

Safer Alternatives to Vapor Degreasing

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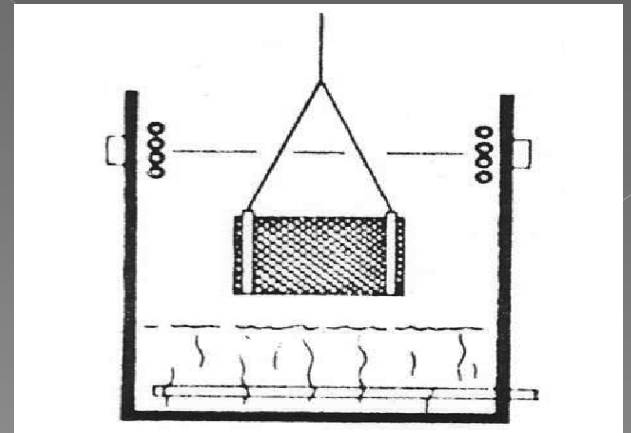
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Background

- ◎ 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

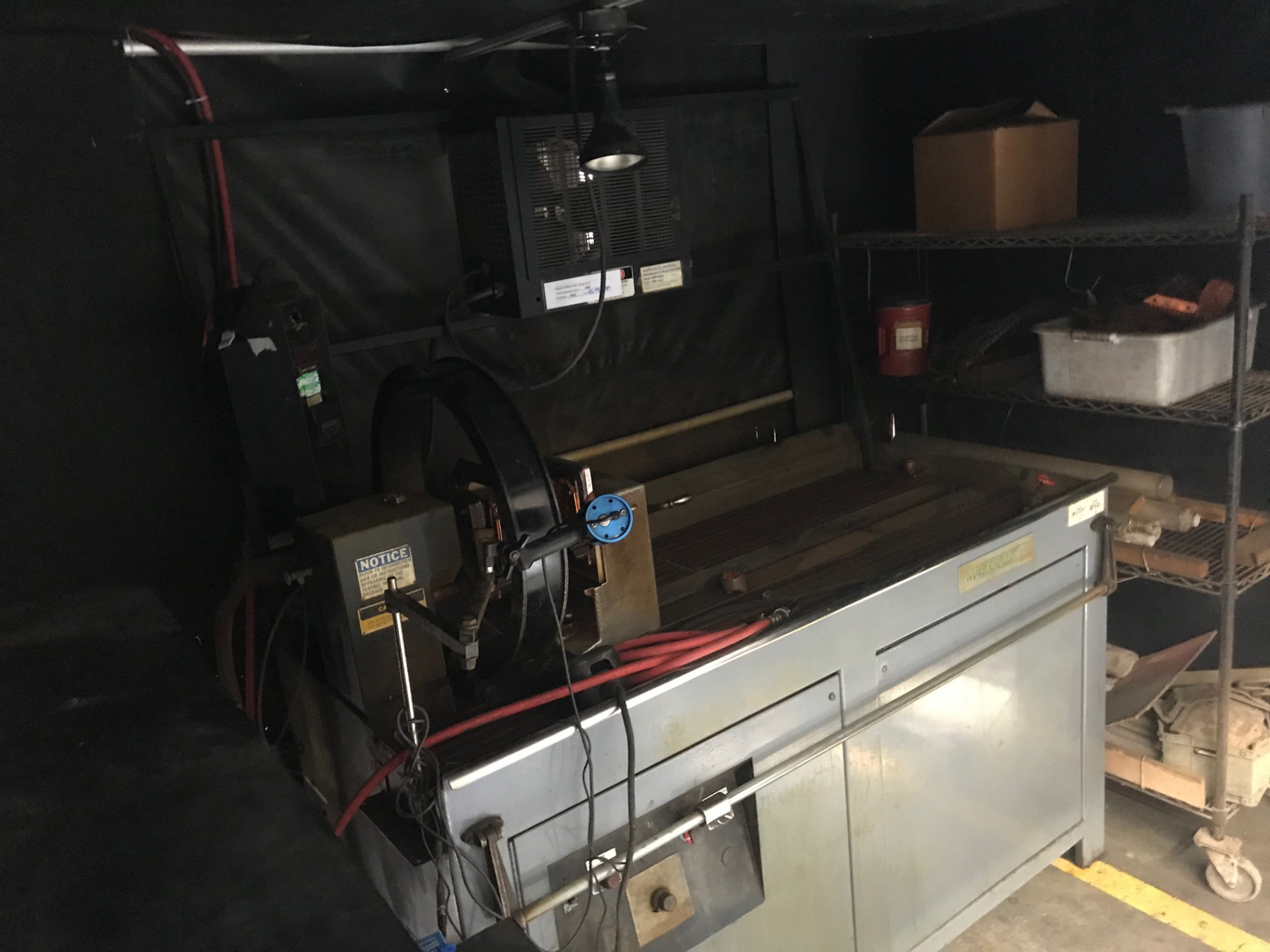
- ◎ Nearly always need to make options as low cost as possible
 - > Example of spray cabinet vs immersion system
- ◎ Can generally show it is cost effective over the life of the system to make the conversion
 - > Facilities have different capital investment policies, problems

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



Bulk Rack Area

PARTS

LARGE POINTER

ALL TIER

HEAD-LO

Handwritten note on a yellow background, partially legible.

Small handwritten labels on the machine's surface.



Dayton

RAMCO

HAF
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

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