Parts Washing

COMMONLY OBSERVED PRACTICES

Most metal manufacturing facilities use one or more parts wash basins containing petroleum-based solvents. The frequency the basins are used and the quantity of waste associated with their usage varies greatly from facility to facility. Facilities that use these basins to clean production parts generate significant amounts of parts wash solvent waste while facilities that use them primarily for maintenance related activities generate much smaller quantities.

Parts wash basins are generally serviced on a set time schedule. Servicing is done by facility employees or, most commonly, through a contract with a service provider.

POLLUTION PREVENTION OPTIONS

Many options exist to reduce the toxicity and/or volume of waste generated from parts washing activities. These options range from simple administrative controls to modest process changes.

Administrative Controls

The first and most easily implemented pollution prevention option involves careful evaluation of existing parts washing solvent quality and scheduled maintenance. Parts washer service intervals are often based on the service company's best estimates, which may be overly conservative; or based on conditions that have changed over time. Basing parts washer service intervals on solvent quality rather than set time schedules is particularly beneficial for facilities that experience seasonal fluctuations in production and/or maintenance activities.

There are no set procedures to establish optimum service intervals. The best method is to rely on the experience of personnel that use the solvent on a daily basis. If two units are used at a facility, dedicate one unit for preliminary cleaning. If additional, higher quality cleaning is desired, the second unit can be used after the preliminary wash. When the operator feels the solvent quality in the preliminary unit is no longer adequate, the second unit can be brought into preliminary use and the dirty unit serviced for reuse as the final wash. By evaluating solvent quality, alternating parts washer servicing between a preliminary and secondary unit, and by servicing the units only when solvent quality dictates, waste solvent generation can be significantly reduced.

If solvent equipment leasing and service companies will not agree to the "as-needed" servicing arrangement, parts wash basins may be purchased and managed in-house. Waste parts wash solvent can be recycled by most hazardous waste management companies. Common parts washer basins cost approximately $600. Common petroleum solvents, in 55-gallon drum quantities, can be purchased at a cost of $2.40 per gallon. Waste solvent recycling services run approximately $2.45 per gallon.

Hybrid Petroleum Solvent Parts Washer Units

A second method to reduce petroleum based parts washer solvent waste generation involves the use of 'hybrid' units. These units are equipped with devices that purify the circulating solvent to significantly increase its service life. Benefits associated with the use of hybrid units include:

- Reduced hazardous waste generation and off-site transportation liabilities. This reduced hazardous waste generation may place the facility in a less restrictive regulatory category (i.e. from a SQG to a CESQG).

- Due to continual solvent purification, a consistently cleaner solvent is available.
- One hybrid unit may replace two or more conventional units.

The following purification methods have been identified:

Distillation

Distillation units look like conventional recirculating parts wash basins but are equipped with a small distillation unit. Solvent is continually distilled and returned to the basin. Oil, grease and other impurities are collected as 'still bottoms' for subsequent disposal. These units reportedly reduce hazardous waste generation by 90%. The estimated cost for lease and service of a distillation unit is $1200 annually. Example vendor literature for this type of unit is enclosed as Appendix B.

Centrifugal Filtration

Centrifugal filtration units use centrifugal force to separate oil, grease and other impurities from the solvent. The impurities are collected in the unit and removed periodically for disposal. One supplier of this type of equipment indicated a 50% reduction in waste solvent can be obtained as compared to conventional parts washers. The annual service charge for a centrifugal filtration unit was quoted at $798. Example vendor literature for this type of unit is enclosed as Appendix C.

Conventional Filtration

Conventional filtration units have a filter (or set of filters) installed in the solvent circulation piping to remove solvent impurities. Periodic replacement and disposal of the filters are necessary.

Performance data for conventional filtration type units, as provided by the equipment suppliers, are summarized below:

- ✓ Typical solvent life increased from 3 to 10 times (average 6 times).
- ✓ Filter cartridge replacement every 4 to 8 weeks (average 6 weeks).
- ✓ Retail price for the parts washing unit is approximately $700.
- ✓ Replacement filters are $10 each.
- ✓ Solvent purchase cost is approximately $2.40 per gallon.
- ✓ Waste solvent disposal would run $2.45 per gallon.
- ✓ An additional cost for filtration type units would be one-time Toxicity Leaching Characteristic Procedure (TCLP) testing of the waste filters. A $400 laboratory fee should be included in this option's cost calculation. If testing indicates the filters are hazardous, a relatively small hazardous waste disposal fee (i.e. approximately $2 per filter) should be included in the calculation. If nonhazardous, solid waste landfill costs would be insignificant.

Example vendor literature for these types of units is enclosed as Appendix D.

