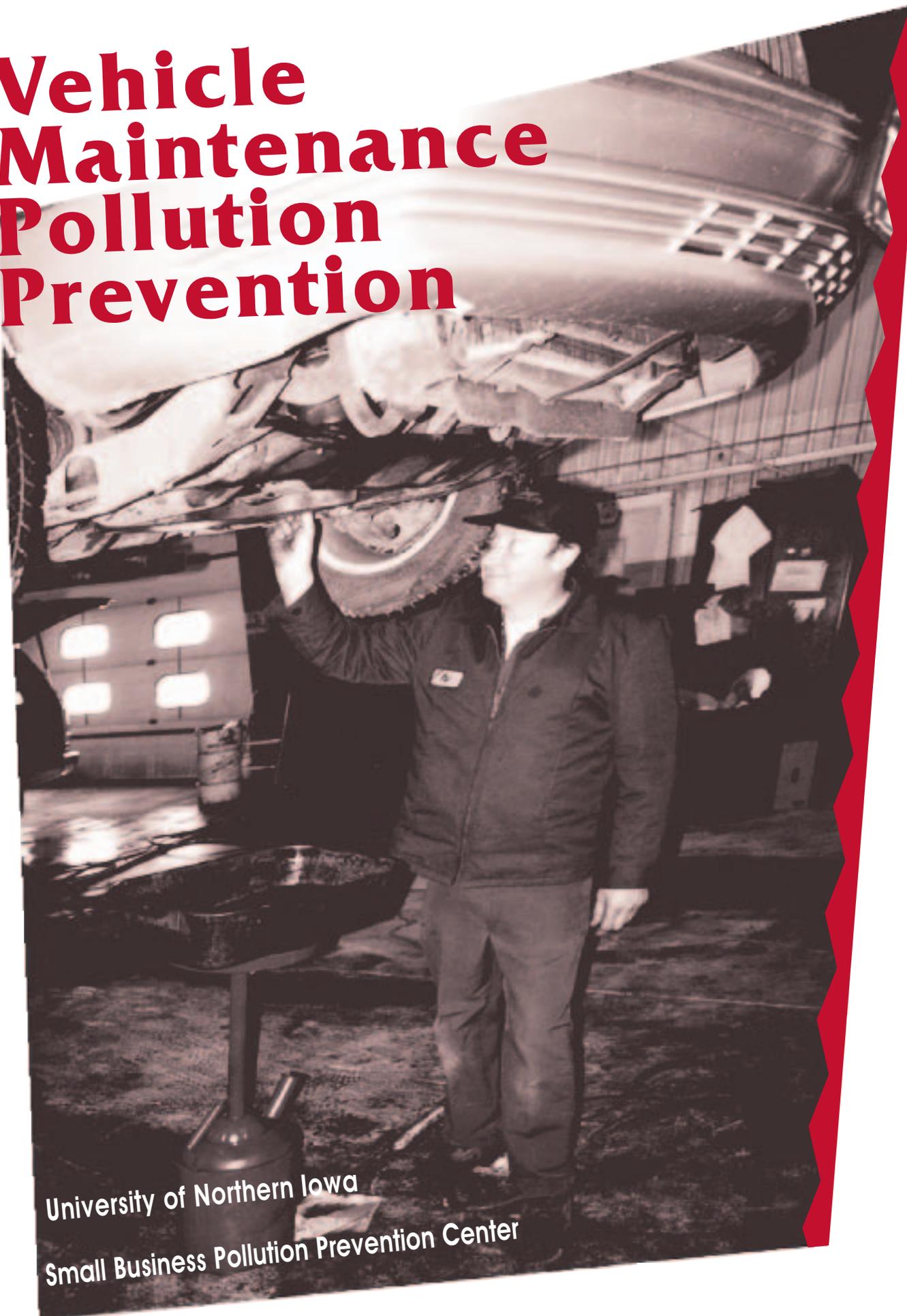


Vehicle Maintenance Pollution Prevention



University of Northern Iowa
Small Business Pollution Prevention Center

Vehicle Maintenance Pollution Prevention

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Vehicle Maintenance Pollution Prevention

Pollution prevention can be defined as: “The use of materials, processes, or practices that reduces or eliminates the creation of pollutants or wastes at the source.” (EPA) Pollution prevention represents a shift away from the old school of thought, “pollution control,” in which waste was not dealt with until after it was generated. Through pollution prevention, we look at the processes that generate the waste to see if we can avoid creating a waste in the first place, or at least reduce the hazardous nature of the waste. When this is not possible, the next best solution to prevent wastes from having a negative impact on the environment is through careful management and recycling.

If you are a vehicle maintenance and repair shop owner or service manager, this manual is for you. It will help you identify areas in your facility where pollution prevention techniques can be applied in a practical manner. Each section presents a waste stream common to vehicle maintenance accompanied by pollution prevention recommendations. Appendices to this manual contain lists of equipment vendors and service providers, regulatory summaries, and other information necessary to implement recommendations.

Although the focus of this manual is on pollution prevention, regulatory information is given as necessary where it impacts pollution prevention practices and to illustrate how pollution prevention can help reduce regulatory requirements. A shop with good pollution prevention practices will be well on its way to regulatory compliance.

What Is a Hazardous Waste?

Knowing what makes a waste hazardous is important in understanding why it should be reduced or eliminated, and in choosing non-hazardous alternatives.

A material becomes a waste when it can no longer be used or reused in its existing form and requires disposal or treatment. In other words, if a material can be reused without being treated, then it is not considered a waste. Reusing materials on or off site can reduce waste generation. Examples of reuse can be as simple as reusing cardboard boxes for shipping or reusing dirty parts wash solvent for precleaning parts to extend solvent life.

A waste is hazardous if it exhibits a specific characteristic, or if it is found on any of the four specifically listed categories of hazardous wastes.

CHARACTERISTIC HAZARDOUS WASTES

There are four characteristics that can make a waste material a hazardous waste: ignitability, corrosivity, reactivity and toxicity.

Ignitability - A liquid waste is ignitable if its flashpoint is less than 140°F. A nonliquid waste is ignitable if it is capable of spontaneous combustion. Ignitable hazardous wastes have the EPA waste code D001.

Examples of potentially ignitable wastes are:

- ✗ Petroleum parts wash solvents
- ✗ Solvent-based paint waste
- ✗ Waste kerosene or gasoline

Corrosivity - A waste is corrosive if its pH is less than or equal to 2.0, or greater than or equal to 12.5. Corrosive hazardous wastes have the EPA waste code D002. Examples of potential corrosive wastes are:

- ✗ Acid or alkaline cleaning solutions
- ✗ Rust removers
- ✗ Battery acid
- ✗ Caustic hot tank waste

Reactivity - A waste is reactive if it reacts violently with water, forms potentially explosive mixtures with water, generates toxic gases when mixed with water, contains cyanides or sulfides that are released when exposed to acid or alkaline materials, or is explosive. Reactive hazardous wastes have the waste code D003. Examples of potential reactive wastes are:

- ✗ Pressurized aerosol cans

Toxicity - A waste is toxic if it fails the “Toxicity Characteristic Leaching Procedure” (TCLP) test for any one of 40 parameters. The TCLP parameters, regulatory levels, and waste codes are listed in Table 1. If test results from a representative sample of waste meet or exceed any one of the listed regulatory levels, the waste is toxic.

Examples of potential toxic wastes are:

- ✗ Painting wastes including used paint booth filters and floor sweepings, masking and rags
- ✗ Oily wastes such as used oil filters, shop rags, and oil absorbent
- ✗ Floor drain sump sludge

To determine toxicity according to the TCLP, use the following procedure:

1. Take a representative sample of the waste stream. Representative means that the amount and type of waste in the sample tested reflect the actual composition of the waste that will require disposal.
2. Send the sample to a laboratory to be analyzed for the TCLP parameters that are potentially present in the waste. A list of analytical laboratories is found in Appendix A. Laboratories can also provide clean sample containers.
3. If the test results indicate that any one or more of the TCLP parameters exceed regulatory limits found in Table 1, the waste is hazardous and must be stored and recycled/disposed of as such. A list of hazardous waste management companies is found in Appendix B.
4. If the test results for all the parameters are below the regulatory limits, the waste is non-hazardous and may be managed as such (for example, disposed of in a landfill).

Table 1 - Toxicity Characteristic Leaching Procedure (TCLP)

<u>Parameter</u>	<u>Regulatory Level</u>	<u>EPA Hazardous Waste Number</u>
Arsenic *	5.0 mg/l	D004
Barium *	100.0 mg/l	D005
Benzene	0.5 mg/l	D018
Cadmium *	1.0 mg/l	D006
Carbon tetrachloride	0.5 mg/l	D019
Chlordane	0.03 mg/l	D020
Chlorobenzene	100.0 mg/l	D021
Chloroform	6.0 mg/l	D022
Chromium *	5.0 mg/l	D007
m-Cresol	200.0 mg/l	D024
o-Cresol	200.0 mg/l	D023
p-Cresol	200.0 mg/l	D025
Cresol	200.0 mg/l	D026
1,4-Dichlorobenzene	7.5 mg/l	D027
1,2-Dichloroethane	0.5 mg/l	D028
1,1-Dichloroethylene	0.7 mg/l	D029
2,4-Dinitrotoluene	0.13 mg/l	D030
Endrin	0.02 mg/l	D012
Heptachlor	0.008 mg/l	D031
Hexachlorobenzene	0.13 mg/l	D032
Hexachloro-1,3-butadiene	0.5 mg/l	D033
Hexachloroethane	3.0 mg/l	D034
Lead *	5.0 mg/l	D008
Lindane	0.4 mg/l	D013
Mercury *	0.2 mg/l	D009
Methoxychlor	10.0 mg/l	D014
Methyl ethyl ketone	200.0 mg/l	D035
Nitrobenzene	2.0 mg/l	D036
Pentachlorophenol	100.0 mg/l	D037
Pyridine	5.0 mg/l	D038
Selenium *	1.0 mg/l	D010
Silver *	5.0 mg/l	D011
Tetrachloroethylene	0.7 mg/l	D039
Toxaphene	0.5 mg/l	D015
Trichloroethylene	0.5 mg/l	D040
Vinyl chloride	0.2 mg/l	D043
2,4-D	10.0 mg/l	D016
2,4,5-TP (Silvex)	1.0 mg/l	D017
2,4,5-Trichlorophenol	400.0 mg/l	D041
2,4,6-Trichlorophenol	2.0 mg/l	D042

* Heavy Metals

Thorough Knowledge

In some cases, a waste can be determined hazardous or non-hazardous without laboratory testing based on “thorough knowledge” of the contents of the waste. Thorough knowledge is most accurate for wastes that are unused or have not been contaminated with other materials. Reviewing material safety data sheets (MSDS) will provide some information about the contents of a material. Since not all ingredients in a product are always listed on the MSDS, additional testing or information may be necessary to make a waste characterization. In addition, wastes will probably contain contaminants not addressed by the MSDS.

When the amount and type of contaminants in a waste are unknown, TCLP testing is normally recommended to make a hazardous/non-hazardous waste determination. In some cases, however, thorough knowledge might be used in place of testing a specific facility’s waste. If there is sufficient TCLP test data available indicating that a consistent waste stream from a specific industry is typically not hazardous, you may be able to apply the data to your facility. Your hazardous waste regulatory agency will decide if this is acceptable.

Remember that each facility is responsible for making an accurate hazardous/non-hazardous determination on all of its wastes. You must balance the cost of testing with the possible risk of liability and regulatory fines.

LISTED HAZARDOUS WASTES

The federal Environmental Protection Agency (EPA) has designated specific materials as hazardous waste due to their consistent nature and widespread distribution. There are four “lists” of hazardous waste, known by the letter used in the hazardous waste number: “F”, “K”, “P”, and “U”. Each of these lists is explained briefly below.

