

# USED ANTIFREEZE RECYCLING POLLUTION PREVENTION ALTERNATIVES

## COMMONLY OBSERVED PRACTICES

Most vehicle maintenance facilities generate used antifreeze. Used antifreeze management practices commonly observed during the IPPI pilot project included reuse, recycling and discharge to the sanitary sewer.

## POLLUTION PREVENTION OPTIONS

Pollution prevention options available for used antifreeze include avoiding improper disposal, reuse and recycling. The method by which a facility chooses to manage its used antifreeze depends on the quantity and quality of used antifreeze generated and resources available to the facility.

### AVOID IMPROPER DISPOSAL

Virgin antifreeze contains ethylene glycol (or less toxic propylene glycol) and chemical additives such as corrosion inhibitors and foam controllers. Used antifreeze is diluted with water and will likely contain some level of heavy metals (as a result of its contact with engine parts) or contaminants from fuel. High heavy metal or other contaminant levels may make used antifreeze a hazardous waste.

Because of the chemicals used in its formulation and the contaminants which may be present, used antifreeze should never be dumped on the ground, discharged to a storm sewer or discharged to a septic system. Improper disposal of used antifreeze may result in soil, groundwater and/or surface water contamination. It may also lead to expensive regulatory fines and cleanup costs.

In some cases, state municipalities allow small amounts of used antifreeze to be discharged to the city sanitary sewer system with prior permission from the wastewater treatment plant. Check with your municipal wastewater treatment plant authorities or city engineer for local regulations.

### REUSE

Reusing used antifreeze to top off vehicle cooling systems is a simple but effective method for managing small amounts of used antifreeze generated at vehicle maintenance facilities. When good antifreeze must be removed for repairs, it should be saved in a clean container for reuse in the system after completing the repairs. This avoids unnecessary disposal of good antifreeze. Since the used antifreeze is being reused for its intended purpose, it is not subject to hazardous waste regulation.

### RECYCLING

If antifreeze cannot be reused (because of the quality or volume of antifreeze generated), recycling is the next preferred management method. A vehicle maintenance facility may contract a service company to recycle its used antifreeze (on- or off-site) or purchase equipment to recycle used antifreeze in-house.

Antifreeze recycling equipment is available in models that operate while hooked up to the vehicle (closed-loop systems) or after the antifreeze has been drained from the vehicle (batch systems). Antifreeze recycling equipment also varies in the way impurities are removed and the quality of recycled antifreeze produced. The most common methods for recycling antifreeze include filtration, deionization and distillation.

Filtration removes the suspended solids present in the used antifreeze but does not remove dissolved contaminants. Deionization and distillation produce more purified antifreeze by removing dissolved contaminants. Deionization is an ion-exchange process that is used to remove dissolved contaminants from the antifreeze after the suspended solids have been removed using filtration. In distillation, used antifreeze is placed in a distillation unit heating chamber where it is vaporized. The vapor is passed through a condenser to form pure ethylene glycol and distilled water. Contaminants that were once present in the antifreeze are left in the bottom of the heating chamber as still bottoms.

In each case, chemical additives must be added to the recycled antifreeze prior to its reuse in a vehicle. Recycling equipment vendors provide these additive packages. Each method also produces some potentially hazardous waste. Filtration units generate spent filters while distillation units generate still bottoms. Since spent filters and still bottoms are potentially hazardous because of toxicity, a hazardous/nonhazardous determination must be performed for these wastes prior to disposal. Deionization units also require periodic recharge of the ion exchange resin used to remove dissolved contaminants.

**RECYCLING SERVICE COMPANIES.** Used antifreeze may be stored on site and provided to a recycling service company. Services provided by an antifreeze recycling company may include:

1. supplying the vehicle maintenance facility with recycled antifreeze while transporting the used antifreeze off site for recycling;
2. transporting the used antifreeze off-site for recycling and keeping the antifreeze; or
3. recycling the used antifreeze on site and leaving the recycled antifreeze at the vehicle maintenance facility for reuse.

Appendix H contains a list of antifreeze recyclers. A minimum pickup quantity of 55 gallons is usually required.