Biodegradation

These units use a 'nonhazardous' solvent that reportedly never requires disposal. Oil and grease accumulating in the unit are degraded by bacteria contained in a replaceable filter. Additional information, from the only identified supplier of this type of unit, is enclosed as Appendix E. An equipment spokesperson provided the following data:

- ✓ A unit cost of $1400
- ✓ Monthly replacement of the $10 bacteria/filter

- ✓ Addition of approximately 5 gallons of solvent every 2 months ($60/five gallons) to make up for evaporation and carry-out.
- ✓ This option would also require the one time TCLP testing ($400) prior to disposal of the waste filters.

Alternative Solvents

D-Limonene

While mineral spirits is a relatively nontoxic solvent, it generally must be managed as a hazardous waste because of ignitability and possibly toxicity if it picks up toxic contaminants from the items being cleaned. Alternative solvents are available that may provide comparable cleaning while generating a nonhazardous waste that will be less costly to dispose of. Two general types of alternatives exist. The first is a citric product (D-limonene) that may be used as a replacement in existing parts washer basins. Common D-limonene solvent blends have flashpoints higher than 140°F so they will not be hazardous because of ignitability (TCLP testing is advised to determine if it is hazardous from toxic metal or organic compound contamination). Nonhazardous, waste D-limonene may be recycled in conjunction with used oil if prior approval from the oil recycler is obtained.

D-limonene can be purchased from most local chemical suppliers at a cost ranging from $15 to $20 per gallon in 55-gallon quantities. As with other alternatives, an initial $400 laboratory cost to characterize the waste as hazardous or nonhazardous should be included in the cost/benefit analysis.

Aqueous Cleaners

Other alternative solvents include aqueous products; specifically neutral and alkaline detergents. These products should be formulated with sequestering agents, surfactants and rust inhibiting additives. Aqueous cleaners work best in pressure spray applications. This requires use of alternative parts washing equipment. Aqueous parts washers resemble dishwashers. Parts are placed in the unit where they are rotated and sprayed with the cleaner. The cleaner is generally heated to facilitate cleaning and reduce drying time. These units cost $3,000 to $4,000. Concentrated aqueous cleaning solution costs approximately $5.50 per gallon in 55-gallon quantities. Example aqueous equipment and solvent vendor information is enclosed as Appendix F.

Facilities plumbed to sanitary sewer systems may be able to discharge aqueous parts washer wastewater to the sewer with prior notification and approval from the city wastewater treatment plant superintendent or city engineer. This method of disposal virtually eliminates off-site waste disposal costs.

Aqueous parts washer wastewater may not be discharged to septic systems or aboveground discharge sources because of regulatory restrictions and potential environmental liabilities. As a result, facilities not located on city sanitary sewer systems must either 1) eliminate this option as an alternative or 2) implement on-site wastewater recycling. On-site wastewater recyclers, designed for this specific application, are available (Appendix F) for approximately $8,000. The recyclers are mobile and can be used to service multiple units. Recycling units will generate a small amount of sludge that will require TCLP testing (an additional $400 cost) and solid/hazardous waste disposal.

COSTS/BENEFITS

The following formulas can be used to calculate the costs/benefits provided by the above pollution prevention options. A company should enter its own data and perform the corresponding calculations.

Existing Conditions

Most manufacturing facilities lease conventional parts washers from a service company. A common monthly lease/service fee for a 30-gallon capacity unit is $100 per month. While the unit has a capacity of 30 gallons, carry-out and evaporation result in the generation of only 15 gallons of waste at the end of the month long service period. This equals an annual solvent usage of 360 gallons and an annual solvent disposal volume of 180 gallons.

Figure 4-1
Parts Washing Alternatives
Cost/Benefit Worksheet
Existing Conditions

ITEM	VARIABLE	EXAMPLE	YOUR FACILITY
A	Gallons of parts wash solvent used per year	360	
B	Gallons of parts wash solvent generated as waste per year	180	
C	Parts washer monthly service charge	$100.00	
D	Annual cost = C x 12	$1,200.00	

Hybrid Petroleum Solvent Parts Washer Units

Distillation

The lease/service costs for distillation parts washer equipment is also around $100 per month, however a significant reduction in the amount of solvent used and generated as waste is expected when compared to the existing conditions.

Figure 4-2
Parts Washing Alternatives
Cost/Benefit Worksheet
Distillation Parts Washer

ITEM	VARIABLE	EXAMPLE	YOUR FACILITY
A	Gallons of parts wash solvent used per year	180	
B	Gallons of parts wash solvent generated as waste per year	18	
C	Parts washer monthly service charge	$100.00	
D	Annual cost = C x 12	$1,200.00	

Centrifugal Filtration

The lease/service costs for centrifugal filtration parts washer equipment is approximately $266 per four month service interval. Again material usage and waste generation is less tha the existing conditions.