F-Listed Wastes: F-listed wastes include a wide variety of commonly found wastes, ranging from solvents to wastewater treatment sludges to dioxin contaminated materials. F-listed wastes that may be associated with vehicle maintenance are designated in Table 2.

K-Listed Wastes: These are hazardous wastes from specific processes, many of which are chemical or pesticide manufacturing. An example is “wastewater treatment sludge from the production of toxaphene.” K-listed wastes are uncommon in vehicle maintenance operations.

P-Listed Wastes: P-listed wastes are acutely toxic chemicals in their unused form only. Examples include arsenic trioxide (gopher bait) and warfarin (rat poison).

U-Listed Wastes: U-listed wastes are toxic commercial chemicals, off-specification products, or manufacturing chemical intermediates, also only in the unused form. Examples include creosote, DDT and formaldehyde.

TABLE 2 - F-Listed Hazardous Wastes from Vehicle Maintenance

F001 - Spent halogenated solvents used in degreasing, or the still bottoms from the recovery of the spent solvents. Solvents include:

- Tetrachloroethylene, or perchloroethylene (perc)
- Chlorinated fluorocarbons
- 1,1,1-trichloroethane
- Carbon tetrachloride
- Methylene Chloride

F002 - Spent halogenated solvents, and still bottoms, from uses other than degreasing.

- Tetrachloroethylene, or perc
- 1,1,1-trichloroethane
- 1,1,2-trichloro-1,2,2-trifluoroethane, or R-112
- Methylene chloride
- Ortho-dichlorobenzene
- Trichlorofluoromethane

F003 - Spent non-halogenated solvents, and still bottoms, that are ignitable.

- Xylene
- Methanol
- Acetone
- Methyl isobutyl ketone (MIBK)
- Ethyl benzene

F004 - Spent non-halogenated solvents and still bottoms.

- Cresols and cresylic acid

F005 - Spent non-halogenated solvents and still bottoms.

- Toluene
- Isobutanol
- Benzene
- Methyl ethyl ketone (MEK)

Liability and Choosing a Waste Management Company

Each business has “cradle-to-grave” liability for all the waste it generates, both hazardous and non-hazardous. This means that responsibility for the waste continues even after the waste leaves the facility for transportation and disposal. Reducing waste is the surest way to reduce liability. The pollution prevention practices in this guide will help to reduce liability by minimizing or eliminating wastes.

When you cannot avoid generating a waste, you should protect your business by dealing only with reliable waste management companies to recycle or dispose of your waste. Remember that no one can take away your liability once you have generated a waste, despite advertising claims and no matter how good the waste management company. Following are some tips to help you make a good choice:

When choosing companies to recycle or dispose of your **hazardous** wastes, ask the following questions and request documentation:

1. Do they have EPA permits to transport, store, and/or dispose of hazardous waste?
 - ✗ Hazardous waste must be transported off site for treatment, storage, recycling or disposal by an EPA/DOT-permitted hazardous waste transportation company.
2. Do they have insurance or other financial means to cover accidental spills?

- ✗ Insurance is the first layer of protection for your business in case of an accident resulting in spills, injury or property damage.
3. Is documentation legible and provided in a timely fashion?
- ✗ Hazardous waste manifests are required for all shipments of hazardous waste and are signed by the waste generator and the transporter when hazardous waste is picked up. The manifest is then signed and dated by the disposal or recycling facility upon receipt of the shipment. This copy is returned to the generator and should be kept on file.
 - ✗ Land Ban forms must accompany the manifest and be kept on file at the generator's site. Land Ban regulations apply to wastes that are banned from land disposal, such as most petroleum-based solvents.
4. Do they operate in a responsible manner?
- ✗ Look for transporters with a good record and facilities that are clean.
 - ✗ Call the appropriate state or federal regulatory agencies to determine whether the company has the proper permits or has had any recent violations. Visiting the facility in person is another option.
5. What is the cost for services?
- ✗ If it is a recycling service, do they return or keep your recycled product?
 - ✗ Choose among reputable waste management companies for the best deal. Pay for good service, not a brand name.
- 

1.0 Parts Washing

Currently, petroleum-based solvents are widely used to remove grease and dirt from parts. These solvents are usually hazardous because of ignitability. There are three basic approaches to pollution prevention in parts washing:

- Substitute non-hazardous cleaning methods
- Use less toxic solvents
- Maximize solvent life

1.1 Substitute Non-Hazardous Cleaning Methods

Replacing hazardous parts wash solvent with non-hazardous substitutes is one pollution prevention alternative. There are many water-based degreasers and cleaning systems on the market today. If you are considering changing to a water-based cleaner, you should first test the product to determine its effectiveness for your application. Using a non-hazardous degreaser is only beneficial if it does the job.

Hazardous solvents can be replaced with non-hazardous substitutes.

Water-based parts washing alternatives include:

- ✗ Hot Soap or Jet-Spray Washers and
- ✗ Aqueous Cleaners (Alkaline and Microbial)

HOT SOAP WASHERS

Hot soap or jet spray washers are like “dishwashers” for parts. They use non-toxic detergent and hot water to remove oil, grease, and dirt. Parts are placed inside the washer and the lid is closed during cleaning. Hot soap washers are available in varying sizes offering both high-pressure and low-pressure models. High pressure models use strong jets of hot water and detergent to cut grease. Low pressure models circulate the water around parts to loosen and remove dirt and grease.

Hot soap washers use hot water and detergent to clean parts.

The benefits of hot soap washers include:

- ✗ Reduced or eliminated employee exposure to hazardous solvents
- ✗ Less employee time spent parts washing
- ✗ Lower cost of cleaning materials
- ✗ Less hazardous waste for disposal

Some models of washers open outward and load from the side (Figure 1), while others open upwards and load from the top (Figure 2).

Cost

The size of hot soap washer needed depends on the size of parts to be cleaned and the frequency of cleaning. Smaller hot soap washers (20 gallons) are available starting at \$2,500 to \$3,000. Small hot soap washers will accommodate most automobile parts, except for engine blocks and transmissions. Medium-sized units (40 - 80 gallons) can accommodate most vehicle parts including transmissions, and cost

approximately \$5,500 to \$6,000. Larger units, priced over \$10,000, are not normally used in the vehicle maintenance industry. A list of hot soap washer suppliers and a cost savings worksheet are found in Appendix C.

When deciding on the size of washer to purchase, be sure to take into account both the size of all parts that require cleaning and the frequency of cleaning.

Other costs associated with hot soap washers are electricity, hot water and soap.

Maintenance

Dispose of hot soap washer sludge properly.

Sludge from oil, grease and other contaminants will accumulate in the washer. To extend the life of the detergent, this sludge should be cleaned out frequently. Prior to disposal, this sludge must be determined hazardous or non-hazardous. Hazardous sludge must be managed and disposed of as a hazardous waste. Non-hazardous sludge can be dried and landfilled, or managed by a septic tank cleaning company. Land application of sludge is not recommended since even non-hazardous sludge may contain enough oil or heavy metals to contaminate soil or groundwater. If non-hazardous sludge is land applied, do so in accordance with applicable regulations.

Some hot soap washers evaporate water so that more has to be added. Others generate wastewater that must be disposed of. Wastewater from hot soap washers may be discharged to the city sewer, provided approval is obtained from the local wastewater treatment authority. If wastewater pH is above local discharge limits and simple neutralization may be required. Prior to discharge, oil must be removed from the wastewater. Oil skimmers are available as an option on the washers, or can be purchased separately. The average cost for small skimmers is \$400 to \$800. A list of oil skimmer suppliers is found in Appendix D.



Figure 2: Hot Soap Washer, Top-loading

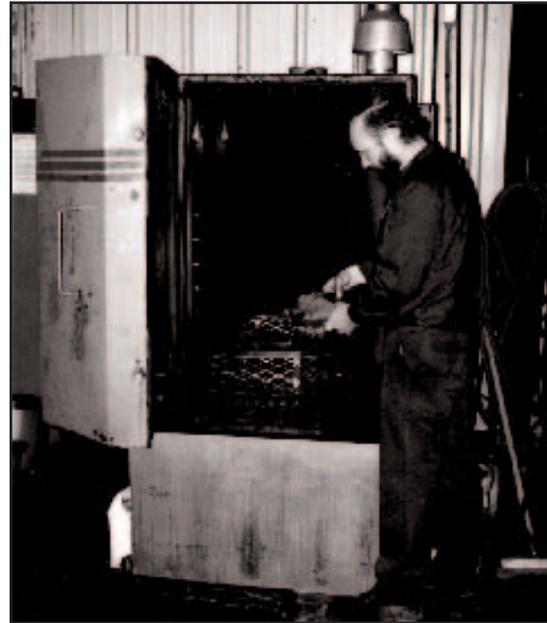


Figure 1: Hot Soap Washer, side loading

Disadvantages

Disadvantages of hot soap washers include the risk of parts rusting, and wastewater disposal problems for facilities not connected to the city sewer. Treatment with rustproofing chemicals after cleaning will help prevent rusting. Contact your vendor to obtain a rust-proofing package.

Hot soap washers may not be a good choice for facilities using septic systems or other shallow wells such as leach fields. Hot soap washer wastewater should not be discharged to septic tanks because it may interfere with the bacterial function of the system. Contaminants in untreated wastewater can accumulate and cause environmental problems. If the wastewater is hazardous, discharge to a septic system would be illegal disposal.

Discharge hot soap washer wastewater to the city sewer, but not to a septic tank or storm sewer.

The best solution for facilities connected to septic or direct discharge systems is to connect to the city sewer. If that is not possible, the water can be collected in a holding tank and hauled to the nearest wastewater treatment plant (if the water is non-hazardous and the treatment plant will accept it.) Other options are to recycle or evaporate non-hazardous wastewater on site, although this equipment is usually expensive. Appendix E contains a list of suppliers for evaporation equipment. Appendix F contains a list of wastewater recycling equipment suppliers.

AQUEOUS CLEANERS

These cleaners are less toxic, water-based alternatives to petroleum-based solvents. They are composed of cleaning agents including detergents, alkaline chemicals, microbes, or a combination of these. Aqueous cleaners can be used in conventional parts washer equipment. Appendix G contains a list of alternative solvent vendors.

Aqueous cleaners are less toxic than petroleum-based solvents.

Benefits include:

- ✗ Less risk of hazardous material exposure to workers than traditional petroleum-based solvents
- ✗ Less risk of fire than from ignitable solvents
- ✗ Potentially decreased disposal costs since used aqueous cleaners may be eligible for discharge to the city sewer

Because spent aqueous cleaners are not ignitable, they may be discharged to the city sewer with prior approval from the wastewater treatment plant. Disposal of spent aqueous cleaners in a septic system is not recommended because the spent cleaners may contain ingredients that will interfere with the bacterial activity in the septic tank. Spent aqueous cleaners may be hazardous because of corrosivity or toxicity (lead and/or benzene) content from contamination from grease and oils. If aqueous cleaners are disposed of off site, a hazardous waste determination must be performed.

Grease and oil from parts will accumulate in the parts washer. This sludge should be managed as outlined in the maintenance section for hot soap washers.

Drawbacks to aqueous cleaners include inadequate cleaning power for some purposes, the risk of parts rusting, and the need for final rinsing with water. To combat corrosion, rust inhibitors are often added to cleaners. Check to see whether a cleaner contains a rust inhibitor, or whether one needs to be added. To determine whether a cleaner will serve your specific needs, sample it prior to purchase.

Alkaline Cleaners

Alkaline cleaners are those that have a high initial pH, usually between 10 and 12. For parts washing purposes, alkaline cleaners are routinely diluted in a ratio from one to three (1:3) or one to ten (1:10).

The cost of aqueous alkaline-type cleaners in concentrate is approximately \$6 to \$10 per gallon. After dilution, the cost per gallon ranges from about \$0.55 to \$2.50.

