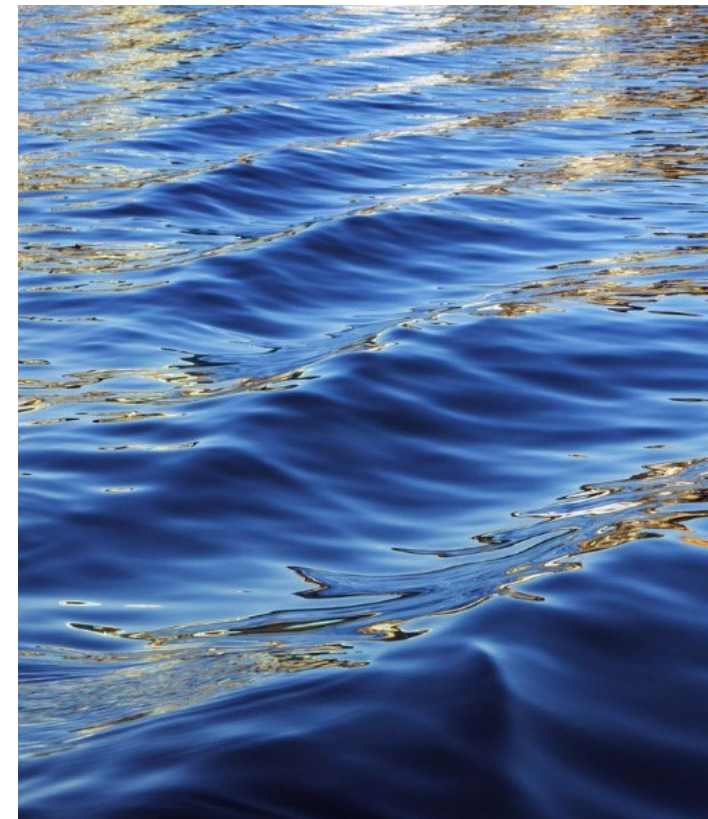


# Session E: Safer Alternatives & Industrial Case Studies

Alicia McCarthy  
TUR Conference, Spring 2023  
Marlborough, MA  
April 12<sup>th</sup>, 2023



# Laboratory Updates & Research

- New Equipment: Spray Wash Cabinet
  - Graymills Tempest™ 20S
  - 20 Gallon rollout stainless steel reservoir
  - Max Spray Pressure at Volume: 600 PSI @180 GPH
    - Demos upon request
- Continued Research: Vacuum Cycling Nucleation (VCN) System
  - Efficacy of low foaming, aqueous cleaners on various contaminants and parts
  - Comparing other cleaning methods:
    - Ultrasonics, immersion, and spray wash applications
- New Research: Modeling
  - Utilizing HSPiP software to identify safer solvent mixtures
  - Ongoing testing to evaluate:
    - Performance efficacy
    - Dry time
- New Research: Process Modification



Image of Tempest 20S Spray Wash from Graymills.com



Image of aqueous VCN at TURI Lab

# Evaluating Alternatives: Halogenated Solvents

Halogenated Solvent	CAS #
Trichloroethylene (TCE)	79-01-6
Methylene Chloride (Dichloromethane or DCM)	75-09-2
Perchloroethylene (PCE)	127-18-4
N-Propyl Bromide (nPB)	106-94-5
1, 2 Trans Dichloroethylene (transDCE)	156-60-5
Hydrofluoroethers (HFE)	multiple
Hydrofluorocarbons (HFC)	multiple



[https://www.turi.org/Our\\_Work/Alternatives\\_Assessment/Alternatives\\_Assessment/Safer\\_Alternatives\\_to\\_Halogenated Solvents Guide](https://www.turi.org/Our_Work/Alternatives_Assessment/Alternatives_Assessment/Safer_Alternatives_to_Halogenated_Solvents_Guide)

# Possible Alternatives – TURI's Lab Tests Performance

## Aqueous Options

- Acidic Aqueous
- Alkaline Aqueous
- Neutral Aqueous
- Caustic
- Enzymatic-Microbial
- Powdered Detergent

