

# Safer Alternatives to Vapor Degreasing

December 15, 2020



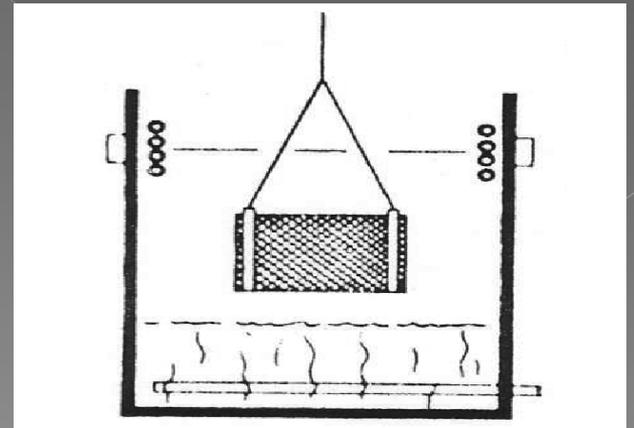
Katy Wolf, Ph.D  
Consultant to PPRC

# Background

- ◎ Vapor degreasing used by thousands of facilities for cleaning parts
  - > Metal finishing, fabrication, assembly
  - > Aerospace
  - > Other
- ◎ TSCA amended in 2016 and EPA was charged with developing regulations on priority listed chemicals
- ◎ PPRC EPA Region 10 project focusing on safer alternatives to TSCA listed priority chemicals
  - > TCE, PERC, MC and nPB are on TSCA list of first 10 priority chemicals and are widely used in vapor degreasing

# What is Vapor Degreasing?

- A vapor degreaser is a stainless steel tank with a heater in the bottom and a set of cooling coils near the top
- Liquid solvent is placed in the degreaser and is heated to its boiling point
- There are solvent vapors above the liquid
- The vapors are contained in the degreaser by the cooling coils



# Vapor Degreasing Continued

- ◎ Parts are loaded into the vapor degreaser, generally in a basket or on a fixture
- ◎ The warm solvent vapors condense on the colder parts
- ◎ The contaminants on the parts are carried into the liquid
- ◎ The vapor zone, where the cleaning is done, always has clean solvent
- ◎ Many degreasers are more complex
- ◎ Solvents used in open-top vapor degreasers have no flash point

# PPRC Project Description

- ◎ Three aerospace subcontractors in Seattle area and one plater in Portland
  - > Assisting them in converting to safer alternatives
  - > All four companies are using nPB
- ◎ Company making ducting for aerospace and industrial applications
- ◎ Company making small diameter tubing for aerospace and industrial applications
- ◎ Company doing nondestructive testing (NDT) for aerospace applications
- ◎ Company that does plating for industrial applications

# Range of Different Alternatives

- ◉ Chlorinated solvents (TCE, PERC, MC)
- ◉ Fluorinated solvents (HFEs, HFCs, HFOs)
- ◉ Solvents with flash points in vapor degreasing (oxygenated, hydrocarbon)
- ◉ Solvents with flash points in cold cleaning (oxygenated, hydrocarbon, terpenes, VMS)
- ◉ Soy-based cleaners
- ◉ Water-based cleaners
- ◉ Other methods (heat, no-clean, blasting)

# Best Alternatives

- ◎ Taking into account health and environmental effects, cost and technical feasibility
- ◎ Almost all operations can use water-based cleaners
- ◎ A few operations of specific types can use soy-based cleaners or other methods
- ◎ In PPRC project, all facilities are converting to water-based cleaners
- ◎ Another HESIS project in California
  - › One facility converting to soy-based process

# Procedures for Finding Suitable Alternative

- ◎ Visit facility, look at operations, discuss processes, discuss options
- ◎ Figure out what cleaner and type of equipment should be used
  - > Based on substrates, configuration, contaminants
  - > Determine whether there are approval issues
- ◎ Have facility send parts with typical contaminants to water cleaner supplier
  - > Discuss, specify equipment, cleaner, conditions

# Procedures Continued

- ◉ Have facility evaluate cleaned parts
- ◉ Investigate equipment
  - > Clean parts on-site or off-site with equipment supplier and selected cleaner
- ◉ Have facility evaluate parts
- ◉ Get quotes on equipment
  - > Sometimes competing processes
  - > Sometimes need competitive quotes

# Procedures Continued

- ◎ Facility purchases equipment
- ◎ Facility installs equipment
- ◎ Must do cost comparison of old and new systems
  - > Needs to include capital cost of new system and operating costs of both old and new systems
- ◎ Facility operates equipment for a time
  - > Need information for estimating operating costs

# Conducting Cost Analysis and Comparison

- ◎ One approach is to use annualized cost
- ◎ Include capital and operating costs
- ◎ Include capital cost for new alternative system
  - > Amortize cost over assumed life of system
- ◎ Use EPA equation for estimating capital cost
- ◎ Must often estimate operating costs since companies don't always have them