Microbial Cleaners

Microbial cleaners use soap to loosen grease and microbes to decompose grease into water and carbon dioxide.

Microbial cleaners contain soaps that loosen the grease from parts and microbes that decompose the grease, turning it into water and carbon dioxide. Microbial cleaners can be used for parts cleaning on- or off-car, and for small spill cleanups. Microbial cleaners come packaged with a container of liquid emulsion containing a stable oxygen source and nutrients for the microbes, and a separate container of microbes. The mixed solution has a shelf life of about 60 days and must be kept within an optimal temperature range of approximately 75-95° for best functioning of the microbes. These cleaners can be used in a conventional parts washer, or they may be used to clean spills. Spent microbial action solution can be discharged to the city sewer with prior approval. Again, do not discharge this spent solution to a septic system.

Disadvantages of microbial cleaners include foul odors and limited solution life after mixing.

Microbial cleaners are priced at approximately \$20 per gallon in the concentrated form. That is about \$15 per gallon for the diluted, ready-to-use mixture.

1.2 Reduce Toxicity of Solvents

Petroleum-based solvents used in degreasing have varying degrees of toxicity. The following information will help in the choice of the least hazardous solvent that is effective in performing the desired task.

Avoid solvents containing chlorine and EPA-listed hazardous solvents.

HIGHLY TOXIC SOLVENTS TO AVOID

Among the solvents to avoid are "halogenated" solvents which are toxic to humans and may potentially damage the ozone layer. The most common "halogen" element in degreasing solvents is chlorine. 1,1,1 trichloroethane is an example of a halogenated, ozone-depleting solvent that has been used for degreasing, but is being phased out by federal regulations.

Table 3 - EPA-Listed Hazardous Solvents Commonly Used in Degreasing

carbon tetrachloride*	chlorinated fluorocarbons*
chlorobenzene*	methylene chloride*
methyl ethyl ketone	tetrachloroethylene (perc)*
trichloroethylene*	toluene
xylene	1,1,1-trichloroethane*

Also to be avoided are the solvents listed by the EPA as being hazardous due to their negative health and environmental effects.

* Halogenated Solvents

LESS TOXIC SOLVENTS

Non-halogenated Petroleum-based Solvents

If petroleum-based solvents are desired for the job, use those that are less toxic than the listed or halogenated solvents. These less toxic solvents include naphtha, mineral spirits and stoddard solvent. These solvents are less toxic, but keep in mind that they can cause adverse health affects, such as skin irritation, and will be hazardous wastes upon disposal/recycling if the flashpoint is below 140⁰F or if TCLP parameters are present above the regulatory limits. The cost of mineral spirits is approximately \$4 per gallon.

Never discharge petroleum solvents outdoors or to the city sewer.

Some newer petroleum-based solvents are formulated to have flashpoints above 140⁰F. While these solvents are not hazardous because of ignitability, they may acquire toxic amounts of lead or benzene from greasy parts. Both the spent cleaner and the sludge that accumulates in the parts washer should be determined hazardous or non-hazardous prior to disposal. Petroleum-based products may not be discharged to the city sewer or a septic system.

Terpenes

Terpene solvents are hydrocarbons derived from wood or citrus fruits, and are used in degreasing. One of the most common terpenes used in parts washing is d-limonene, which is derived from lemon or orange peel oils. The advantages of terpenes are that they are:

- ✗ not ozone depleters
- ✗ derived from renewable resources (citrus fruit peels)

Terpenes are solvents made from citrus fruit peels.

The disadvantages of terpenes include:

- ✗ high toxicity to aquatic life
- ✗ high cost

Terpenes are available alone or in mixtures with petroleum-based solvents. Used terpenes or terpene mixtures with a flashpoint below 140⁰F will be hazardous waste because of ignitability. Spent terpene solvents with a flashpoint above 140⁰F are not considered ignitable but a hazardous waste determination should be performed on the waste prior to disposal. Spent terpenes should not be discharged outdoors or to the city sewer. They should be recycled (e.g., fuel blending) through a hazardous waste management company or used oil marketers (if the spent terpenes are non-hazardous). Contact your used oil marketer prior to adding terpenes to used oil.

Terpene solvents generally range in price from \$10 to \$18 per gallon, with some blends costing as much as \$35 per gallon.

At least one supplier provides a chemical additive that prolongs the life of terpenes. The chemical is a clarifier that is added to the terpene mixture and causes most of the contaminants to settle out. After addition of the clarifier, the grease and dirt will settle to the bottom of the container, and the solvent mixture will be clear. The grease and dirt sludge should then be removed. A hazardous waste determination on the sludge is necessary prior to disposal.

1.3 Maximize Solvent Life

Good operating practices that increase efficiency in solvent use can maximize solvent life and reduce waste. Solvents should be used in parts washers with lids rather than open buckets or pans which often results in unnecessary evaporation and spillage.

Parts washers pump solvent up from a reservoir through a spigot (often equipped with a brush) into a work basin. The solvent drains back into the reservoir through a screen in the bottom of the basin. Screens are made of reusable metal or disposable fabric. Metal screens are preferred since disposable filters are a potentially hazardous waste stream. Another feature to consider is a drain shelf that fits inside the basin of the parts washer and allows solvent to drain from parts prior to removing them from the washer. Drain shelves either come standard with the parts washer or are available as an option. Suppliers of parts washers are listed in Appendix H.

Parts washers may be leased with a service agreement or purchased and serviced in house. When a service agreement exists, shops are cautioned to change the solvent only when necessary. Negotiate service agreements to avoid unnecessary disposal. When more than one parts washer is used, skip a servicing session for one of the washers, while replacing solvent for the remaining washers as usual. Designate the parts washer with contaminated solvent “for dirty parts only” and reserve parts washers with new solvent for final cleaning. This extends the life of the solvent. Remember, the more often your solvent is changed, the more waste you generate, and the more cost and liability you incur. Solvent waste management companies are listed in Appendix I.

Parts washers can be drum mounted, or free standing. Costs vary greatly because of size, the type and quality of construction material, and added features such as parts baskets or drain shelves.

Newer parts washers have filter units that extend the life of the solvent by filtering out contaminants (Figure 3). Dirty solvent passes through the filtering unit where contaminants are removed, and clean solvent goes back into the reservoir for reuse. Filter-type parts washers require less frequent servicing than traditional parts washers and will reduce the amount of waste solvent generated.

The type and location of the filters on the parts washer vary. Enclosed disposable fabric filter units mounted on side of the washer remove primarily particulates. Clay-containing filter units that are placed

Extending the service period can maximize solvent use.



Figure 3: Parts washer with side-mounted filtering unit

Chapter 1: Parts Washing

in the solvent reservoir or in the parts wash basin remove primarily oil and grease. Remember that a hazardous waste determination should be performed on the used filters prior to disposal.

Units may be leased that use cyclonic action rather than an actual filter to remove solids. The solvent passes through a “filtering” unit where cyclone (centrifugal) action is initiated, causing the solids to settle out where they can be collected for disposal.

To extend the effective life of solvent in a parts washer:

- ✗ Keep parts washer lids closed and spray nozzles turned off when not in use
- ✗ Locate the units away from heat sources and drafts to minimize loss by evaporation
- ✗ Mechanically pre-clean parts by scraping or wire brushing
- ✗ Drain parts thoroughly prior to removing them from the parts washer to prevent dragout (loss of solvent adhering to parts)
- ✗ Install a shelf in the parts washer to facilitate draining. The shelf should not interfere with closing the lid
- ✗ Use only the size and number of parts washers necessary. Eliminate parts washers that are not used very often
- ✗ Avoid unnecessary cleaning - determine what level of cleaning is required
- ✗ Replace solvent only when it is no longer usable. Extend service contract changeout schedule based on seasonal usage

1.4 Solvent Distillation

If parts wash units are owned by the shop, on-site solvent distillation (recycling) can reduce waste effectively. Used solvent is placed in the still, heated to the boiling point, and then cooled, producing nearly pure liquid solvent that can be reused. Figure 4 shows how solvent distillation works.

Solvent stills are available in a range of sizes, depending on needs of different shops. Be aware that stills have different heat settings. Solvents with high boiling points may require a vacuum assist attachment. Table 4 gives average prices of solvent distillation equipment obtained from midwestern vendors.

Reduce solvent waste through on-site recycling.

Be careful to keep solvents separate to ensure maximum purity after distillation.

Contaminants in the solvent will form a residue after distillation called “still bottoms,”

Table 4 - Solvent Distillation Equipment Costs

Still Capacity	Cost	Vacuum Assist
2 gallons	\$2,100	\$1,400 extra
3.5 gallons	\$3,000	\$1,700 extra
5 gallons	\$4,000	\$2,000 extra
7.5 gallons	\$4,700	\$2,300 extra
15 gallons	\$8,500	\$4,500 extra

that require hazardous waste disposal. Store still bottoms in a sealed, labeled container prior to disposal. Heat resistant plastic bags can be purchased to place in the heating chamber to hold the still bottoms after distillation. The bags reduce the need to clean the inside of the still.

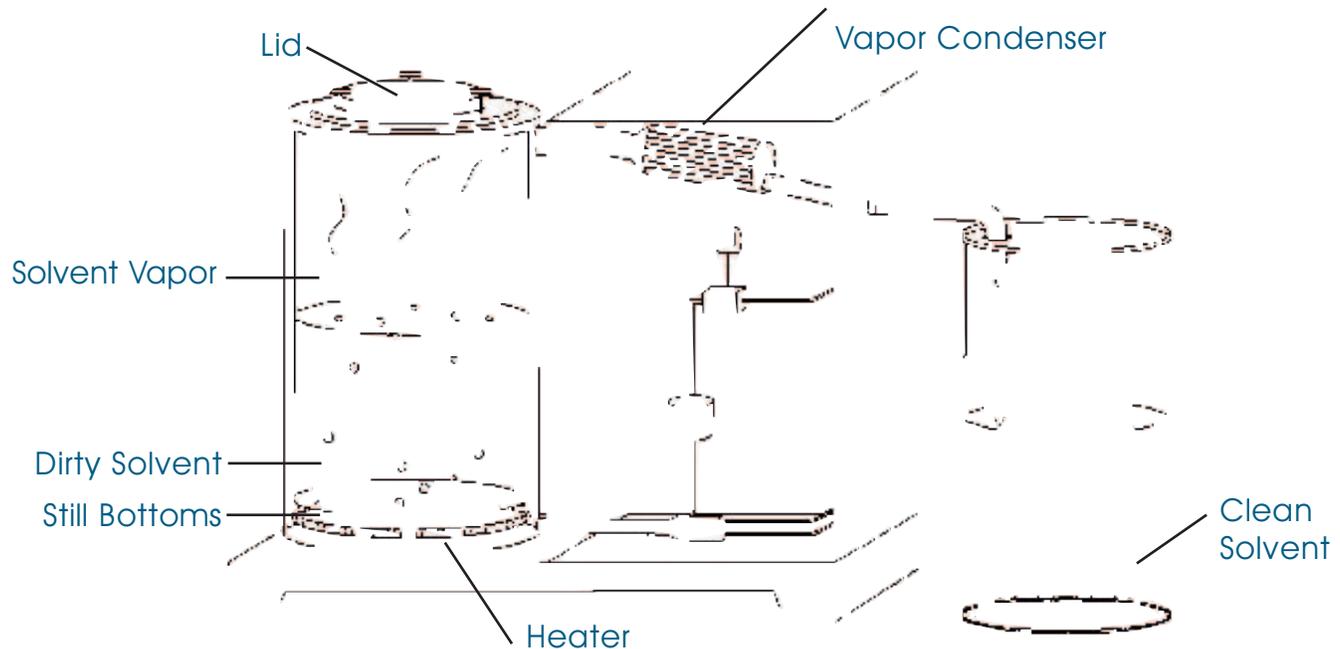
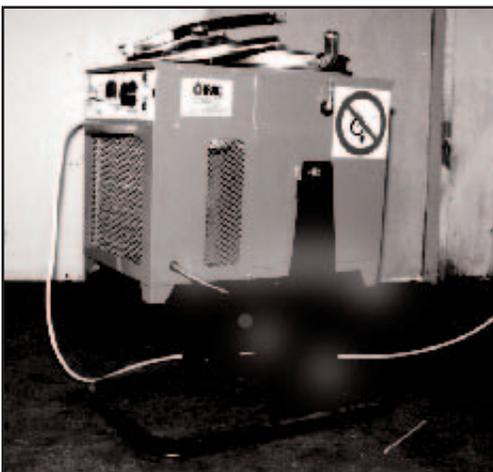


Figure 4- Solvent Distillation

When estimating the cost savings from on-site solvent recycling, take into account the cost of new solvent and the cost of off-site recycling. Appendix J contains a list of solvent recycling equipment suppliers and a cost savings worksheet. In general, shops that generate 50 gallons of waste solvent per month will get their money back on a small still in just over one year.