## Solvent Options

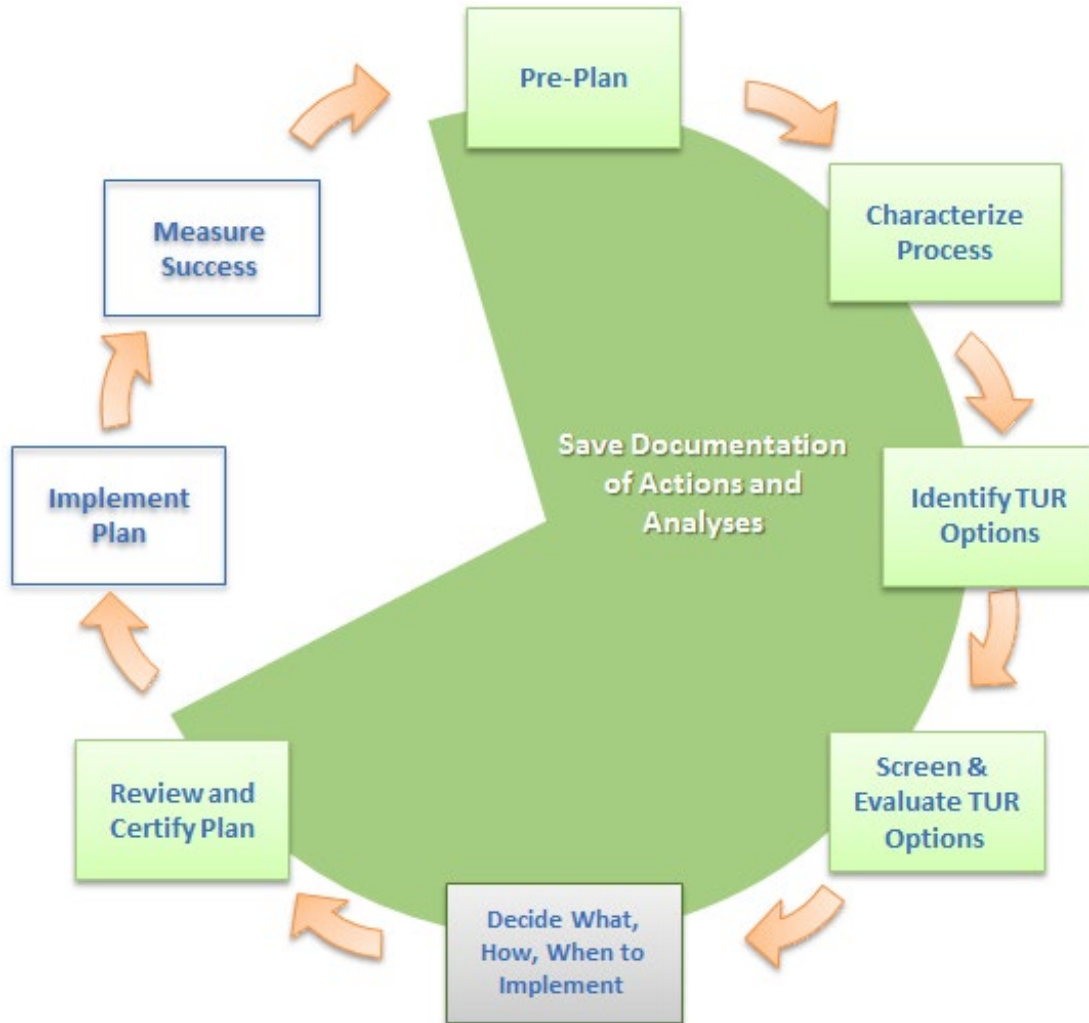
- Biobased
- Terpenes
- Esters
- Alcohols
- Glycol Ethers
- Ketones
- Petroleum Distillates
- Volatile Methyl Siloxanes
- Semi-Aqueous Cleaners

## Equipment

- Vapor Degreasing
- Vacuum Degreasing
- Vacuum Cycling Nucleation
- Ultrasonics
- Spray Cleaning
- Pressure Washing
- Immersion
- Manual Wiping
- Plasma

[www.cleansolutions.org](http://www.cleansolutions.org)

# Toxics Use Reduction Planning



- Work with a **team**
  - Engage diverse perspectives
- Understand **how** chemicals are used and **why**
  - Gather relevant data
- Identify a suite of possible **options** to consider
  - Maximize creativity and research
- Determine which options are **feasible**
  - Satisfy the needs of the facility
- **Recommend** implementation of best option(s)

