrc.uiuc.edu)

- **2008 Rate is ~ 80% due to new process**

Trial to Client Ratio & Implementation Rate

FY	Trials	Clients	T/C
1998	88	32	2.75
1999	123	42	2.93
2000	112	36	3.11
2001	65	26	2.50
2002	100	32	3.13
2003	107	32	3.34
2004	93	23	4.04
2005	102	25	4.08
2006	111	18	6.17
2007	100	23	4.35
2008	**133**	**24**	**5.54**

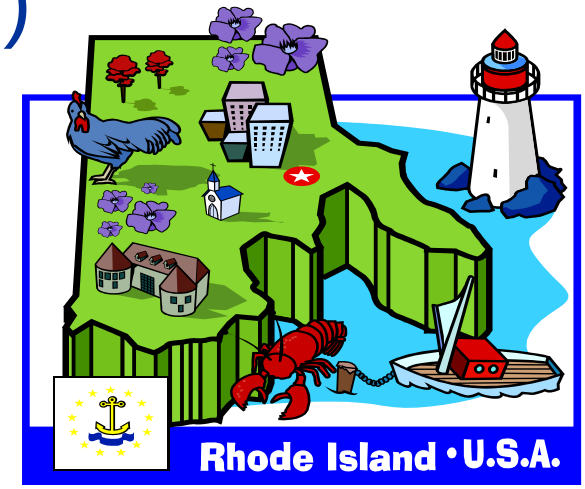
30% I.R

~80% I.R.

EPA Funded TCE Grants

- Massachusetts (2003 – 2005)
  - TURI & OTA

- Rhode Island (2006-2008)
  - RI DEM
  - EPA
  - TURI Laboratory

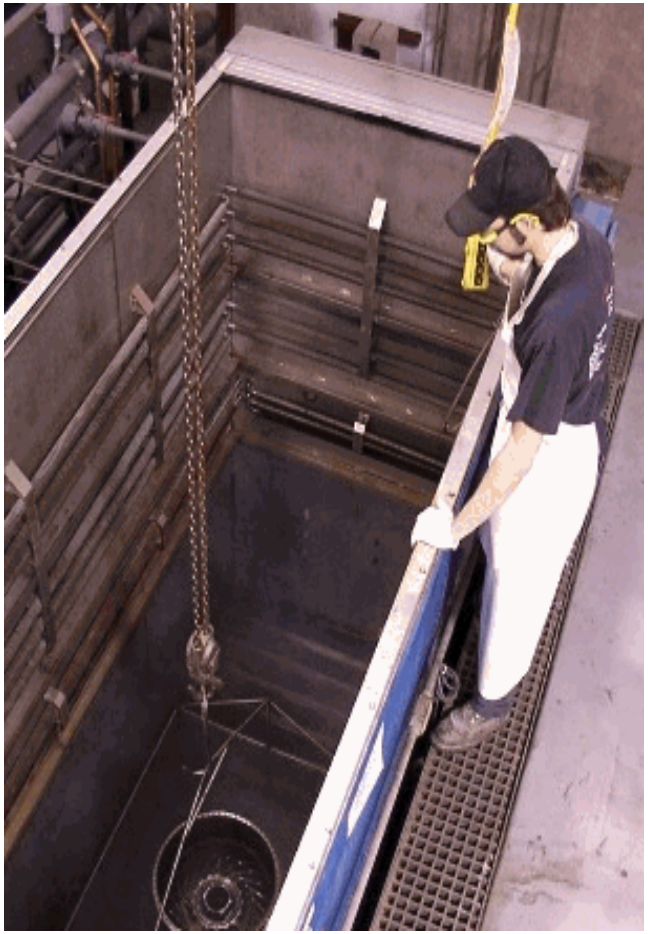


MA TCE Grant – TURI / OTA

- **Identify small, non-filing users of TCE**
  - Project is targeted at smaller businesses using chlorinated solvents
  - who may not have direct access to pollution prevention information & resources
- **Focus primarily on cleaning - Vapor degreasing, immersion, hand wipe, other**
  - Offer technical assistance to reduce / eliminate
  - Offer compliance assistance with MACT Stds
  - Disseminate information

MA TCE Grant - Process

- Mailing lists
- Mass mailing
- Calls
- Time spent trying to find small companies
  - *Found mostly larger ones, using degreaser*
  - *Wanted DROP-IN SOLVENTS*
- *TURI & OTA worked together*



MA TCE Grant - Testing

- Worked with 8 companies
  - Replace TCE/Chlorinated Solvents in cleaning applications
  - Most wanted Drop-In replacements
  - Most larger companies, known to program

- A wide range of industries

Aircraft	Wire & Cable
Electronics-Ceramic	Jewelry
Metal working job shops	Tool
Capacitors	

MA TCE Grant - Outcome

- **Hard to find small job shops this way**
- *Larger shops want to vapor degrease*
  - *need drop in replacement*
- Drop-in must work & be economical
- *Did testing on alternatives we found in literature & online*
  - Published article on TCE Drop-In Solvents
  - Process Cleaning Magazine Sept/Oct 2006 (handout)

What Action is Still Needed?