Do not forget to use caution when operating a solvent still. Follow manufacturer's instructions. Add only the amount and types of solvent recommended by the manufacturer. Stills will emit some solvent fumes during operation. Be sure to wear a respirator.



**Figure 5: Solvent Distillation Unit
5-gallon model**

Solvent stored on site prior to recycling should be stored in labeled containers. The storage containers should be in good condition and located on an impermeable surface, away from drains and fire hazards. The storage area should have secondary containment to contain solvent in case of a spill or leak.

Solvent filtration units are also available to recycle solvent. The solvent is removed from the parts washers and placed in the filtration unit where a series of filters removes contaminants. The cost of a 30-gallon unit is approximately \$7,000.

The filters, like the still bottoms from distillation, must be determined hazardous or non-hazardous prior to disposal.

Recommended Best Practices for Parts Washing

- ✓ For shops connected to city sewer lines, consider replacing hazardous solvents with a hot soap washer that cleans parts using non-toxic detergent and hot water, or aqueous cleaners used in a standard parts washer.
- ✓ Discontinue the use of halogenated solvents (solvents containing chlorine or other halogens).
- ✓ If solvents are necessary, use less toxic blends such as mineral spirits or terpenes.
- ✓ Use solvent in a parts washer with a lid. To extend solvent life:
 - Use only the size and number of parts washers necessary
 - Mechanically preclean parts
 - Prevent loss through evaporation by keeping parts washer lids closed and spray nozzles turned off when not in use
 - Drain parts thoroughly prior to removing them from wash basin
 - Avoid unnecessary cleaning
- ✓ Use a parts washer with a solvent filtering feature to extend solvent life.
- ✓ Extend parts washer service intervals to get the most use out of the solvent.
- ✓ Consider on-site solvent distillation to reduce waste.



2.0 Used Oil & Oily Wastes

The majority of used oil generated at vehicle maintenance facilities is the result of normal maintenance operations, including the replacement of engine oils and transmission fluids. Other used oils are generated during repair of specific systems. Oil-contaminated wastes include disposable shop rags and used oil absorbent materials.

The goals of pollution prevention for used oil and oil-contaminated waste for service shops are:

- minimize used oil-contaminated wastes,
- recycle used oil properly, and
- recycle used oil filters

ROAD OILING BAN

The application of used oil for dust suppression or weed killing on gravel roads, parking lots or elsewhere is illegal in most cases by federal law. Used oil can readily contaminate soil and ground or surface waters. Even small amounts of oil produce a visible sheen that indicates problems.

2.1 Minimize Used Oil-Contaminated Wastes

SEGREGATE WASTES

Keep used oil separate from other wastes. While adding used solvent to used oil is currently legal in some situations, this practice can render the oil unsuitable for recycling or illegal for burning and should be avoided. Regulations require that used oil be stored in containers labeled "USED OIL." Prior to adding other materials such as brake fluid, obtain approval from the oil recycler. Never mix listed hazardous wastes such as paint thinners or carburetor cleaners (methylene chloride) with used oil since that will cause the used oil to be a hazardous waste.

Keep used oil separate from other wastes. Never mix listed hazardous wastes with used oil.

SHOP RAGS

Disposable shop rags used to wipe greasy parts are potentially hazardous because of oil and grease or solvent contamination, and must be determined hazardous or non-hazardous prior to disposal. Note that disposable rags contaminated with a listed hazardous waste are hazardous. Switching to launderable cloth rags will minimize this waste stream and eliminate the need for testing the rags. Soiled cloth rags sent to a laundry facility are not considered a waste since they are being reused. Wastewater from washing the rags is the responsibility of the laundry facility. Be aware that laundry facilities will not accept rags with excessive amounts of oil or solvent. Wring rags into the appropriate container (i.e used oil into the used oil container) before sending them to the cleaner. Store dirty rags in a container that will not absorb oil or leak. (Figure 5) Partially used rags can be stored separately and labeled for reuse prior to laundering.

Use launderable shop rags to reduce waste.

If a laundry service is not feasible, minimize disposable shop rag waste. Use rags completely prior to discarding them. Cut over-sized rags in half or in quarters to reduce waste.

OIL ABSORBENT

Another source of waste is oil absorbent (clay or other disposable absorbent material) used for spills and drips. The absorbed oil is lost and cannot be recycled or burned for energy recovery. In addition, used oil absorbent is potentially hazardous and must be determined hazardous or non-hazardous prior to disposal. Used oil absorbent that tests hazardous must be disposed of by a hazardous waste management company. Non-hazardous used oil absorbent with no free liquids may be landfilled (subject to approval by the landfill and local regulations.)

To avoid or minimize this unnecessary waste, catch drips before they end up on the floor using a drip pan underneath leaking vehicles when possible (Figure 7). Drip pans should have sufficient volume to capture the amount of oil that may leak, and should not be easily tipped over. Oil-laden parts that have been removed for repair or replacement should be placed on a drain pan rather than being allowed to drain onto the floor. Used oil in the drip pans should be drained into a used oil container, and drip pans should be stored carefully to prevent spills. For example, store smaller drip pans over a larger drip pan to avoid contaminating the floor. Drip pans used for different fluids should be segregated. For example, do not use the oil drip pan to collect antifreeze or solvent.

When overhead work is being done, it may not be feasible to use drip pans on the floor. (Who wants to stand in one?!) When a drip pan cannot be used, absorbent pads or elevated drip pans (Figure 7) may be used to keep leaks off the floor.

Absorbent pads last longer than traditional clay oil absorbent, but are disposable and must be determined hazardous or non-hazardous prior to disposal.



Figure 6: Metal can for used rag storage

Use drip pans to catch spills and leaks.



Figure 7: Drip pan under vehicle

SPILL CLEANUP

Some oil spills are bound to occur. The use of disposable oil absorbents should be minimized or eliminated completely. A good alternative for spill clean-up is to use launderable rags or a specially designated mop and bucket. Special oil-absorbing mops are available. The oil can be wrung into the used oil container and recycled. Appendix K lists reusable oil absorbent suppliers.

When purchasing oil absorbent materials, be sure to consider their reusability. Absorbent “socks” for example, may be reused about 10 times, but must then be determined hazardous or non-hazardous prior to disposal. Roller-wringers (Figure 8) are available to remove the maximum amount of oil from the socks. Be wary of oil absorbent products advertising “biodegradability” as they may have many of the same disposal concerns as nonbiodegradable products.

Once the bulk of the spill is cleaned, a soap and water solution may be used to clean the residual oil sheen. This wastewater can be discharged to the local wastewater treatment plant or to a septic system. Do not discharge this water directly outdoors since even non-toxic soaps can pollute soil and streams.



Figure 8: Roller wringer with absorbent sock

ON-SITE OIL STORAGE

Maintain oil storage tanks or drums in good condition. Inspect all used oil storage areas regularly for leaks and spills. To prevent contamination from spills, locate used oil containers on an impermeable surface preferably with a containment system that can retain a volume of oil equal to the storage capacity of the largest container. If

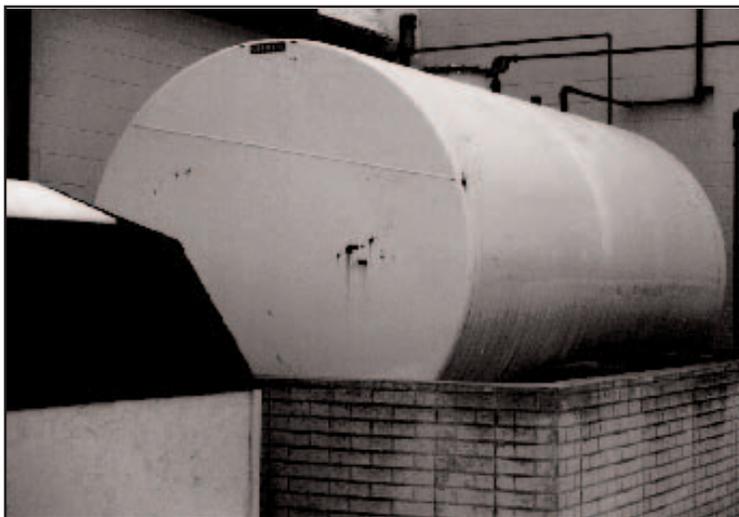


Figure 9: Used oil storage with containment

a container is leaking, fix it immediately or transfer all oil to another container. Storing drums on pallets facilitates leak detection. Any oil spills or ground contamination should be cleaned up immediately to prevent the spread of contamination. Protection from vandalism is also a consideration with outdoor storage. Store oil in a locked area if possible.

Clean spills with cloth shop rags or a mop and bucket.

A spill prevention control and countermeasure plan (SPCC) may be required depending on storage quantities. Contact the IWRC at (319) 273-8905.

To help prevent spills, use large drum funnels to pour used oil into storage containers. After use, remove the funnel and close the drum to avoid contaminating the used oil. Store funnels over a drip pan to ensure that oil remaining on the surface of the funnel will be contained. Place this residual oil in the used oil storage container.

If economically feasible, purchase oil in bulk, instead of quart-sized containers. Purchasing in bulk is less expensive and minimizes waste. Bulk oil dispensers are available for easier and cleaner measuring.

2.2 Recycle Used Oil

The best used oil management options for small- and medium-sized vehicle maintenance facilities are to:

- ✗ burn used oil on site for energy recovery in an approved used oil space heater, or
- ✗ provide used oil to a used oil "marketer" or an approved collection center.

Federal used oil regulations are summarized in Appendix L.

Do not add hazardous solvents to used oil, because the resulting mixture may be a hazardous waste, or may be unsafe to burn. Adding refrigerant oil is strongly discouraged because the chlorofluorocarbons contained in this oil will likely cause the used oil parameters to exceed burning specifications and cause the used oil marketer to reject it. Before adding non-hazardous fluid other than used oil (transmission or brake fluid, etc.), make sure that practice is acceptable by contacting the used oil space heater manufacturer or used oil marketer/collection center.

USED OIL SPACE HEATERS

Shops may burn their own used oil and oil from do-it-yourselfers (private citizens and farmers generating fewer than 25 gallons per month) in specially-designed used oil space heaters. Oil contaminated with hazardous waste should not be burned in space heaters.



Figure 10: Used Oil Space Heater

According to used oil regulations, used oil space heaters must have a capacity of 500,000 BTU per hour or less, and be vented outside. These heaters are priced at about \$4,000 for the equipment and \$1,600 and up for installation. A list of used oil space heater suppliers is found in Appendix M.

Benefits of on-site used oil space heaters include reduced liability since oil is not transported off-site and reduced energy costs for heating.

It is possible for a shop to burn oil from other businesses by becoming a permitted used oil burner. Oil testing requirements apply. Check with your regulatory agency for all applicable requirements.