Figure 4-3
Parts Washing Alternatives
Cost/Benefit Worksheet
Centrifugal Filtration Parts Washer

ITEM	VARIABLE	EXAMPLE	YOUR FACILITY
A	Gallons of parts wash solvent used per year	225	
B	Gallons of parts wash solvent generated as waste per year	90	
C	Parts washer monthly service charge per 4 month interval	$266.00	
D	Annual cost = C x 3	$798.00	

Conventional Filtration

Figure 4-4
Parts Washing Alternatives
Cost/Benefit Worksheet
Conventional Filtration Parts Washer

ITEM	VARIABLE	EXAMPLE	YOUR FACILITY
A	Unit Cost	$700.00	
B	Waste Filter Testing	$400.00	
C	Gallons of parts wash solvent used per year	195	
D	Solvent purchase cost per gallon	$2.40	
E	Gallons of parts wash solvent generated as waste per year	36	
F	Solvent disposal cost per gallon	$2.45	
G	Filter purchase and disposal cost per year	$100.00	
	Annual cost = (C x D) + (E x F) + G	$656.00	
	Capital cost = A + B	$1,100.00	

Biodegradation

Figure 4-5
Parts Washing Alternatives
Cost/Benefit Worksheet
Biodegradation Parts Washer

ITEM	VARIABLE	EXAMPLE	YOUR FACILITY
A	Unit Cost	$1,400.00	
B	Waste Testing	$400.00	
C	Gallons of parts wash solvent used per year	40	
D	Solvent purchase cost per gallon	$12.00	
E	Filter purchase and disposal cost per year	$144.00	
	Annual cost = (C x D) + E	$624.00	
	Capital cost = A + B	$1,800.00	

Alternative Solvents

D-limonene

Figure 4-6
Parts Washing Alternatives
Cost/Benefit Worksheet
Alternative Solvents - D-Limonene

ITEM	VARIABLE	EXAMPLE	YOUR FACILITY
A	Unit Cost	$600.00	
B	Waste Testing	$400.00	
C	Gallons of parts wash solvent used per year	80	
D	Solvent purchase cost per gallon	$17.50	
E	Gallons of parts wash solvent generated as waste per year	40	
F	Solvent disposal cost per gallon	$0	
	Annual cost = C x D	$1,400.00	
	Capital cost = A + B	$1,000.00	

Aqueous Cleaners

Figure 4-7
Parts Washing Alternatives
Cost/Benefit Worksheet
Alternative Solvents - Aqueous Cleaner

ITEM	VARIABLE	EXAMPLE	YOUR FACILITY
A	Unit Cost	$3,500.00	
B	Waste Testing	$400.00	
C	Gallons of parts wash solvent used per year (Concentrate)	55	
D	Cleaner purchase cost per gallon	$5.50	
E	Gallons of parts wash solvent generated as waste per year	275	
F	(Diluted)		
	Solvent disposal cost per gallon	$0	
	Annual cost = C x D	$300.00	
	Capital cost = A + B	$3,900.00	

Figure 4-8 shows a summary of the cost comparisons listed above as compared to existing practices.

Figure 4-8
Cost Comparison - Parts Washing Alternatives

Option	First Year Cost	Subsequent Annual Cost	Payback	Subsequent Annual Savings (Loss)	Estimated Hazardous Waste Reduction
Existing Conditions	$1,200.00	$1,200.00	-	-	-
Distillation	$1,200.00	$1,200.00	0	0	90%
Centrifugal Filtration	$798.00	$798.00	0	$402.00	50%
Conventional Filtration	$1756.00	$656.00	1 year	$544.00	80%
Biodegradation	$2,424.00	$624.00	2 years	$576.00	100%
D-limonene Solvent	$2,400.00	$1,400.00	NA	($200)	100%
Aqueous Cleaner	$4,200.00	$300.00	3 years	$900.00	95%

As can be seen from Figure 4-8, numerous cost effective pollution prevention options are possible based on these example situations. The greatest annual cost savings is obtained using aqueous parts washing methods if one is willing to assume the 3-year payback requirement to recoup the initial purchase and laboratory analysis costs. With the exception of the D-limonene, all other options achieve net annual cost savings with initial purchase cost paybacks of 2 years or less. D-limonene may become economically attractive as well if future product costs decrease.

It is important to note that hybrid (purification) units maintain a consistently cleaner solvent due to continual purification. As a result, one of these units may be able to replace two or more conventional units. If one alternative unit can replace two conventional units, then the cost/benefit for that unit increases twofold.

One should also be cognizant of the hazardous waste reduction potentials of these options. Although pollution prevention benefits were not included in the above calculations, they are nonetheless important and should be considered when making any process change.