- The $1,000,000 question still is:
  HOW DO WE FIND THE LITTLE GUYS?

- **Show** Drop-In replacements are only a temporary, regulatory fix & not a good EH&S solution

- Find **how to motivate** people to move away from vapor degreasing,
  - Information on EH&S, testing etc

Help with cost (MATCHING GRANTS)

TURI Matching Grants

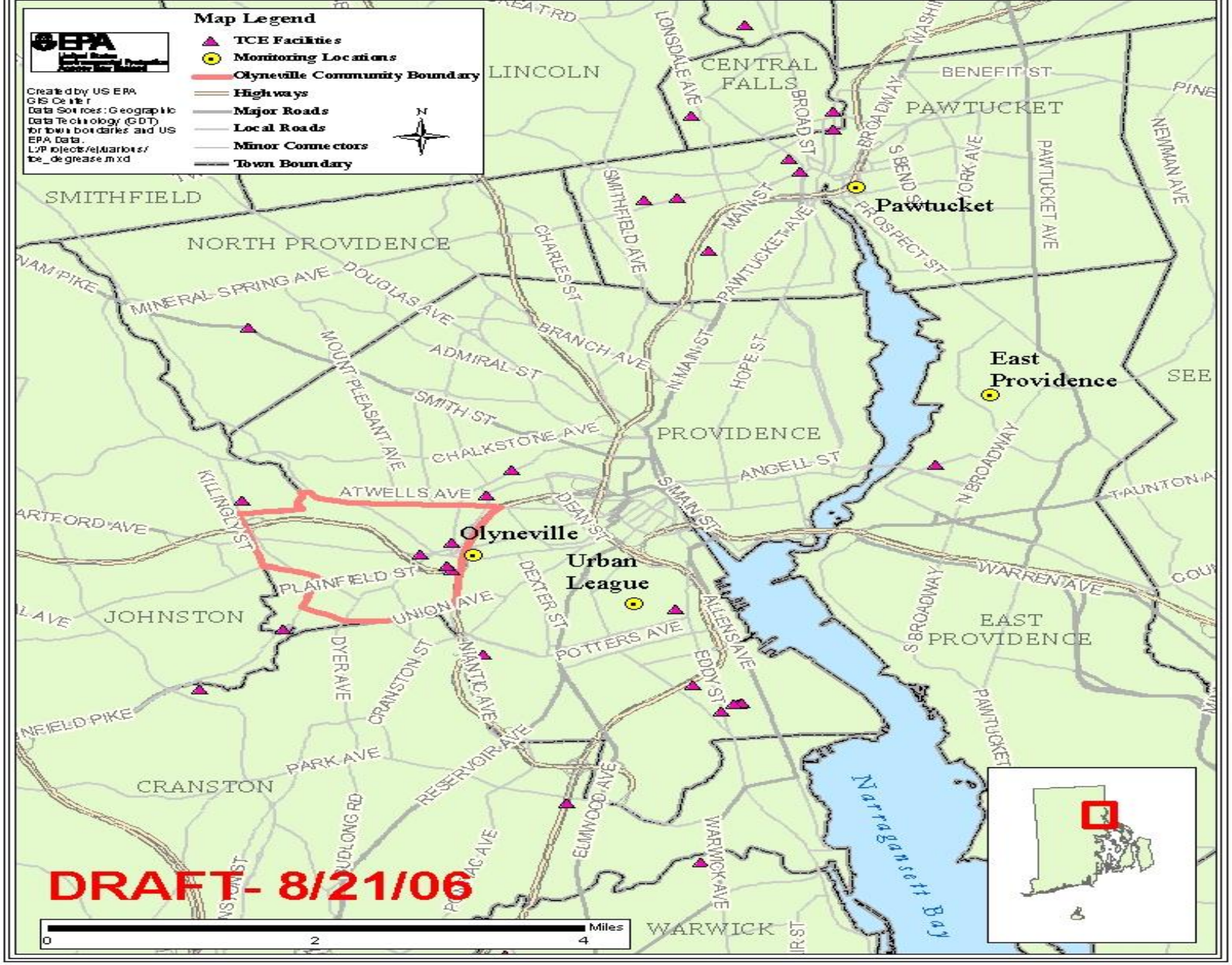
Pam Eliason

- Industry Research Program Manager, Senior Associate Director

RI TCE Grant - EPA / TURI Lab

- EPA notified by RI DEM that many metal finishers/ polishing shops were out of compliance with air regulations because of TCE use
  - RI DEM had documented non compliance, began to issue NOV's
  - DEM didn't have resources to pursue
- EPA Region 1 provided funding for the RI DEM to conduct air monitoring in the Providence, Rhode Island area
- **Uncovered TCE at elevated levels**