USED OIL MARKETER/RECYCLER

A used oil marketer collects used oil and provides oil, as fuel, directly to a burner. Marketers are required to test the oil prior to burning to ensure that the oil meets EPA specifications. Used oil marketers generally offer transportation services. Depending on the marketer, the generator may be paid a small amount of money for the used oil, or they may have to pay the marketer. Since the generator is liable for contamination resulting from mismanaged used oil, marketers should be chosen carefully to ensure that the oil is recycled properly. Used oil marketers are listed in Appendix N.

2.3 Recycle Used Oil Filters

When removing an oil filter during an oil change, make sure to put a drip pan underneath the vehicle to catch any oil that spills during the operation. After the filter has been removed, the residual oil must be removed prior to disposal or metal recycling. Methods to remove oil from used filters include:

- ✗ Hot-draining (near engine operating temperature) for a minimum of 12 hours, after puncturing either the anti-drain back valve or the dome end of the filter, and
- ✗ Hot-draining and crushing,
- ✗ Hot drain and dismantle.

Hot-draining and crushing is the preferred method since it removes considerably more oil than draining alone, and reduces the volume of the filter. Be sure to take spill prevention steps during crushing, including a drip pan or drum large enough to catch all oil from the filter. Oil filter crusher suppliers are listed in Appendix O. Crushed filters may be accepted by local scrap dealers for recycling.

Crush used oil filters for maximum oil removal.

When moving filters, avoid spills by putting the filters on a tray and storing them in a container that will not leak. Many shops use mobile oil filter-draining containers on wheels for easy and clean transporting. (Figure 11) Remember to empty the mobile containers into the used oil storage container frequently enough to avoid overflowing.

While many states allow landfill disposal of properly drained oil filters, the casings are high quality metal and should be recycled. Although some metal recyclers do

not accept used oil filters because of the possibility of contamination from residual oil in the filters, there are companies that specialize in oil filter recycling. Oil filter recyclers often provide a drum to collect the filters, and they usually either shred the filters or crush them together into large briquettes. The used oil is recovered and recycled and the metal is sent

Recycle used oil filters.



Figure 11: Mobile oil filter drainer

to a scrap dealer. This service costs about \$70.00 to \$90.00 per drum of uncrushed filters. Contact recyclers directly for more information. See Appendix P for a list of oil filter recyclers.

Recommended Best Practices for Used Oil Management

- ✓ Store used oil in closed containers labeled "USED OIL."
- ✓ Do not mix hazardous waste with used oil. Do not add any other fluids to used oil without prior approval from the oil recycler. Stress to employees the importance of following these rules.
- ✓ Locate oil storage tanks or drums on an impermeable, curbed surface (such as concrete) to contain leaks and spills.
- ✓ Regularly inspect all oil storage drums or tanks for leaks and spills.
- ✓ Use large drum funnels or fill tubes when filling used oil drums. After use, store drum funnels on a drip pan to collect dripping oil.
- ✓ Place drip pans underneath leaking vehicles to collect dripping oil.
- ✓ Pour collected oil from drip pans into used oil containers. Store drip pans carefully to avoid oil spills. Use separate drip pans for different fluids.
- ✓ Place all oil-laden parts on a drip pan.
- ✓ Clean spills using a cloth rag or mop that can be wrung-out and reused. A biodegradable soap and water solution may be used to clean up oil sheens.
- ✓ Avoid using disposable oil absorbents. Oily wastes must be evaluated prior to disposal to determine whether they are hazardous or non-hazardous.
- ✓ Burn used oil on site in a used oil space heater.
- ✓ Recycle used oil through a used oil marketer.
- ✓ Remove residual oil from used oil filters.
- ✓ Recycle used oil filters through a scrap yard or used oil filter recycler.
- ✓ If filters are to be landfilled, drain and crush for maximum oil removal and volume reduction.



3.0 Used Antifreeze

Used antifreeze is generated from the servicing of vehicles, either expressly to replace the antifreeze, or inadvertently when antifreeze is removed to service parts such as radiators, thermostats, or water pumps.

Virgin antifreeze contains ethylene glycol, corrosion inhibitors, and foam controllers and is mixed in a 50 percent solution with water for use in vehicles. According to ASTM standards, a 50 percent solution of ethylene glycol and distilled water should protect against boiling to 226°F or higher, and protect against freezing to -34°F or lower. pH should be between 9.5 and 10.2.

Antifreeze becomes less effective when the ingredients break down and contaminants accumulate. These contaminants include calcium, magnesium, chloride and sulfate from the make-up water, and dissolved and suspended metals from contact with cooling system parts. Ethylene glycol may degrade into acids, thus lowering the pH of the coolant, and increasing the likelihood of corroding metal parts. If dissolved metal levels, such as lead or cadmium are high enough, used antifreeze may be a hazardous waste.

Antifreeze requires changing or treatment when its corrosion protection abilities decrease or it no longer provides adequate protection against freezing. Freeze point can be tested with a hand-held refractometer that can be obtained from some antifreeze recycling equipment vendors and most auto parts stores. pH can be checked using test paper or hand-held pH meters.

Propylene Glycol

Propylene glycol has been introduced as a "non-toxic antifreeze" because it is less toxic to humans and animals than ethylene glycol. Spent propylene glycol, however, is also potentially hazardous because of the same contaminants found in used ethylene glycol: fuel, solvents and heavy metals. Mixing propylene glycol and ethylene glycol may cause a problem in accurately reading the freeze point of the antifreeze.

Pollution prevention options for antifreeze are:

- Avoid improper disposal
- Minimize used antifreeze
- On-site recycling
- Off-site recycling

3.1 Avoid Improper Disposal

Never dump antifreeze on the ground or discharge to a septic system. Ethylene glycol is toxic by ingestion and can cause coma and/or death in animals and children who are attracted to its sweet flavor. In addition, used antifreeze will likely contain some level of heavy metals from contact with engine parts. High heavy metal levels may make used antifreeze a hazardous waste.

Septic systems are not appropriate for antifreeze disposal because:

- ✗ Antifreeze may interfere with the bacterial functioning of the septic system, and
- ✗ If the antifreeze is hazardous, discharge into a septic system is considered illegal disposal of a hazardous waste, subject to fines and clean-up costs.

Most state municipalities allow discharge of small amounts of used antifreeze to the city sewer with prior permission from the wastewater treatment plant. According to EPA regulations, the antifreeze must be discharged directly to the sewer and not containerized first. Check with your state and city for local regulations.

3.2 Minimize Spent Antifreeze

The amount of waste antifreeze can be minimized by replacing it only when necessary. Visually check antifreeze for contaminants, and test for freeze point and pH. Fresh ethylene glycol or corrosion inhibitors can be added to adjust these parameters without disposing of the antifreeze.

Save and reuse antifreeze when possible.

When good antifreeze must be removed for repairs only, save it in a clean container, and reuse it in the system after the repairs have been completed. This avoids unnecessary disposal of good antifreeze.

Segregate spent antifreeze from other wastes such as spent parts wash solvent or used oil. Mixing wastes will adversely affect their recyclability.

If antifreeze cannot be reused, recycling is the next preferred option. Recycling can be performed on site by purchasing recycling equipment, or off site through an antifreeze recycling company.

3.3 On-Site Recycling

Antifreeze recycling equipment is available in models that operate either while hooked up to the car (on-vehicle), or after the antifreeze has been removed from the car (off-vehicle). In addition, antifreeze recyclers differ in the way they remove impurities. The most common types for use in vehicle repair shops are filtration and distillation units.

A list of antifreeze recycling equipment suppliers and a cost savings worksheet are found in Appendix Q. Check vehicle manufacturers' warranties prior to putting recycled antifreeze into any vehicle to ensure that the use of recycled antifreeze will not invalidate the warranty.

Check vehicle manufacturers' warranties prior to using recycled antifreeze.

Antifreeze Distillation

In distillation, spent antifreeze is removed from the vehicle and placed in the heating chamber of the recycler, where it is heated to the boiling point with the aid of a vacuum-assist unit. The vapor then passes through a cooling unit, where it returns to the liquid state. The recovered liquid will be nearly pure ethylene glycol, and will require anti-corrosion and other additives prior to use in vehicles. Recycling equipment vendors provide additive packages. Figure 12 shows an antifreeze distillation unit.

Chapter 3: Used Antifreeze

Used antifreeze destined for recycling should be stored in clean, labeled containers. Drums that previously contained virgin antifreeze are ideal.

The still bottoms (contaminants remaining in the bottom of the heating chamber) are potentially hazardous, and require a hazardous waste determination prior to disposal. Hazardous still bottoms must be stored in sealed, labeled containers, and disposed of by a permitted hazardous waste management company. Non-hazardous antifreeze still bottoms can be dried and landfilled with permission of the landfill operator.

Antifreeze Filtration

The two types of filtration commonly used to recycle antifreeze in vehicle maintenance shops are chemical "filtration" (or precipitation) and ultra-filtration. In chemical "filtration," chemicals are added to used antifreeze to bind together positively and negatively charged particles.

Ultra-filtration involves passing used antifreeze through a series of successively finer filters to remove contaminants suspended in the antifreeze. Initial purchase costs of filtration units are between \$2,000 and \$6,000.

Deionization is an ion-exchange process which removes virtually all of the dissolved solids from the antifreeze. Filtration units with deionization are priced from about \$9,000. After filtration, additives must be replenished. Recycling equipment vendors provide additive packages.

Used filters from antifreeze recycling must be determined hazardous or non-hazardous prior to disposal, and managed accordingly, similar to still bottoms.

On-vehicle recycling units are equipped with hoses that attach directly to the vehicle, forming a closed-loop recycling system (Figure 13). The old antifreeze is removed from the vehicle and stored inside the recycler. The system is flushed with a cleaner.



Figure 13: Antifreeze recycler attached to vehicle

The antifreeze is then recycled, the additives replenished and the recycled coolant returned to the vehicle through the attached hoses.

Off-vehicle recycling requires that used antifreeze be removed from a vehicle and placed in the recycler where contaminants are removed by filtration or distillation. Additives are replenished, and the coolant can then be reused.



Figure 12: Antifreeze distillation unit

Used filters from antifreeze recycling are potentially hazardous.

On-Site Antifreeze Recycling Considerations

The amount of used antifreeze generated, along with the cost of available equipment, will help determine whether on-site recycling is economically feasible. Appendix Q has a list of antifreeze recycling equipment suppliers and a cost savings worksheet.

Table 5 - Antifreeze Recycling Equipment Costs

Type of Unit	Capacity	Cost
Distillation	15 gallons	\$ 5,000
	55 gallons	\$11,000
Filtration (on car) without deionization	---	\$3,000 - \$5,000
Filtration (on car) with deionization	---	\$ 9,000 - \$12,000
Filtration (off-car)	32 gallons	\$ 6,000

Dispose of still bottoms and used oil filters properly.

Another concern with on-site antifreeze recycling is proper disposal of recycling wastes. Distillation and filtration residues and used filters are potentially hazardous wastes which must be tested prior to disposal. Hazardous recycling residues must be disposed of by a hazardous waste management company. Dry non-hazardous recycling residues containing no free liquids may be landfilled.

3.4 Off-Site Recycling

Used antifreeze may also be stored on site, picked up by an antifreeze recycling company and transported off site for recycling. There is usually a minimum pickup quantity of 50 or 55 gallons. Some antifreeze recycling companies provide on-site antifreeze recovery services and leave the recycled antifreeze on site for reuse. See Appendix R for a list of antifreeze recyclers. Spent antifreeze should be determined hazardous or non-hazardous prior to disposal. Antifreeze that is designated hazardous must be transported and stored off site by a hazardous waste management company.