# TUR Techniques Implemented

Input  
substitution

Process  
modification

Product  
redesign

Process  
modernization

Improved  
operations and  
maintenance

Integral  
recycling

## Aqueous Adoptions

CD Aero

Southbridge

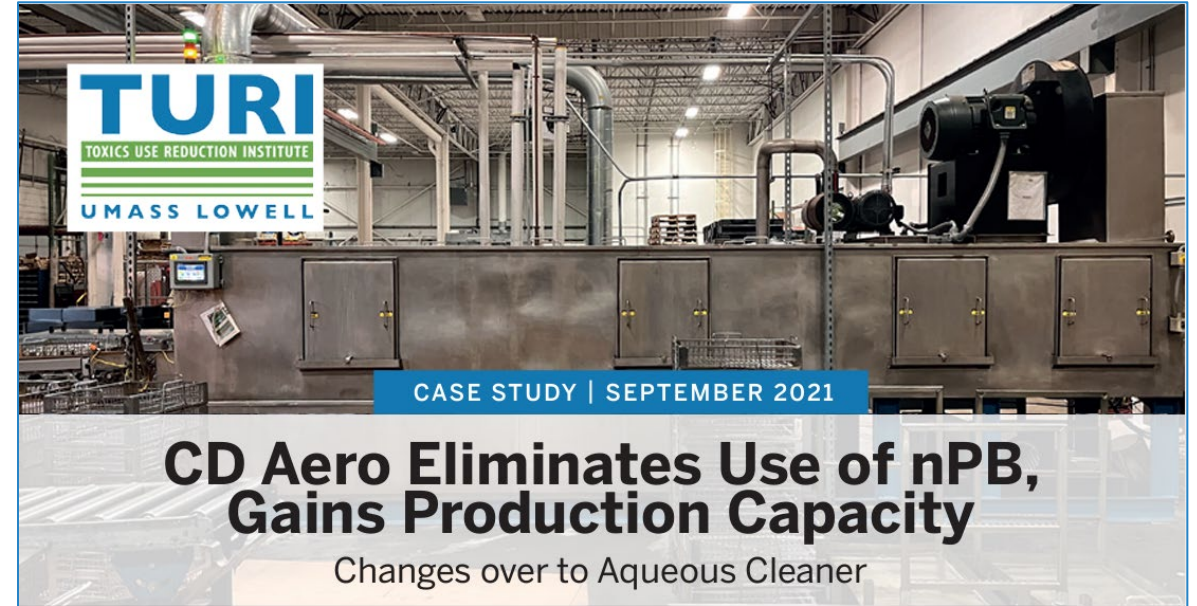
Steel Art



**CD Aero**

*A Division of Cornell Dubilier Electronics, Inc.*

- Manufactures intelligent capacitor solutions for medical, military, health and beauty sectors
- Was using nPB in a vapor degreaser to clean oils off metal and ceramic parts
- Degreaser was outdated, containing 10,000 lb. solvent and emitting 5,000 lb. solvent
- New owners prioritized replacing nPB with an aqueous process
- Company switched to alkaline aqueous phosphate-based cleaner, used on a new conveyor belt system



<https://youtu.be/1Z-JdjPKVbQ>



# CD Aero Results

## Operating and Maintenance Cost Comparison of CD Aero's Old and New Systems

Item	Old nPB System: Annual Costs	New JenFab/Aquaease System: Annual Costs	Cost Savings
<b>Cleaning solution</b>	\$15,000	\$15,000	—
<b>Electricity</b>	*\$56,500	\$35,500	\$21,000
<b>Steam</b>	\$25,500	\$11,250	\$14,250
<b>Water</b>	\$0	\$1,000	(\$1,000)
<b>Impregnation oil disposal</b>	\$600	\$600	—
<b>Regulatory reporting (TURA fee)</b>	\$1,200	\$0	\$1,200
<b>Maintenance Costs</b>	\$11,000	\$0	\$11,000
<b>Total</b>	<b>\$109,800</b>	<b>\$63,350</b>	<b>\$46,450</b>

\* Electricity costs of equipment, carbon absorption, and chiller.