# Important Considerations

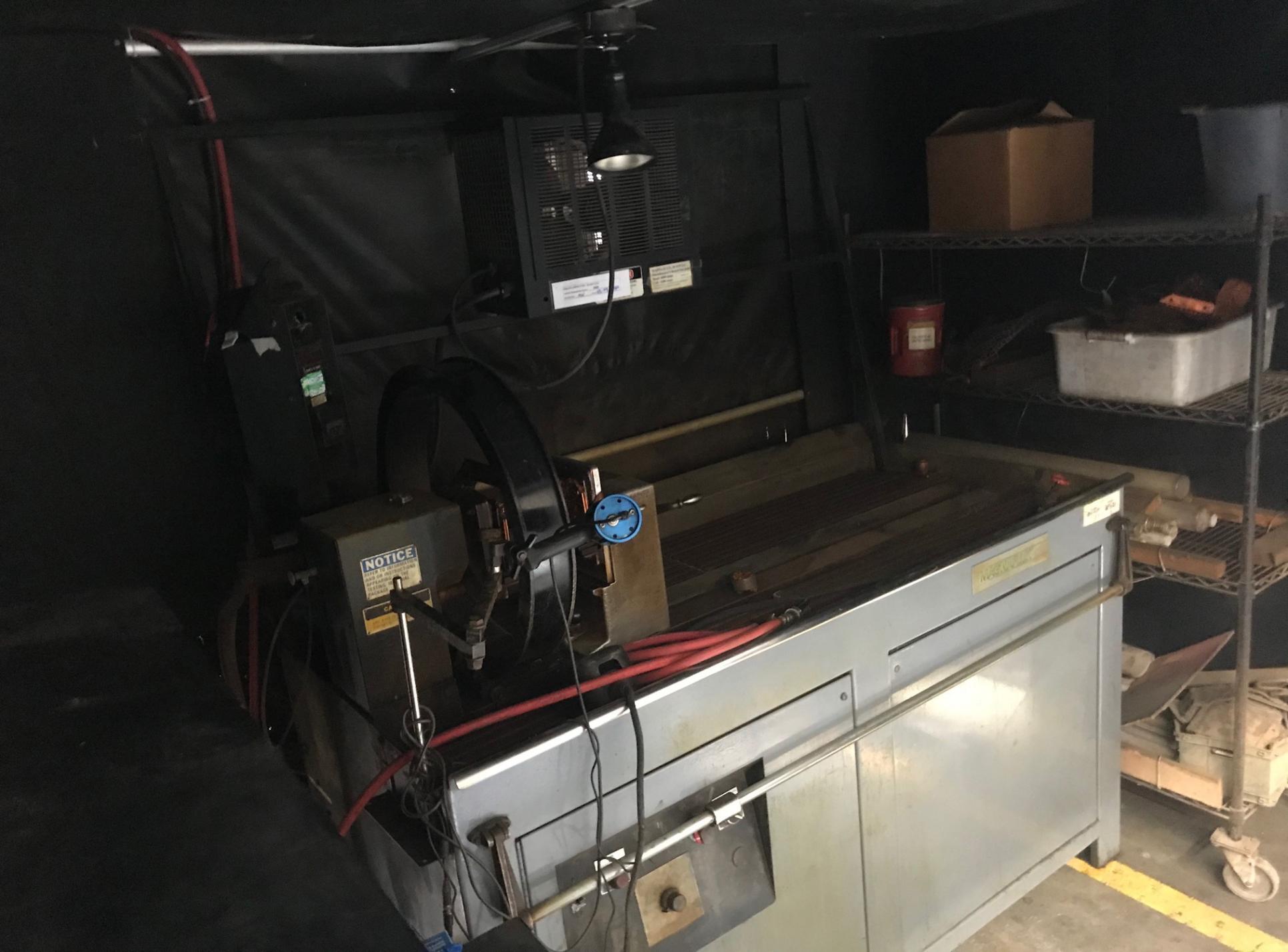
- ◎ Nearly always need to make options as low cost as possible
  - > Example of spray cabinet vs immersion system
- ◎ Can generally show it is cost effective over the life of the system to make the conversion
  - > Facilities have different capital investment policies, problems

# Case Study Example

- ◎ Aerospace subcontractor offering NDT services to many companies
- ◎ Cleans parts prior to and after application of NDT fluids
- ◎ Used large nPB vapor degreaser for many years
- ◎ Did testing, found suitable approved water-based cleaner
- ◎ Tested in equipment and quotes on new equipment were higher than facility was willing to pay

# Example Continued

- ◎ Subcontractor found second-hand system but another company bought it first
- ◎ Identified company that offers second-hand systems and subcontractor purchased it
- ◎ Has installed equipment and has been operating it for several months
- ◎ System is working well



**NOTICE**  
PLEASE DO NOT OPERATE  
THIS MACHINE WITHOUT  
THE PROPERLY TRAINED  
PERSONNEL.  
GA

WAGNER  
MACHINERY





Dayton

RAMCO

HAR  
FRE  
QUALITY  
LOWES

# Annualized Cost Comparison

Cost Element	Vapor Degreaser	Water System
Equipment	-	\$7,030
Cleaner	\$22,425	\$1,211
Water	-	-
Filters	-	\$75
Energy	\$17,537	\$9,605
Labor	\$25,407	\$31,023
PPE	-	-
Disposal	\$2,046	-
Total	\$67,415	\$48,944

# Issues in Working With Companies on Alternatives

- ◎ Nearly always want drop-in alternative
  - > Must know everything about alternatives so you can discuss why they cannot use them
- ◎ Must have good relationships with vendors
  - > Must know a lot about cleaners, what equipment will work and how to work around approvals
- ◎ Must encourage companies to convert
- ◎ Must be prepared to assist companies in estimating operating costs
- ◎ Covid-19 is affecting business and companies often cannot purchase alternative system
- ◎ If there are no regulations or threats of regulation, there is little incentive to convert

# Conclusions

- ◎ Water-based cleaning systems are viable and cost effective substitutes for vapor degreasing for vast majority of operations
- ◎ Other safer alternatives can be used in some situations
- ◎ Need significant expertise developed through direct experience to work with companies on conversions
  - > There is no “drop-in” or “magic answer”

# Contact Information

Dr. Katy Wolf

Consultant to PPRC

Phone (818) 371-9260

[katywolfirta@gmail.com](mailto:katywolfirta@gmail.com)