Table 6 - Antifreeze Recycling Service Costs

Status of Antifreeze Recycler	Cost per 55 gallons
Permitted to Manage Hazardous Waste; Recycles off-site; Keeps antifreeze	\$75 - \$120
Not Hazardous Waste-Permitted; Recycles off-site; Keeps antifreeze	\$20 - \$30
Not Hazardous Waste-Permitted; Recycles on-site; Leaves antifreeze on-site	\$100

Recommended Best Practices for Antifreeze Management

- ✓ When good antifreeze must be removed for repairs only, save it and return it to the system after the repairs have been completed.
- ✓ Segregate spent antifreeze from other wastes such as used parts wash solvent or used oil.
- ✓ Consider purchasing equipment to recycle antifreeze on site. Check manufacturers' warranties prior to putting recycled antifreeze into any vehicle.
- ✓ Properly dispose of antifreeze recycling filters and residues (still bottoms).
- ✓ If on-site recycling is not economically feasible, send used antifreeze off site for recycling with a reputable recycler.
- ✓ Antifreeze stored on site should be stored in closed, labeled containers to prevent cross-contamination of wastes.
- ✓ Do not discharge antifreeze to septic systems or outdoors. Prior to direct discharge to the city sewer, obtain permission from the local wastewater treatment plant.

4.0 Wastewater & Sludge

Wastewater is generated at vehicle maintenance shops from floor cleaning and vehicle washing. In most shops, wastewater drains into a sump, where dirt and grit settle out and accumulate at the bottom, forming a sludge. Both the sludge and the wastewater can cause environmental damage if not managed properly.

The goals of pollution prevention for wastewater are to:

- reduce the amount of wastewater generated,
- reduce wastewater toxicity
- discharge wastewater where it will have the least environmental impact
- reduce the levels of toxics in sludge

4.1 Reduce the Amount of Wastewater Generated

Some suggestions for minimizing the amount of water used for floor or vehicle cleaning are:

- ✗ Use dry floor cleaning methods.
- ✗ Train employees to use water efficiently.
- ✗ Save water in a holding tank and reusing it for preliminary cleaning.

Dry floor cleaning methods include sweeping and vacuuming. These methods should be used as much as possible in place of, or prior to wet washing.

When cleaning the floor or vehicles, employees should be trained in the efficient use of water. Use only as much water as is absolutely necessary for cleaning. Shut the water supply off when it is not being used. Consider installing flow-restricting water-saving devices on faucets.

Use dry floor-cleaning methods like sweeping and vacuuming.

Pump water from the sump, after solids have settled out, to a holding tank where it can be reused for the preliminary cleaning of floors or vehicle undercarriages. Sludge that collects in the holding tank should be added to the sump sludge.

4.2 Reduce Wastewater Toxicity

Vehicle maintenance wastewater may be hazardous because of contamination from oils, solvents, antifreeze, or other materials. To reduce the toxicity of the wastewater, shops can:

- ✗ Use only non-toxic soaps to clean floors and vehicles instead of hazardous solvents,
- ✗ Prevent drips and spills from reaching the floor (this is discussed in detail in the Used Oil section),
- ✗ Clean spills immediately, preferably using a dedicated mop and bucket or launderable rags. Never clean spills by hosing them down with water.

- ✗ Perform vehicle maintenance work in areas with no floor drains, or seal off the drains during work to prevent spills from contaminating wastewater.
- ✗ Store hazardous wastes and hazardous materials, such as parts wash solvent, away from drains. If this is not possible, seal off drains in hazardous material storage areas.

4.3 Discharge Wastewater for the Least Environmental Impact

Discharge wastewater to the city sewer when possible.

Discharging wastewater to the city sewer is generally the best option, provided the wastewater does not contain ignitable solvents, oils, or solids, and the wastewater treatment plant has given prior authorization. Prior authorization is important because you may be held responsible for any unauthorized discharge that causes costly damage to the wastewater treatment equipment, or interferes with the plant's ability to treat the wastewater. In the event of an accidental spill to the city sewer, immediately contact the wastewater treatment plant to minimize the risk of harm to treatment plant employees and damage to the system. Minimize the chance of accidental spills using the recommendations listed above. Keep in mind that the wastewater treatment plant has the right to refuse any industrial wastewater discharge at any time.

Remove oil and solids from wastewater prior to discharge.

Solids and oil must be removed from the wastewater prior to discharge to the city sewer. Solids generally settle out in the sump and oil floats to the surface where it can be removed. The settled solids form a sludge which must be cleaned out. Commercial oil skimmers are available that generally use an oleophilic (oil-attracting) material immersed in or run over the top of the water to absorb oil only. Once separated, the oil can be transferred to a used oil container. A list of oil skimmer suppliers is found in Appendix D.

Identify all drains in your facility to ensure that wastewater is not being discharged to a storm sewer. Storm sewers discharge outdoors. For shops serviced by the local wastewater treatment plant, all indoor drains should be plumbed to the city sewer or sealed. Drains not connected to the city sewer should be sealed.

For facilities that are not connected to the city sewer, disposal of waste washwater is problematic. Industrial wastewater (even vehicle washwater) should not be discharged to storm drains or directly outdoors. Such discharges may cause environmental harm and be in violation of federal and state law. The best option is to connect to the city sewer, if possible. Alternatives to manage washwater in the absence of a city sewer connection are:

- ✗ Minimize the amount of washwater generated and use only mild soaps for cleaning floors and vehicles.
- ✗ Collect wastewater in a holding tank and reuse to its full extent.
- ✗ Containerize and transport non-hazardous wastewater to the nearest wastewater treatment plant for disposal.

Chapter 4: Wastewater & Sludge

- ✗ Treat water on site with a water recycling unit.
- ✗ Evaporate water on site using evaporating equipment if the water is non-hazardous. The resulting sludge will require a hazardous waste determination.
- ✗ Wash vehicles off site at a commercial car wash.

Appendix E lists suppliers of evaporating equipment; Appendix F lists wastewater recycling equipment suppliers.

Septic systems are designed for domestic sewage. Industrial discharges may kill necessary bacteria in the septic tank and/or cause overloading. Small amounts of non-hazardous wastewater may be discharged to a septic tank if the functioning of the system is not affected.

Industrial wastewater should not be discharged to septic systems.

4.4 Reduce Levels of Toxics in Sludge

Sludge removed from cleaning vehicle maintenance sumps should be primarily dirt and grit, but may contain oils, solvents and other materials. A TCLP laboratory test is often required to determine whether the sludge is hazardous or non-hazardous. When sludge contains pollutants at or above the regulatory limit, it is hazardous and must be disposed of by a hazardous waste management company. In order to keep sludge non-hazardous, drains should be protected as noted in section 4.2. Reuse of materials for cleaning and spill management can help to keep sludge toxic levels low.

Non-hazardous sludge should be managed by a sump cleaning company, or dried until no free liquids remain and sent to a landfill. Sludge can be dried by spreading it on an impermeable surface, such as concrete, or by placing it in a drum and periodically mixing. Direct application of sump sludge on the ground (landspreading) should be avoided as it may cause environmental damage for which the waste generator would be liable. In addition to a hazardous waste determination, local regulations may require other testing and monitoring. If a sump cleaning company is managing your sludge, ensure that they are managing it properly and in accordance with local and federal regulations.

Recommended Best Practices for Wastewater & Sludge Management

- ✓ Use dry floor cleaning methods, including sweeping and vacuuming.
- ✓ Train employees to use water efficiently. Use only as much water as needed for cleaning. Consider installing water-saving devices on faucets.
- ✓ Save water in a holding tank and reuse it for preliminary cleaning.
- ✓ Use only mild soaps to clean floors and vehicles.
- ✓ Prevent drips and spills from reaching the floor. (See the Used Oil section.)
- ✓ Clean spills immediately, preferably using a dedicated mop and bucket or launderable rags. Never clean spills by hosing them down with water.
- ✓ Protect floor drains from hazardous waste spills to prevent contamination of wastewater and sludge. Seal off drains in work areas and near hazardous waste storage.
- ✓ In the absence of a city sewer connection, collect wastewater and transport it to the nearest wastewater treatment facility (with prior permission and only if the wastewater is non-hazardous).
- ✓ Discharge non-hazardous wastewater to the city sewer, with permission from the wastewater treatment authority. Remove solids and oil prior to discharging wastewater to the city sewer.
- ✓ Reduce levels of toxics in floor drain sludge by protecting drains from hazardous materials.
- ✓ Non-hazardous sludge can be dried and landfilled or managed by a sump-cleaning company. Follow all local and federal regulations when landspreading
- ✓ Hazardous sludge must be managed by a hazardous waste management company.



5.0 Refrigerants

Chlorofluorocarbons, refrigerants used in air conditioners, are suspected to contribute to the depletion of the stratospheric ozone layer. For this reason they are being phased out of production. This includes R-12, which is commonly used in vehicles. The venting of refrigerants is banned by federal regulations. It appears that most service shops are using refrigerant recycling equipment which is required by law to service vehicle air conditioners.

Venting refrigerants is banned.

The goals of pollution prevention for refrigerant are to:

- minimize refrigerant vented to the atmosphere, and
- use effective alternatives to R-12.

5.1 Minimize Refrigerant Venting

DURING SERVICING

Refrigerant should not be vented to the atmosphere. Refrigerant reclaiming units must be used during air conditioning (AC) servicing to decrease the possibility of refrigerant loss. Use independently approved equipment certified to meet SAE standard J-1990 to evacuate and recharge AC systems. EPA notification and certifications are required. Refrigerant regulations are summarized in Appendix S.

To prevent refrigerant loss during services, evacuate all refrigerant prior to maintenance or repair of air conditioning systems. Manifold hoses must have a shutoff valve located at the end of each line to prevent leakage. If an air conditioning system comes into the shop leaking refrigerant, evacuate the system immediately. Make it a policy to encourage customers to repair rather than “top off” leaking systems. Note that topping off a leaking system will result in unnecessary refrigerant loss. Repairing a system will protect the environment and lessen the need to purchase R-12, which is rising in cost. Instead, find the leak and take corrective measures prior to recharging the system.

Encourage AC repairs rather than “topping off” leaking systems.

Avoid using products containing R-12 designed to be used in-system to find leaks. Use such products only as a last resort. Many air conditioning system leaks can be detected with a simple visual inspection of the hoses, connections and condenser. If visual inspection does not expose the problem, use an electronic sniffer to detect the leaks. Do not use R-12 or leak detection products containing R-12 to find leaks in an R-134a system.

When recharging, do not use small (12 ounce) disposable containers of refrigerant. The cans cannot be reused, and are not equipped with a shutoff valve. Any unused refrigerant remaining in the can will be lost as waste. In addition, the price per pound of refrigerant is much less when purchased in bulk.

DURING STORAGE

To help avoid leaking of stored refrigerant, use only D.O.T. or U.L. approved containers. Label the containers to indicate the type of refrigerant stored. Avoid mixing storage containers for different types of recycled refrigerants, since this could cause cross contamination. Segregate any refrigerant that has been contaminated and store it in a specifically labeled container. Send mixed refrigerants to a reclamation center to be separated and purified.

5.2 Alternative Refrigerants

The pending phase-out of R-12 has brought an influx of alternative refrigerants and refrigerant blends. Prior to using an alternative, make sure it is acceptable according to the regulations and the manufacturer of the vehicle.

Since many of the new refrigerants and blends are not compatible with R-12 or R-134a, it is important to ensure that the system being serviced does not contain a mix of refrigerants. If a system contaminated with another refrigerant is evacuated into the reclaiming facility, all refrigerant contained in the unit will be contaminated and must be sent to a refrigerant reclamation facility.

Determine which type of refrigerant is used in a vehicle prior to servicing. A label under the hood should identify refrigerant type. Otherwise, a device is available on the market to identify refrigerant in a system as R-12, R-134a, or unknown. Appendix S contains vendor information for this device.

Some alternative refrigerants on the market today contain liquefied petroleum (LP) gas. These refrigerants can cause contamination and pose a significant explosion risk. Air conditioning technicians should be made aware of the dangers of these products, and take precautionary measures to prevent injury. It is best to avoid the use of such refrigerants.