TCE Degreasing Facilities in Greater Providence, Rhode Island



RI TCE Grant - Process

Picture courtesy of Valerie Rickman

- Started workgroup including RI DEM, RI Dept. Health, Narragansett Bay Commission, TURI Lab
  - Contacted 40 individual metal finishers and performed site visits (Before TURI)
  - Reduced list down to 24 shops who needed assistance (Before TURI)

- EPA contracted with TURI & awarded Grant
  - To test metal parts
  - Find effective alternative cleaner
  - Do hands on workshops – (did 2)

RI Hands On Workshop

RI Grant Testing & Outcome

- **75% Reduction of TCE** Usage for 12 of 24 companies ID'd by DEM & EPA
  - Reported using 26,500 pounds of TCE for cleaning in 2006
  - At end of 2008 grant period, only 7,000 pounds still being used

Read more about the grant online at:

http://www.turi.org/laboratory/cleaning_research_projects/trichloroethylene_reduction_in_rhode_island

MA & RI Grant – Lessons Learned, Outcomes, Surprises

- Two Types of Alternative Lines
  - Aqueous Systems
  - Drop-In Chemical Alternatives
- Mailings & general outreach didn't work with this sector
- **Personal connection needed** to be made to gain access

MA & RI Grant Comparison

- Massachusetts
  - Surprising how hard it was to find small companies
  - Larger companies wanted to stay with Vapor Degreaser
  - Drop in Replacements came to forefront
- Rhode Island
  - Working with EPA INVALUABLE
  - Regulatory issues / action pending Motivated
  - Hands on Workshops helped, **seeing was believing**

Why Aqueous Cleaners?

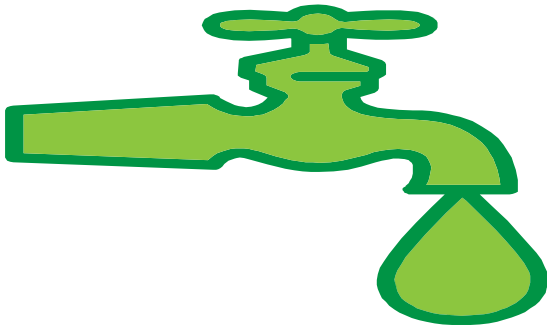
Because of the following environmental indicators:

- Non-Volatile Organic Compounds (non-VOCs)
- Non-Ozone Depleting Substances (non-ODSs)
- Zero Global Warming Potential (GWP = 0)
- Low or No Toxicity
- Non-Flammable

Refer to Handout for Aqueous Alternatives to TCE

Aqueous Pros & Cons

- PROS
  - Better EH&S Profile
  - Regulations
  - Disposal
  - Chemical cost may be less, dilutable
- CONS
  - Dry & rinse issues
  - New Equipment
  - Training
  - Water usage



Drop In Solvent Replacements

- Many companies worked with during grants requested direct solvent replacements
  - Use existing equipment with small adjustments
  - Worried about performance of alternatives
    - Part geometry, compatibility, rinsing & drying
  - **No money for new equipment**

Drop-In Solvents Identified

- Identified 20 alternative drop-in solvent degreasers
- Six Classes of Chemicals
  - **N Propyl Bromide – nPB**
  - Hydrofluorocarbon – HFC
  - Hydrofluoroethers – HFE
  - Hydrochlorofluorocarbon – HCFC
  - Volatile Methylsiloxanes – VMS
  - trans 1,2 Dichloroethylene – DCE

See Handouts in Back

Drop-In Solvent Pros & Cons

- PROS
  - Easy
  - No new equip needed
  - Less/no regulations
  - Same disposal
- CONS
  - No real EH&S improvement
  - Expensive
  - May not work on all soils
  - May require more energy

Drop-In Solvent Substitutions

- Often deemed viable alternative due to less environmental regulations
- Is NOT really TUR
- Does not address EH&s
- nPB – most chosen drop-in alt.
  - Price
  - Performance
  - Severe human neurotoxin but less ODP
- **Possible interim step**

Rhode Island & nPB

- RI DEM Office of Air Resources
- **June 16, 2008, open meeting on RI Air Pollution Control Reg. (APC) No. 36**
- One part of the reg. modifications are to include nPB in their vapor degreasing requirements (waiting on more details)
- **For More information contact**
  - Gina Friedman: gina.friedman@dem.ri.gov

Potential Hazards of Solvents

Acute Issues

- Reactivity such as flammability

Chronic Issues

- May deplete the ozone layer (ODP)
- May add to global warming (GWP)
- May contain toxics
  - Volatile Organic Compounds (VOCs)
  - Carcinogens
  - Reproductive Toxins
  - Neurological Toxins