**IN-HOUSE RECYCLING.** An alternative to storing and managing used antifreeze for subsequent disposal/recycling is in-house recycling using a batch or closed-loop antifreeze recycling system. Example vendor information on closed-loop and batch antifreeze recycling systems are provided in Appendix H. Based on vendor information, closed-loop systems typically rely on filtration and/or deionization for recycling antifreeze. Closed-loop systems may be hooked up directly to a vehicle to flush the cooling system and recycle dirty antifreeze. As a result, no used antifreeze is drained from the vehicle or requires storage (significantly reducing a facility's environmental liability associated with storing, handling and disposing of used antifreeze). Closed-loop systems may also be used to recycle used antifreeze in batch quantities.

Batch antifreeze recycling systems may use filtration, deionization or distillation to recycle used antifreeze. Antifreeze must be drained from the vehicle and transferred to the batch recycling unit. Because it is not a closed-loop system (i.e. antifreeze has to be drained from the vehicle to be reclaimed), a hazardous/nonhazardous waste determination is required for the used antifreeze reclaimed with batch recycling equipment.

Costs for in-house antifreeze recycling equipment depend on the method used to recycle antifreeze. For example, a simple closed-loop filtration system costs approximately \$2,200 to \$3,400 depending on the accessories purchased with the unit. Closed-loop or batch recycling systems that use deionization or distillation are generally more expensive (\$7,000 to \$10,000), but produce a higher quality recycled antifreeze.

The cost per gallon of recycled antifreeze also varies depending on the type of unit purchased. Based on vendor information, recycled antifreeze from closed-loop recycling systems costs \$2 or more per gallon largely because of the chemicals that must be added to the antifreeze. Other expenses associated with closed-loop recycling systems include costs for replacing spent filters, fees for laboratory characterization of spent filters (TCLP testing for a hazardous/nonhazardous determination) and potential disposal costs for hazardous spent filters. Costs are also incurred for periodically recharging the ion exchange resin used in deionization recycling systems.

Based on vendor information, batch distillation units can recycle used antifreeze for approximately \$1.20 per gallon (see Appendix H). This cost per gallon reportedly includes chemical additive costs, waste disposal costs and the cost of running the system.

## **POLLUTION PREVENTION COST/BENEFITS**

Table 4-1 presents a general guide for comparing costs between the various antifreeze recycling options available to vehicle maintenance facilities. Beside equipment costs and cost per gallon of used antifreeze generated, other factors that should be considered when selecting a recycling option include:

- The quality of recycled antifreeze produced and whether the recycling system meets applicable vehicle manufacturer's performance standards are important considerations since they may affect a vehicle's warranty. Vehicle manufacturers' warranties should be reviewed to ensure that the use of recycled antifreeze from a particular recycling system will not invalidate the warranty.
- If used antifreeze is stored before recycling (either on-site or off-site) or if batch recycling equipment is used, it will be subject to a hazardous or nonhazardous determination. A hazardous/nonhazardous determination requires submitting a representative sample of the used antifreeze to a laboratory for toxicity characteristic leaching procedure (TCLP) analysis. To save on laboratory fees, the used antifreeze may also be assumed hazardous. If the used antifreeze is determined or assumed hazardous, the following requirements must be met:
  1. The quantity of used antifreeze generated each month and stored on site must be included in the facility's hazardous waste inventory and used to determine the facility's hazardous waste generator status.
  2. The used antifreeze must be stored and managed according to the set of hazardous waste generator regulations applicable to the facility.
  3. Only a hazardous waste management company may be used to transport the used antifreeze off site for recycling or disposal.

As indicated above, a vehicle maintenance facility would be subject to additional regulatory burdens if the used antifreeze is determined to be hazardous. If the used antifreeze is found to be nonhazardous, hazardous waste regulations do not apply and any reputable recycling company may be used for off-site transportation and recycling.