RETROFITTING

By the end of 1995, all major manufacturers will have stopped production of R-12. Although there should be enough R-12 to keep current systems operating for several years, as supplies of R-12 diminish, some of these systems will need to be retrofitted to use alternative refrigerants such as R-134a or MP52. When retrofitting, it is important to remember that new refrigerants have characteristics and compatibilities with other products that must be addressed.

The lubricants used with R-12 (mineral oils) are not compatible, and should not be used in retrofitted systems. Some lubricants used with R-134a and MP52 are highly hygroscopic (i.e., will readily absorb moisture), and should have limited exposure to the atmosphere. Be sure to check manufacturer's instructions for use and storage of lubricants.

Chapter 5: Refrigerants

Make sure all system O-rings are compatible and functional with the replacement refrigerant. R-134a runs at a higher pressure and temperature range and may exceed the range of some O-rings. Some compressor shaft seals may also need to be replaced when retrofitting. Contact the compressor manufacturer to make this determination. If the seals do need to be replaced, use only seals made of compatible materials that will withstand the operating temperatures of the replacement refrigerant.

When in doubt as to proper retrofitting procedures, always consult the air conditioner manufacturer. Retrofitted systems should be relabeled and proper fittings installed to prevent the accidental contamination of the system with other refrigerants. If proper retrofitting procedures are not followed, loss of refrigerant, personal injury, or a poor operating system may result.

Recommended Best Practices for Refrigerant Management

- ✓ Use only independently approved reclaiming and recycling units certified to meet SAE standard J-1990 to evacuate and recharge air conditioning systems.
- ✓ Evacuate and recover refrigerant from system before servicing to avoid releases.
- ✓ Make it a policy to encourage customers to repair rather than “top off” leaking systems. Instead, find the leak and take corrective measures prior to recharging the system.
- ✓ Detect leaks with a simple visual inspection of the hoses, connections and condenser, or an electronic sniffer. Avoid using leak detecting products containing R-12.
- ✓ Prior to using an alternative refrigerant, make sure it is acceptable according to the regulations.
- ✓ Avoid mixing R-12 and R-134a since contaminated refrigerant must be sent to a refrigerant recycling facility.
- ✓ Determine the appropriate type of refrigerant prior to servicing.
- ✓ Avoid alternative refrigerants containing liquefied petroleum (LP) gas. These refrigerants can cause contamination and pose a significant explosion risk.
- ✓ When in doubt as to proper retrofitting procedures, always consult the air conditioner manufacturer. Be certain to use the proper lubricants, O-rings, etc.
- ✓ Relabel retrofitted systems and install proper fittings to prevent the accidental contamination of the system with other refrigerants.

A **Refrigerant Oil Reclamation Guide** has been produced by the IWRC. Step by step instructions for setting up the system with common tools and operating to extract refrigerant are provided. This practical guide is available at a minimal charge from the IWRC (800)422-3109.

6.0 Painting

Waste paint and paint-contaminated wastes are generated in auto body paint booths as a result of refinishing operations. The goals of pollution prevention in auto body painting are to reduce solid waste and air emissions (including Volatile Organic Compounds [VOCs]) and include the following.

- Reduce paint-contaminated wastes
- Improve spray application practices
- Reduce waste from equipment cleaning
- Reduce waste from surface preparation
- Reduce waste from surface coating
- Recycle waste thinner

6.1 Reduce Paint-Contaminated Wastes

Paint-contaminated wastes such as filters, floor sweepings, masking, disposable rags and mixing cups, may be hazardous because of heavy metals and solvents in the paints and thinners. These wastes should be determined hazardous or non-hazardous to select the appropriate disposal method. Hazardous paint-contaminated wastes must be disposed of by a hazardous waste management company. Non-hazardous paint-contaminated wastes can be landfilled. Paint-contaminated wastes that test hazardous usually contain heavy metals such as lead and chromium. Use paints that contain no heavy metals whenever possible.

Avoid using paints that contain heavy metals.

To minimize the amount of paint- and solvent-contaminated waste:

- ✗ Use reusable mixing cups and sticks and wash them in an automatic gun washer.
- ✗ Use cloth rags when the application permits. These rags can be cleaned by a laundry service and returned. Ask the laundry service to keep those rags separate, since auto body refinishing requires rags free of any oil or other contaminants.

6.2 Improve Spray Application Practices

Improper spray painting techniques is a common reason for excessive waste in painting operations.

Following are some suggestions to improve spray technique.

- ✗ Always hold gun perpendicular to the surface being sprayed, using parallel strokes. Never arc the gun.
- ✗ Feather the trigger at the beginning and end of each pass.
- ✗ Use a 50 percent overlap for each pass. This technique may need to be altered slightly when applying high metallic, high solids basecoats and with some three stage systems.

Proper spray application techniques reduce paint waste.

- ✗ When painting small and medium sized panels, make each pass the full length of the panel.
- ✗ With larger panels, use a comfortable stroke, with a 4" - 5" overlap of the strokes.
- ✗ If blending is necessary, keep the blend area as small as possible without jeopardizing appearance.
- ✗ Spray the border edges of the substrate first (banding). This will assure all edges are covered without extending the spray pattern well beyond the borders of the object.

SPRAY EQUIPMENT

Newer spray equipment has been developed in the attempt to achieve a higher transfer efficiency than conventional siphon feed spray guns.

Newer spray equipment can provide high transfer efficiency.

In order to choose the best spray equipment for your application, you need to first determine how much you can afford to spend and what types of coatings you will be spraying. Next, consult your paint representative to determine which type of gun will work best with the product(s) you will be using.

Choose the spray equipment that will achieve the highest transfer efficiency while providing the required atomization properties within your price range. Be sure to use the proper fluid tip/air cap combination and gun settings for the material being sprayed. Consult your paint or spray gun representative for assistance.

6.3 Reduce Waste from Equipment Cleaning

Equipment cleaning can cause a great deal of unnecessary waste if not done properly. Fortunately, enclosed gun washing systems are now available to replace

Enclosed gun washers reduce waste and save time.

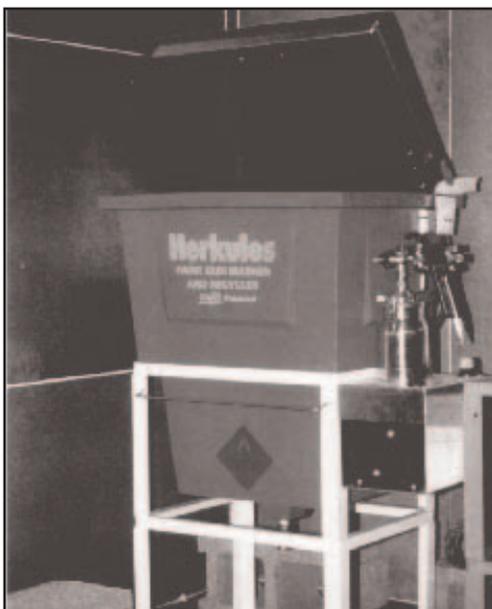


Figure 14: Enclosed Gun Washer

manual cleaning as seen in Figure 14. These enclosed gun washing systems reduce employee time spent cleaning and exposure to hazardous solvents. In addition, less cleaning solvent is lost to evaporation. To further reduce air emissions, use cleaning solvents that are low in volatile emissions.

If the guns are to be cleaned manually, spray into an enclosed backdrop to retain atomized solvents. Use a broom straw, cleaning broach, or if necessary a soft wood toothpick to clear passageways.

6.4 Surface Preparation

Use the least toxic cleaning solution possible. Always wash dirt and grime from the vehicle using water or a soap and water mixture. Use water-based cleaners whenever possible for subsequent cleanings to remove tar, grease, wax, etc. If, due to heavy contamination, waterborne cleaners prove unsatisfactory, use solvent-based cleaners for initial cleaning and waterborne products for secondary cleaning operations.

When solvent-based cleaners must be used, do so sparingly. Use launderable rags if possible. Keep disposable solvent-laden dirty rags in a closed container prior to disposing of them properly (through a hazardous waste management company if necessary). Solvent containers should be closed when not in use. If possible, avoid painting sequences that would require multiple prepaint cleaning operations.

6.5 Surface Coating Materials

To reduce air emissions during surface coating, use either water-based or high-solids, low VOC materials. VOC content is normally listed on Material Safety Data Sheets (MSDS).

Following are some recommendations to reduce air emissions and waste for each phase of auto body surface coating.

PREP COATS

- ✗ Use versatile products such as epoxy primers or self-etching primers. These may alleviate the need for additional surface coating operations such as primer-surfacing or primer-sealing.
- ✗ If a self-etching primer or epoxy primer is not desired, use a wash-primer, or metal conditioner, conversion coating system.

PRIMER-SURFACERS

- ✗ Use a properly operating primer gun with the correct fluid tip/air cap combination for your particular type of primer-surfacer.
- ✗ If the curing time of waterborne products proves unsatisfactory, consider using versatile urethane primers.
- ✗ To reduce VOC emissions, limit material costs and achieve a better quality product, perform body work using a minimal amount of primer-surfacer.
- ✗ If a clear sealer is to be used, make sure the primer-surfacer is a color that can easily be covered with the desired topcoat.

PRIMER-SEALERS

- ✗ Use low VOC urethane primer-sealers as an alternative when possible.
- ✗ Always choose primer-sealer in a color that can be easily covered with the desired topcoat, or choose a tintable primer-sealer and tint it to an easily-covered shade.

SEALERS

- ✗ Choose a sealer appropriate for each specific job.
- ✗ If filling capabilities are required, use a primer-sealer in place of a sealer.
- ✗ Always choose a primer-sealer of a color that can be easily covered with the coating to be sprayed, or choose a tintable primer-sealer.

TOPCOATS

- ✗ Mix color coats in-house, making certain the formula for the proper shade of the specific color code is used. This will help avoid the need for blending the finish to achieve a satisfactory color match.
- ✗ Keep good records of paint match information, including spray-out cards and detailed notes.
- ✗ Avoid the use of lacquer-based topcoats.
- ✗ Choose low VOC topcoats that require fewer than three coats to achieve adequate coverage (polyurethane or urethane).
- ✗ Apply only the number of coats needed to achieve a quality finish.
- ✗ Use high solids/low VOC clears to topcoat color coats.
- ✗ Keep the addition of paint additives to a minimum.
- ✗ When available, use waterborne basecoats.

6.6 On-Site Solvent Recycling

Reduce solvent waste through on-site recycling.

On-site solvent distillation can be used to recycle waste thinners. Distillation units have improved greatly in the last few years, and are available through several local distributors. A still not only reduces the amount of new thinner purchased, it also helps reduce the amount of hazardous waste generated. Most recycled solvent is used for gun washing. In many cases, on-site solvent recycling will eliminate the need to purchase virgin gun wash grade solvent. See Section 1.4 of this manual for more information on solvent distillation equipment.

Much of this section was taken from the manual, "Auto Body Surface Coating: A Practical Guide to Reducing Air Emissions," available from the Iowa Waste Reduction Center at (319) 273-8905. The Auto Body Guide provides detailed recommendations for each step of the auto refinishing process.

7.0 Batteries

Lead acid batteries contain lead and corrosive acid. Both new and used batteries should be stored in a safe manner to prevent leaks and subsequent ground contamination. Pollution prevention in battery management involve:

- on-site battery storage
- used battery recycling

7.1 On-Site Battery Storage

Indoor storage on an acid-resistant rack or tub is preferable. Batteries stored outdoors should be stored on an impermeable surface such as concrete with secondary containment, and sheltered from rain to prevent acid run off. Other pollution prevention recommendations are:

- ✗ Keep a neutralizing agent such as baking soda near in case of a spill.
- ✗ Do not stack batteries since that may cause them to fall and crack.
- ✗ Store batteries and battery acid away from flammable liquids, ignition sources and drains.

