



TCE Replacement Case Studies

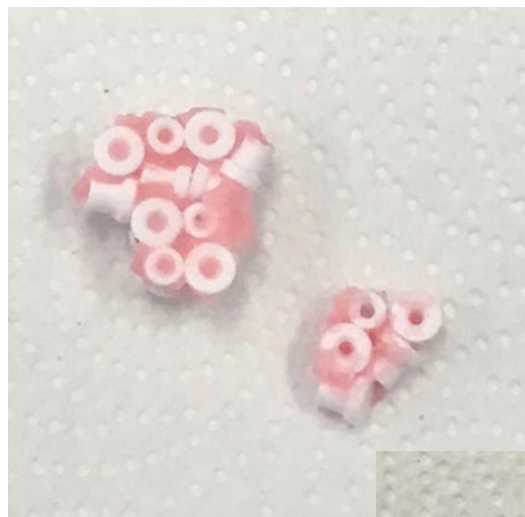
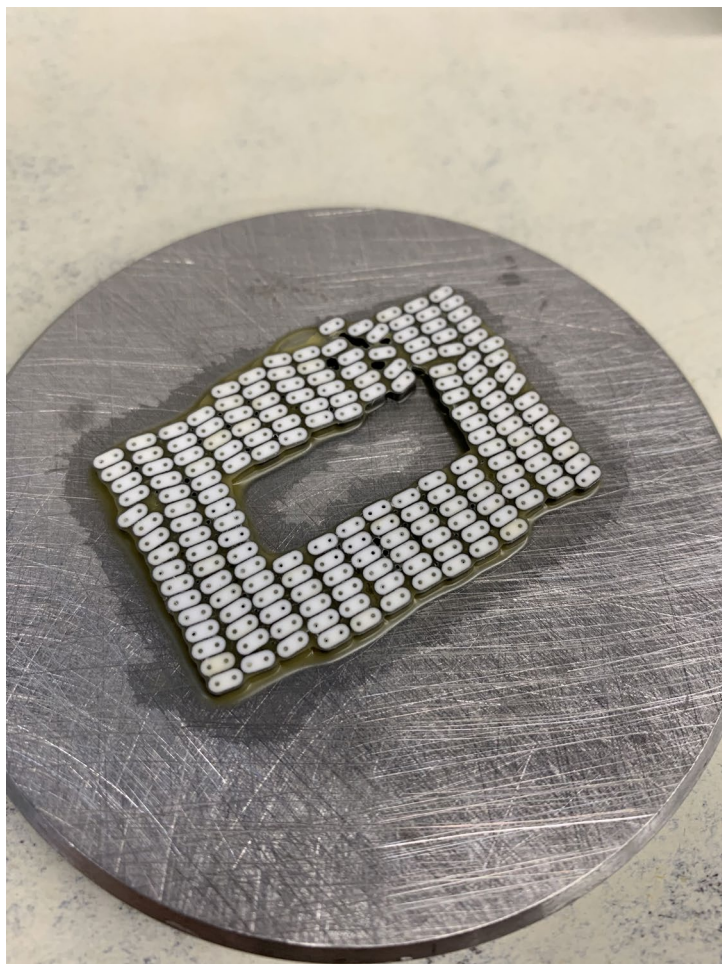
Alicia McCarthy
Toxics Use Reduction Institute
University of Massachusetts Lowell

Case Study 1:

Removing Wax with Detergent

- Company working with ceramic, glass, and metal engineered parts
- Worked with TCE in a vapor degreaser to remove wax from parts
- Identified a mixture of Baking Soda and Borax in Water
 - Borax is an endocrine disruptor
- Worked with lab to identify alternative detergents

Case Study 1: Brown and Pink Wax



Case Study 1: Old Equipment



Case Study 1:

Alternatives Identified and Performance

- Alternatives Evaluated/Identified
 - Surf Powder Detergent (Client request)
 - Left residue/highest EHS hazard out of alternatives
 - Tide Original Powder Detergent
 - Left a lot of residue
 - Gain Original Powder Detergent
 - Left a small amount of residue
 - Potential alternative with rinse step refined
 - Method Liquid Detergent **Recommended**
 - No residue

Case Study 2 – Precision Orifices

- Precision orifices
 - Pneumatic Fittings
 - Bicycle/ball pumps
 - Tire pressure gauges
 - Some nail guns
 - Hydraulic Nozzle and Restrictors
 - Fuel systems
 - Oil tools
 - Race cars
- What is being removed?
 - Lubricating/Lapping Oils; Dirt; Fibers; Fingerprints
 - Verification with microscope