## Productivity Increases Between CD Aero's Old and New Systems

Item	Old nPB System	New JenFab/Aquaease System	Comments
<b>Training</b>	Several weeks of training many years ago	Approximately 30 minutes for each of 3 operators	Minimal training was needed to learn the new system
<b>Throughput</b>	Up to 40.5 baskets per hour	Over 68 baskets per hour	68% increase in throughput
<b>Maintenance Labor</b>	Approx. 3 hours per week	Under 2 hours per week to wash down tanks and replenish system	33% reduction in maintenance labor

# Added Benefits



Freed up 1920 sf on the shop floor, which can now be used for manufacturing space.  
Estimate an additional \$16,000/year cost savings



No carbon absorption system required in the new unit



Workers appreciate health and safety improvements



Significant ease of use and reduced labor time with new equipment

# Alternative Vapor Degreasing Technology



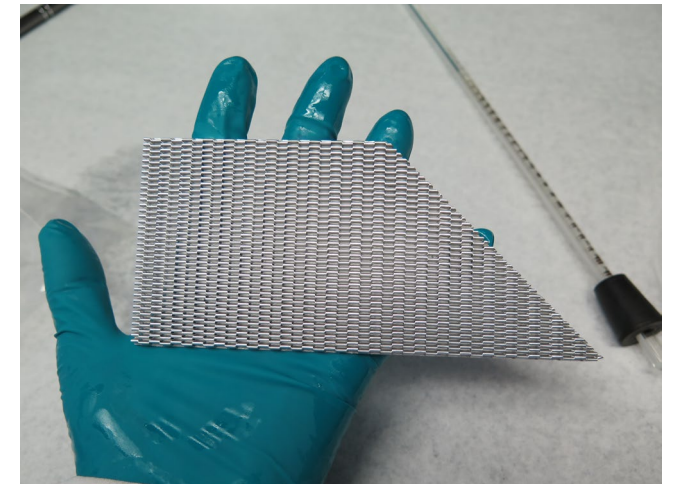
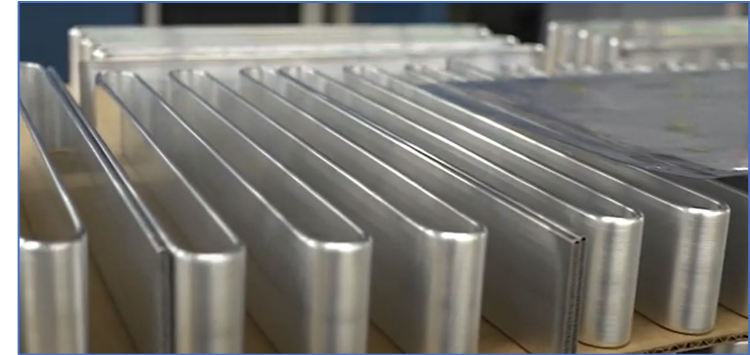
# BOYD CORPORATION

Low hanging  
fruit



- Improved O&M and Process Modernization (1994-2009)
  - Increased freeboard, automated parts handling, temperature monitoring, etc.
  - Optimized recycling still
- Input Substitution (early 2010s)
  - Transitioned welded parts from TCE to aqueous cleaning
- Process Redesign (2017)
  - Implemented vacuum cleaning process for Al brazing process
  - Reduced TCE emissions by 6000 lb/year
- Current work
  - Completely eliminating TCE in Cu cell applications

Most  
challenging to  
implement



# Currently Implementing



Vishay Barry



Boyd (Lytron)



SE Shires



Steel Art



Southbridge  
Sheet Metal  
Works



Central Metal  
Finishing

# steel art

Architectural Signage | Look close

- Manufactures architectural quality signage
- Vapor degreasing to remove buffing compounds from aluminum, stainless steel and brass
  - TCE originally
  - Switched to nPB in early 2000's
- Drivers for change
  - Vapor degreaser failed/no longer operational in 2020
    - New degreaser >\$50,000
  - Short-term solution
    - Manual cleaning with acetone bath
      - Slower cleaning process, high flammability, health risks to workers



# Steel Art Process

- Worked with TURI lab
- Received TURI Industrial Grant
- New Cleaner: Metalnox 6435 (alkaline aqueous)
  - Proven performance and productivity
  - Comparable to vapor degreasing results
    - Conceded a little extra time to achieve desired results
    - Continuing to develop rinse aids to improve
  - Less expensive



# Contact Us

Visit our website [www.turi.org](http://www.turi.org) for

- Free laboratory testing
- Databases and tools
  - [www.Cleanersolutions.org](http://www.Cleanersolutions.org)
  - <https://P2OASys.turi.org>
  - [www.TURAdata.org](http://www.TURAdata.org)



Alicia McCarthy  
Laboratory Specialist  
Email: [Alicia\\_McCarthy@uml.edu](mailto:Alicia_McCarthy@uml.edu)  
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