**Table 4-1  
Used Antifreeze Recycling Guide**

<b>Antifreeze Recycling Method</b>	<b>Equipment Cost</b>	<b>TCLP Testing Required for Antifreeze?</b>	<b>New Antifreeze Purchase Cost /Gallon of Used Antifreeze Generated<sup>b</sup></b>	<b>Waste Generated from Recycling</b>	<b>Est. Recycling Cost/Gallon of Used Antifreeze Generated</b>	<b>Est. Total Cost/Gallon of Used Antifreeze Generated</b>
<b>Provide to a Waste Management Company as Hazardous Waste</b> (Recycles off-site and keeps antifreeze)	None	No - may assume hazardous	\$2.00	None	\$1.50 - \$2.00	\$3.50 - \$4.00
<b>Provide to a Recycler as a Nonhazardous Waste</b> (Recycles off-site and keeps antifreeze)	None	Yes	\$2.00	None	\$0.45 - \$0.55	\$2.45 - \$2.55
<b>Provide to a Recycler as a Nonhazardous Waste<sup>a</sup></b> (Recycles and leaves antifreeze on-site)	None	Yes	\$0	None	\$2.00 - \$2.50	\$2.00 - \$2.50
<b>On-Site Recycling Using Closed-Loop Filtration</b>	\$2,200 - \$5,000	No - If not stored prior to recycling	\$0	Spent Filters	\$2.00 - \$3.00	\$2.00 - \$3.00
<b>On-Site Recycling Using Closed-Loop Filtration with Deionization</b>	\$7,000 - \$8,000	No - if not stored prior to recycling	\$0	Spent Filters	\$2.50 - \$3.50	\$2.50 - \$3.50
<b>On-Site Recycling Using Batch Distillation</b> (15 gallon capacity)	\$7,500 - \$8,000	Yes	\$0	Still Bottoms	\$1.20 - \$2.00	\$1.20 - \$2.00

<sup>a</sup> Indicates the used antifreeze is recycled using filtration

<sup>b</sup> Assumes the used antifreeze generates is 50% water

- ❑ Potentially hazardous wastes such as spent filters, sludge or still bottoms are generated from antifreeze recycling equipment. Like used antifreeze that is stored on site before recycling, these wastes must be characterized as hazardous or nonhazardous for proper management and disposal.
- ❑ Facilities using an antifreeze recycling service company do not have to purchase, maintain or operate equipment.

The worksheet provided as Figure 4-1 should be completed to obtain an estimate of the cost/benefits associated with recycling antifreeze. To complete Figure 4-1, locate vendors of equipment and antifreeze recycling companies to obtain pricing information.

<b>Figure 4-1 Used Antifreeze Recycling Cost/Benefit Estimate Worksheet</b>			
<b>ITEM</b>	<b>VARIABLE</b>	<b>EXAMPLE</b>	<b>YOUR FACILITY</b>
<b>A</b>	<b>Purchase cost of recycling equipment (if in-house recycling)</b>	<b>\$8,000</b>	
<b>B</b>	<b>Estimated cost per gallon of recycled used antifreeze</b>	<b>\$1.50</b>	
<b>C</b>	<b>Analytical fees (waste and used antifreeze characterization)</b>	<b>\$800.00</b>	
<b>D</b>	<b>Estimated annual waste disposal cost (if in-house recycling)</b>	<b>\$100.00</b>	
<b>E</b>	<b>Total capital cost (recycling equipment and lab costs) = A + C</b>	<b>\$8,800.00</b>	
<b>EXISTING CONDITIONS (12 MONTH)</b>			
<b>F</b>	<b>Quantity of used antifreeze generated per year</b>	<b>300</b>	
<b>G</b>	<b>Annual disposal cost</b>	<b>\$600.00</b>	
<b>H</b>	<b>Antifreeze purchase cost per gallon</b>	<b>\$4.00</b>	
<b>I</b>	<b>Replacement antifreeze purchase cost = (G / 2) x I</b>	<b>\$600.00</b>	
<b>J</b>	<b>Total annual used antifreeze cost = H + J</b>	<b>\$1,200.00</b>	
<b>RESULTS</b>			
<b>K</b>	<b>Total annual cost of recycling = (B x G) + D</b>	<b>\$550.00</b>	
<b>L</b>	<b>Additional profit from recycled antifreeze (per gallon) = I - B</b>	<b>\$2.50</b>	
<b>M</b>	<b>Total annual profit from recycled antifreeze = N x G</b>	<b>\$750.00</b>	
<b>N</b>	<b>ANNUAL SAVINGS WITH RECYCLING = K - M</b>	<b>\$650.00</b>	
	<b>RECYCLING EQUIPMENT PAYBACK PERIOD = A / (O + P)</b>	<b>5.7</b>	