

Case Studies: Vapor Degreasing Conversions to Safer Alternatives

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Background

- Vapor degreasing used by thousands of companies in the U.S. for cleaning parts
- Dominant industries that rely on vapor degreasing
 - > Metal parts manufacturers, assemblers, fabricators, microelectronics and electronics manufacturers, assemblers, aerospace primes and job shops
- Solvents most commonly used in vapor degreasing
 - > Trichloroethylene (TCE)
 - > Perchloroethylene (PERC)
 - > Methylene chloride (MC)
 - > n-Propyl bromide (nPB)
- Conversion process is similar for any of the four solvents

Case Study Conversions

- ◎ PPRC project

- > Worked with four companies
- > All four used nPB
- > Two converted and completed work with other two
- > Report can be accessed at https://bit.ly/nPB_Alt1

- ◎ HESIS project

- > Worked with two companies
- > Both used nPB
- > One converted and completed work with other company



Case Study 1: MAPSCO

- ◎ Company offers NDT services for aerospace parts
- ◎ Used 130 gallon nPB vapor degreaser
- ◎ Worked with water cleaner supplier to test alternatives and identified effective cleaner
- ◎ Worked with equipment suppliers and identified suitable immersion/agitation equipment
- ◎ Purchased and installed second-hand cleaning system
 - > Used successfully for nearly a year



Annualized Cost Comparison for Mapsco

Cost Element	Vapor Degreaser	Water System
Equipment	-	\$7,854
Cleaner	\$22,425	\$1,211
Filters	-	\$75
Energy	\$17,537	\$9,605
Labor	\$25,407	\$31,023
PPE	-	-
Disposal	\$2,046	-
Total	\$67,415	\$49,768

Case Study 2: Exotic Metals Forming Company

- ◉ Manufactures ducting for aerospace and industrial applications
- ◉ Subject to numerous aerospace requirements and EU's REACH standards
- ◉ Used large nPB vapor degreaser for many years
- ◉ Worked with water cleaner supplier and company converted most operations in facility to one cleaner
- ◉ Converted to existing immersion/agitation system
- ◉ Also worked on converting anti-spatter process





Annualized Cost Comparison for Exotic for Cleaning Process

Cost Element	Vapor Degreaser	Water System
Equipment	-	-
Cleaner	\$34,000	-
Filters	-	\$63
Energy	\$20,218	\$3,849
Labor	\$125,892	\$30,002
PPE	\$3,208	\$69
Disposal	\$5,297	-
Total	\$188,615	\$35,741

Annualized Cost Comparison for Exotic for Anti-Spatter Process

Cost Element	nPB Anti-Spatter	Water Anti-Spatter
Anti-Spatter	\$72,000	\$8,580
Application Equipment	\$1,037	\$104
Labor	\$19,368	\$19,368
PPE	\$3,480	-
Total	\$95,885	\$28,052

Case Study 3: Plating Company

- Company is a job shop that provides plating services
- Parts made of stainless steel, copper, brass, aluminum and carbon steel
- Uses three types of polishing compounds to polish parts
- Used large 110 gallon nPB vapor degreaser for many years
- Did testing, found effective water-based cleaner alternative
- Evaluating quote on alternative ultrasonic cleaning system



Annualized Cost Comparison for Plating Company

Cost Element	Vapor Degreaser	Water System
Equipment	-	\$3,235
Cleaner	\$28,680	\$5,721
Energy	\$3,650	\$1,572
Labor	\$22,132	\$22,132
PPE	\$250	-
Disposal	\$300	\$550
Total	\$54,814	\$33,210

Case Study 4: Tube Manufacturer

- ◎ Company manufactures small diameter tubes for aerospace applications
- ◎ Converted from very old vapor degreaser to new degreaser recently
- ◎ Worked with water cleaner supplier and identified suitable water-based cleaner
- ◎ California company with similar operations converted to ultrasonic system
- ◎ Worked with equipment supplier to test in less costly spray cabinet and testing was successful
- ◎ Company evaluated spray cabinet purchase



Annualized Cost Comparison for Tube Manufacturer

Cost Element	Vapor Degreaser	Water System
Equipment	-	\$7,053
Cleaner	\$3,727	\$631
Filters	-	\$16
Energy	\$350	\$2,004
Labor	\$7,652	\$7,652
PPE	\$1,200	-
Disposal	\$1,000	\$1,200
Total	\$13,929	\$18,556

Case Study 5: Microelectronics Manufacturer

- ◉ Manufactures microelectronics for medical devices
- ◉ Subject to FDA requirements
- ◉ Uses thick film deposition process
- ◉ Relied on nPB vapor degreaser to remove particles and handling soils
- ◉ Tested parts in existing printed circuit board water cleaning system
- ◉ Got FDA approval to convert to existing system



Case Study 6: Optical Components Manufacturer

- ◎ Company is job shop that manufactures optical components
- ◎ Uses pitch and wax to polish optical components
- ◎ Contaminants are difficult to remove
- ◎ Worked with company to test soy/water cleaning process and it worked successfully
- ◎ Obtained quotes from two equipment suppliers
- ◎ Company evaluating system with larger bath



Annualized Cost Comparison for Optical Components Manufacturer

Cost Element	Vapor Degreaser	Soy/Water System
Equipment	-	\$2,548
Cleaner	\$5,280	\$626
Filters	-	\$72
Energy	\$1,416	\$2,170
Labor	\$50,050	\$50,050
PPE	\$1,200	-
Disposal	-	\$336
Total	\$57,946	\$55,802

Issues for Companies on Alternatives

- ◎ Companies nearly always want drop-in alternative and vendors are always selling something
- ◎ Companies skeptical that water-based cleaners will work and testing with cleaner/equipment suppliers can help
 - > Suppliers will work with companies for free
- ◎ Many water cleaners approved for aerospace use and some suppliers will get approval for additional cleaners
- ◎ Need to make alternative cleaning systems as low cost as possible
- ◎ No incentive to convert without regulations

Conclusions

- ◎ Water-based cleaning systems are viable and cost effective substitutes for vast majority of vapor degreasing operations using solvents today
- ◎ Other safer alternatives can be used in some situations
- ◎ There is no drop-in or magic answer
- ◎ You have to know a lot of things and establish credibility and relationships
 - > experience is the only way to do it
- ◎ Best strategy for companies is to find a permanent solution so they don't have to convert again

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