Store batteries on an impermeable surface with secondary containment.

7.2 Used Battery Recycling

Used lead acid batteries are exempt from most hazardous waste regulation if they are recycled, but the waste generator is still responsible for contamination caused by batteries transported off site as well as stored on site. Batteries should be stored safely, and only reputable recyclers should be used. Keep receipts for batteries picked up, and be familiar with the final destination of the batteries to ensure that they are being recycled by an EPA-permitted company. A list of lead-acid battery recyclers is found in Appendix T.

Recycle used batteries through a reputable recycler.

Recommended Best Practices for Battery Handling

- ✓ Store batteries on an acid-resistant surface -- indoors if possible, and away from flammable liquids, ignition sources and drains.
- ✓ Avoid stacking batteries.
- ✓ Recycle batteries through a reputable company.



8.0 Disposable Aerosol Cans

Whenever possible, replace disposable aerosol cans for on-car degreasing or lubrication. The active ingredient or the propellant in the can may be hazardous. Cans that contain hazardous product or propellant are hazardous wastes if material is left in the can. Pressurized cans are also an explosion hazard. Pollution prevention options for handling disposable aerosol cans include:

- Replace disposable aerosol cans
- Proper disposal or recycling of spent aerosol cans

8.1 Replace Disposable Aerosol Cans

There are two basic options for replacing disposable cans for on-car cleaning/lubrication:

- ✗ Refillable spray canisters
- ✗ Portable parts wash units equipped with basins to catch the overspray

REFILLABLE CANISTERS

Refillable canisters use compressed air as a propellant are available in 8, 16 and 32 ounce capacities. Prices range from approximately \$27 to \$60. Vendors sometimes provide a trial canister. Appendix U contains a list of refillable spray can suppliers.

PORTABLE PARTS WASHERS

Portable parts washers such as brake washers are available. These washers are often on wheels and are equipped with a solvent reservoir, a cleaning brush and a wash basin that drains back into the reservoir. Brake washers cost approximately \$500 to \$900.

8.2 Manage Aerosol Cans Properly

If aerosol cans are used, utilize all of the material in the can, including the propellant. Cans that have been emptied until less than 3 percent by weight of the original product remains in the can, and the pressure inside the can is equal to that outside, are exempt from hazardous waste regulations. They should be recycled through a scrap metal dealer. Empty cans can be landfilled if recycling options for the cans do not exist in your area. Defective cans that still contain hazardous product or propellant should be returned to the manufacturer or disposed of as a hazardous waste.

Recommended Best Practices for Disposable Aerosol Cans

- ✓ Use refillable spray cans.
- ✓ Use portable parts washers.
- ✓ Utilize the entire contents of aerosol cans.
- ✓ Defective cans containing hazardous product or propellant should be returned to the manufacturer or disposed of as a hazardous waste.
- ✓ Recycle empty metal cans or dispose of in a landfill.



9.0 Waste Fuels

Fuel used in automobiles generally does not become a waste unless it has been contaminated due to an act of vandalism or human error, or has become unsuitable for use in an automobile engine due to its chemical degradation (varnished).

If the fuel is contaminated with materials that can be filtered out, do so. If gasoline has "varnished," try using it in small two-cycle or four-cycle engines (for example, lawn mowers), or dilute it with clean fuel for use. If an acceptable use cannot be found for the fuel, it should be disposed of through a permitted hazardous waste management company that will use it to fuel industrial furnaces.

Recommended Best Practices for Waste Fuels

- ✓ If possible, filter contaminants out and use as fuel in a smaller engine, such as a lawn mower.
- ✓ Dilute with uncontaminated fuel and use.
- ✓ If an acceptable use cannot be found for the fuel, then it should be disposed of through a hazardous waste management company.

10.0 Overall Waste Reduction

Solid waste generated at vehicle maintenance shops includes office paper, cardboard, plastic and scrap metal.

Packaging waste can be reduced by buying in bulk. For example, oil and antifreeze can be purchased in drums or totes rather than in individual containers. Look for ways to reuse spent materials in house. For example, used office paper can be cut up and used for note pads, or cardboard boxes could be reused for shipping.

Reuse used office paper for note pads.

What cannot be reused should be recycled. Office paper, cardboard and plastics are commonly recycled items. Some communities have local recycling collection centers. Take advantage of them if they are available to you. Otherwise, contact your waste hauler for more information on recycling. Some waste haulers also collect recyclables.

Waste that will be recycled will need to be collected on site and separated. For example, white paper should be separated from colored paper, and different types of plastics should be kept separate. Specific instructions on exactly what can be recycled and how the materials must be separated depend on the requirements of your particular recycling program.

It is also important to remember to buy products with recycled content whenever possible to “close the recycling loop.”

Most shops recycle some metal scrap. Metal waste that usually gets landfilled includes used oil filters and empty cans. Check to see whether your scrap metal dealer will accept these items for recycling.

Take precautions to avoid messes in the recycling collection area in your shop. Drain bottles (such as oil bottles) into drip pans before putting them into recycling bins. Have reusable absorbents available near the recycling bins to catch and clean up the spills.

Recommended Best Practices for Waste Reduction

- ✓ Buy products in bulk whenever possible.
- ✓ Look for opportunities to reuse spent materials on site.
- ✓ Separate materials for recycling. Utilize local recycling centers or contact your waste hauler about initiating recycling.
- ✓ Keep recycling collection areas clean.

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Cost Savings Estimate Worksheet Hot Soap Degreaser

Parts Cleaning Expenses	Example	Your Shop
A. Number of Parts Washer Stations	2.00	
B. Cost of Each Tank per Month	\$100.00	
C. Time Spent Cleaning Parts per Month	8 hrs.	
D. Cost of Labor per Hour	\$10	
E. Total Cost of Labor per Month (C X D)	\$80.00	
F. Parts Wash Expenses per Month (A X B) + E	\$280.00	
Hot Soap Degreasers		
G. Biodegradable Soap Expenses per Month (Buying Bulk is Cheaper)	\$35.00	
H. Operating Costs per Month (Utilities)	\$50.00	
I. Total Expenses per Month (G + H)	\$85.00	
J. Sludge Testing and Disposal*	\$750.00	
Cost Savings		
K. Expenses per Year Using Solvent (F X 12)	\$3,360.00	
L. Hot Soap Unit Expenses per Year (I X 12) + J	\$1,770.00	
M. Total Cost Savings per Year (K - L)	\$1,590.00	
Payback Period		
N. Cost of Equipment	\$1,650.00	
O. Payback Period in Terms of Years (N / M)	1 yr.	

Please note the fact that this worksheet uses on hot soap degreaser replacing two solvent parts washing sinks.

*Assumes approximately one fifty-five gallon drum of potentially hazardous sludge will result per year. This sludge must be tested to determine whether it is hazardous. If hazardous, it must be disposed through a hazardous waste management company.

Cost Savings Estimate Worksheet Solvent Distillation Unit

Weekly Generation Rate	Example	Your Shop
A. Amount of Solvent Generated per Week	5 Gal.	
Cost of Off-Site Recycling per Week		
B. Off-Site Disposal Cost per Unit	\$20.00	
C. Cost of Virgin Solvent	\$10.00	
D. Total Cost per Gallon (B + C)	\$30.00	
E. Total Weekly Off-Site Disposal Cost (A X D)	\$150.00	
Amount of Solvent Recovered During On-Site Distillation		
F. Average Percentage Recovered (90%)	0.90	
G. Amount of Solvent Recovered (A X F)	4.50 gal.	
Cost of On-Site Recycling per Week		
H. Average Still Bottom per Week	1 gal.	
I. Off-site Disposal cost of Still Bottoms	\$10.00/gal	
J. Weekly Cost of Still Bottom Disposal (H X I)	\$10.00	
K. New Solvent Needed (A - G)	0.50 gal	
L. Weekly Cost of New Solvent (K X C)	\$5.00	
M. Cost of On-Site Recycling per Week (L + J)	\$15.00	
Cost Savings per Week for On-Site Recycling		
N. Total Cost Savings per Week (E - M)	\$135.00	
Payback Period		
O. Average Cost of Distillation Unit	\$4000.00	
P. Yearly Savings by Recycling On-Site (N X 52)	\$6864.00	
Q. Payback Period in Terms of Months (O / P)	7.2 yrs	

Note: Still bottoms are generally more costly to dispose per gallon than spent solvent, but the quantity of still bottom is considerably less than spent solvent. Also, recycling your solvent will reduce the amount of hazardous waste you generate. Thus, your regulatory status is reduced.

Appendix Q

Cost Savings Estimate Worksheet Antifreeze Distillation Unit

Antifreeze Used Per Week	Example	Your Shop
A. Amount of Antifreeze Used (1)	5 gal.	
Cost of Antifreeze per Week		
B. Off-Site Disposal Costs per Gallon (2)	\$20.00	
C. Cost of Virgin Antifreeze	\$5.00	
D. Total Cost per Gallon per Week (B + C)	\$25.00	
E. Total Cost of Antifreeze per Week (A X D)	\$125.00	
Amount of Antifreeze Recovered per Week		
F. Average Percentage Recovered (90%)	0.90	
G. Amount of Antifreeze Recovered (A X F)	4.50 gal	
Weekly Operating Cost of On-Site Distillation Unit		
H. Cost of Additives per Week	\$5.00	
I. Still Bottom Disposal per Week (3)	\$15.00	
J. New Antifreeze Needed per Week (A - G)	0.50 gal	
K. Weekly Cost of New Antifreeze (J X C)	\$2.50	
L. Total Operating Cost per Week (H + I + K)	\$22.50	
Cost Savings Per Week		
M. Cost Savings per Week (E - L)	\$102.50	
N. Service Charge for Recycling per Week (4)	\$15.00	
O. Total Cost Savings per Week (M + N)	\$117.50	
Payback Period		
P. Cost of Antifreeze Distillation Unit	\$4,000.00	
Q. Total Savings per Year (O X 52)	\$6,110.00	
R. Payback Period in Terms of Months (P / Q)	8.4 yrs.	

1. Based on 2 jobs per week

2. Estimated on \$165.00/55 gallons of hazardous antifreeze

3. Estimated on \$300/55 gallon drum of still bottom; 1 drum generated every 2 years

4. Based on a \$5.00 added recycling charge per job.

Pollution Prevention

Cost Savings Estimate Worksheet Antifreeze Filtration Unit

Antifreeze Used Per Week	Example	Your Shop
A. Amount of Antifreeze Used (1)	5 gal.	
Cost of Antifreeze Per Week		
B. Off-Site Disposal Costs per Gallon (2)	\$20.00	
C. Cost of Virgin Antifreeze	\$5.00	
D. Total Cost per Gallon per Week (B + C)	\$25.00	
E. Total Cost of Antifreeze per Week (A X D)	\$125.00	
Operating Cost of Filtration Unit Per Week		
F. Cost of Additives per Week	\$5.00	
G. Resin Tank Recharge Cost per Week (3)	\$15.00	
H. Filter Disposal (4)	\$4.50	
I. Total operating Cost per Week (F + G + H)	\$24.50	
Cost Savings Per Week		
J. Cost Savings per Week (E - I)	\$101.50	
K. Service Charge for Recycling per Week (5)	\$15.00	
L. Total Cost Savings per Week (J + K)	\$16.50	
Payback Period		
M. Cost of Antifreeze Filtration Unit	\$4,000.00	
N. Total Savings per Year (L X 52)	\$6,085.00	
O. Payback Period in Terms of Months (M / N)	7.2 yrs.	

1. Based on 2 jobs per week
2. Estimated on \$165.00/55 gallons of hazardous antifreeze
3. Estimated \$100 per charge and 100 jobs prior to recharge.
4. Estimated on \$310/55 gallon drum of used filters; 1 drum generated every 2 years
5. Based on a \$5.00 added recycling charge per job.