See Chemical Fact Sheets for PCE & TCE

EH&S of Drop In Alternatives

- Mary Butow
  - Research Assistant, TURI

TCE Case Studies - MA

- **Aerovox** – TCE & PCE vapor degreasing
  - Switched to nPB
- **Current Client, Gear Mfr**. – TCE vapor degreasing
  - Switch to nPB (working on aqueous soln.)
- **Other known switches**
  - TCE to HFE in vacuum vapor degreaser
  - TCE to aqueous system

Aerovox - Project

- **Test Objective –** Replace PCE & TCE in vapor degreasing operations - must use existing equipment
- **Problems with Current Method –** PCE emission
- **Purpose of Cleaning –** To remove excess oil prior to part validation
- **Product Use –** PCE & some TCE

switched to nPB

Aerovox - Summary

- Testing was conducted over a one-month period
  - 4 Soils
  - Immersion cleaning with no rinsing, air drying
- Tried to identify a product that could be used on all of the contaminants
  - 11 products, 6 worked on each of 4
  - One of the products was tested in a beaker vapor degreaser at client's request
    - Efficiency in the vapor cleaning was very high for all four contaminants
- Ensolv was selected by the client for in-house testing (nPB)
  - Client has converted operations to Ensolv using vapor degreasing equipment

Current Client, Gear Mfr - Project

- **Test Objective –** Replace TCE in vapor degreasing & dip/immersion applications (most worker exposure)
- **Problems with Current Method –**
  - EH&S concerns
  - Regulatory issues
- **Purpose of Cleaning –** to clean manufacturing soils; oils, greases & metal working fluids from machines parts
- **Product Use – TCE, both applications**

switched to nPB

Current Client, Gear Mfr - Summary

- *A drop-in solvent was evaluated as a quick fix to the client's use of TCE*
- *Follow up on-site visit by SSL revealed additional TUR opportunities*
  - *Replacing manual cleaning in buckets located throughout facility*
- Project ongoing to replace drop-in fix (nPB)
  - Looking into aqueous

TCE Case Studies - RI

- **Ira Green** – TCE vapor degreasing
  - 270 Employees
- **Three A's** – TCE vapor degreaser
  - 5 Employees

Case Studies in Handout
Are you STILL using Trichloroethylene?
A Guide for Metal Finishers

Provided by EPA (from previous presentation on grant)

Ira Green - Background

- 270 employees - Products consist of metal pieces for the DoD
  - Used 12,500 pounds of TCE in 2004
- When EPA contacted Ira Green, the company was very close to exceeding permit limitations
- Already had enforcement action against them by the RI DEM 2003 and 2004

Images from http://www.iragreen.com

Ira Green – Finding an Alternative

- EPA collected Polishing Compound and Parts for TURI to clean (did running during project)
- Set up a test tank w/ alternative in Ira Green's facility ***(provided sample)***
  - Worked right on floor, they plated after cleaning
  - Determined that alternative solution works as well as TCE
- Using alternative in existing ultrasonic tanks for 60% of product
  - Using nPB as a drop in replacement while waiting to purchase additional ultrasonic equipment

Three A's - Background

- Small, family-owned job shop – 4 employees
- Owner wanted to stop using TCE because of associated health risks
- Used approximately 55 gallons (~750 pounds) / year at a cost of about $1000

Three A's – Finding an Alternative

- Needed to find an alternative process that would maintain an antique finish on metal parts
- An alternative was found
  - Retrofit current degreaser with ultrasonic transducers
  - Saving money on equipment costs
  - 1-3% aqueous solution worked well
- DEM assessed fine, they couldn't afford new equipment & fine
  - So they found their own solution

Three A's – Outcome

3A's Found a used Steam Cleaner, more time but OK

Furniture Handles Needing Cleaning

Steam Cleaner that Replaced TCE

Substitution & Implementation

- IT CAN BE DONE! IT TAKES....
- A plan specific to your goals & needs
  - Priorities; EH&S, cost, compliance etc.
  - Process changes if any that can be done
  - Capital available
- TURI Lab & OTA – We are here to help
  - heidi@turi.org jason_marshall@uml.edu
  - (978)934-3249
  - http://turicleanbreak.blogspot.com
  - www.cleanersolutions.org
  - www.turi.org/laboratory

Tools & Resources for TUR

- Try it on your own
  - Talk to others in your industry
  - Use supply chain opportunities
  - Use Cleaner Solutions – TURI Lab Database
    - www.cleanersolutions.org
- Use online articles, resources & links
  - http://www.turi.org/laboratory/trichloroethylene_tce_reduction_resources
- Call TURI / OTA / DEP
- Handouts

Questions?

THANK YOU

Now

Dr. Jason Marshall

Database GURU