Case Study 2 – Cleaning Station/Dry Station



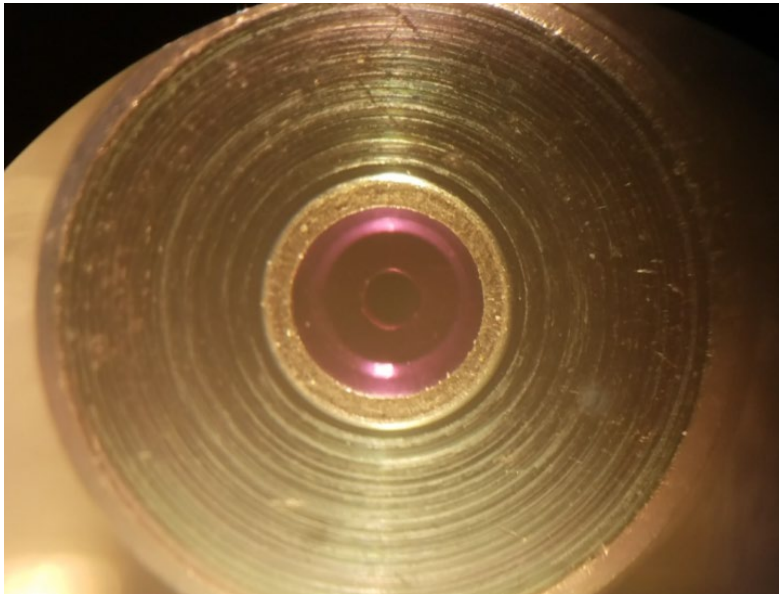
Case Study 2 – Alternative Requirements

- Low flammability/ Non flammable
- Work quickly (1-5 minutes)
 - Current cleaning takes 5 seconds to swish and then heat dry
- No residue on or inside parts
- Reduced health hazards



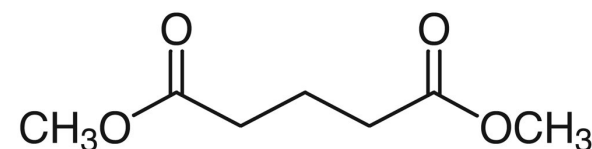
Case Study 2 – Clean vs Dirty Parts

Can you tell which one is clean and which one is dirty?



Case Study 2 – Cleaning Alternatives on Market

- Initial Review of Alternative Options
 - Aqueous Options
 - Left a residue even after rinse
 - Halogenated Options... So Nope.
 - Chlorinated Solvents
 - Hydrofluoroethers (HFEs)
 - Trans 1, 2 Dichloroethylene
- Hansen Solubility Parameters
 - Dimethyl glutarate
 - Great degreaser
 - Needed dry step – vacuum oven



Case Study 3 - Lytron

View the [Case Study 3 – Lytron](http://www.mntap.umn.edu/industries/facility/machine/tcealternatives/#TCE.Recordings) video or visit the recordings section on the TCE Alternatives Project webpage at <http://www.mntap.umn.edu/industries/facility/machine/tcealternatives/#TCE.Recordings>



Case study 3 – Lytron

Phase I: Aluminum Fin and Flat Parts

- Could not use aqueous options due to substrate
 - Risk of corrosion
- Remove contaminants within 30 minutes
 - Blasocut Coolant
 - Oak Series Lubricant
- Verify cleanliness for customers
 - Contact angle
 - Gravimetric
 - Visual
- Interested in new equipment process
 - Vacuum Cycling Nucleation System (VCN)



Case study 3 – Lytron Phase I Results

- Switched chemistry and added Vacuum Cycling Nucleation (VCN) equipment
 - Removed 6,000lbs of TCE
 - Recycle 98% of solvent
 - However, using DCE....
 - Not finished! HSPiP to identify alternatives



Case study 3 – Lytron

Phase II: Copper Fin and Tubing

- Looking for an aqueous/enzymatic option
 - Willing to do a rinse/dry step
- Clean fin and tubing parts within 30 minutes or less
- Must be able to remove Oak 15C expanding, bending and forming metalworking oil
- Looking to buy new equipment



Case study 3 – Lytron

Phase II: Results

- Three aqueous options were effective
 - Emerald HD 2 (15%)
 - Aquavantage 1400 GD (5%)
 - United Smart Solve 605 (5%)
 - Heated ultrasonics (130 F) for 30 minutes
 - Added rinse step for Aquavantage 1400 GD
- Verification of cleanliness
 - Contact angle and visual for fin parts
 - White glove test and visual for tubing

Questions?

Toxics Use Reduction Institute

www.turi.org

978-934-3275

The Offices at Boott Mills West
126 John Street, Suite 14
Lowell, MA 01852



Alicia McCarthy,
Laboratory Specialist
Alicia_McCarthy@uml.edu
978-934-3889