

On-Site Distillation

A Guide for Choosing and Operating an On-Site Distillation Unit

The following guide discusses some important points your business should think about when choosing and operating a distillation unit to reclaim your spent solvent.

Although spent solvents often designate as hazardous wastes, many contaminated solvents can be reclaimed, and then re-used. Distilling solvents at a facility is a common way to extend their useful life.

Before investing in a distillation unit, take the time to consider whether you really need one or not. If you can reduce the amount of spent solvents you generate, a still may not be necessary. Whether or not you have a still, reducing your solvent use and using less toxic solvents are good ideas, well worth pursuing.

Pollution Prevention

Before investing in a distillation unit, see if you can reduce your generation of hazardous waste from spent solvents by answering these five questions:

1. Can I reduce the amount of solvent I use? Good housekeeping, preventive maintenance, proper waste management, and inventory control practices can help reduce solvent use.
2. Can I consolidate the different kinds of solvent I use and use only one solvent for several purposes? Can this solvent be distilled? Is this solvent recyclable?
3. Is there a less toxic alternative? Before buying any solvent, check the Material Safety Data Sheet (MSDS). Try to choose a non-hazardous or less-hazardous water-based cleaner.
4. Can I use a filtration device when using the solvent? This can reduce the amount of solids and prolong the use of the solvent. For example, placing a mesh screen in the opening of a drum is one simple way to filter the solvent.
5. Can I save money by investing in these Pollution Prevention (“P2”) measures to reduce my use of hazardous solvents? Are the costs of managing spent solvent greater than the costs of these P2 measures?

If your analysis of P2 opportunities indicates an economic reason to continue use of hazardous solvents, the next step is to consider the alternatives available for management of spent solvent.

Management Choices for Spent Solvent

Although spent solvents are often hazardous wastes, many contaminated solvents can be reclaimed, and then reused. The first step in selecting a spent solvent management option is to determine if there is a simple, effective, and inexpensive spent solvent management process such as decanting, simple filtration, or centrifuging that can produce a useful recycled product. For example, filtration is used to separate solvents from solid contaminants.

Do I need a permit from Ecology to use a still at my facility?

No. You are allowed to recycle on-site.

Benefits of On-Site Distillation

If you decide that an on-site distillation unit is right for your business, here are some of the potential benefits:

- ✓ Reduces the amount of new solvents you need to purchase.
- ✓ Reduces the amount of hazardous waste generated and stored on-site;
- ✓ May reduce your generator status and regulatory requirements,
- ✓ Reduces long-term liability related to transporting spent solvents off-site for treatment and disposal.

Getting the Most Out of Your Still

How to Recover a Quality Solvent

- Distill different types of solvents separately, and do not mix different types of spent solvents in the same container.
- Do not contaminate the solvents with water.
- Make sure the distillation unit has the proper temperature range, capacity, and processing time for the solvent you want to recycle.
- Filter out solids. A lower concentration of solids in the material to be distilled will help the still operate more efficiently. Higher concentrations of solids should be avoided – they insulate the heat source from the solvent and reduce the efficiency of the recovery.
- Reclaimed solvent may not be as effective as pure solvent. If the reclaimed solvent cannot be used in the original process, look for alternative uses such as cleaning painting equipment.

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- The success of your solvent recycling program may depend on having an individual dedicated to supervising and initiating the operation. Remember, an employee responsible for collecting, recycling, and ensuring that the solvent is reused will make your program a success.

Reducing Still Bottoms

Still bottoms should be minimized by filtering out solids before distillation if possible, and operating the still in such a way that the maximum amount of solvent is recovered.

In some cases, still bottoms can be reused in the manufacturing process. For example, the still bottoms from fiberglass may be used for filler in certain applications. Also, some vendors can recycle the still bottoms from paints and inks.

Shop Around Before Choosing a Still

Questions to Ask Your Vendor:

Does the still have a UL 2208 label rated for the solvents you plan to recycle?

This rating allows you to operate your still inside your facility. Without this rating, fire code requires that you use the still outside your facility.

Are there other costs in setting up the still at my facility?

To determine this, identify any special requirements of the still such as electrical, water system, or fireproofing, needed for proper installation and operation.

Will the vendor distill a sample of my waste?

This can help you evaluate the quality of the reclaimed product and determine what percentage of the initial waste can be successfully recovered.

What kind of maintenance is required?

Make sure the maintenance procedures are provided by the vendor in a written manual.

When using the still, do the different types of solvent need to be distilled separately?

If the answer is yes, make sure the employees understand the solvent separation procedure.

Safety Concerns

By asking your vendor a few additional questions you will help secure the health and safety of your employees.

- Will the still automatically shut down in case of water failure, in case the pot (distillation chamber) exceeds a safe operating temperature, or in case the condenser water goes above a preset temperature?
- Does the still have a pressure relief valve that will activate in cases of extreme pressure?
- Can the unit sense when all the solvent has been distilled and only contaminants are cooking?
- For flammable solvents, is an explosion-proof electrical still available?
- Does the unit have a feature to prevent the pot's lid from opening until the contents have cooled to a safe temperature?
- Will the vendor provide operator safety training?

Are the still bottoms easily removed from the pot and how will I dispose of them?
Still liners help remove the sludges left in the bottom of a still. Otherwise you may have to remove them by scooping them out, requiring personal protective equipment. Do not scoop out hot still bottoms, as their vapors could be explosive if ignited.

Will the unit need a vacuum to more efficiently distill the solvent(s) I use?
A vacuum unit lowers the boiling temperature. If you have large volumes of solvent with high boiling points to distill, a vacuum unit can make recovering the solvent more energy efficient. A vacuum unit can make the cost of distilling high boiling solvents more economical. Vacuum units are more expensive than atmospheric units. Ask your vendor if a vacuum unit is needed for your solvent and what level of vacuum will provide the best solvent recovery.

Do you have a customer user list, referrals, and/or a letter of recommendation?
Ask if others in the area are using their equipment.

What kind of condenser will I need?
Choosing the right condenser depends on the type of solvent you are distilling. A still boils solvent into vapors by adding heat. The condenser then removes that heat from the vapors to form a liquid again. An inadequate condenser will only condense a portion of the vapors, thereby allowing the uncondensed vapors to escape to the atmosphere.

In some cases, an air-cooled condenser may be adequate. However, these condensers are not as effective as water-cooled condensers in controlling the solvent vapor temperature. Water-cooled equipment delivers a higher, more consistent condensation than air-cooled equipment. Water-cooled condensers are generally more efficient and provide more consistent solvent recovery year-round. Consider reusing the cooling water.

Will the solvent deteriorate any components of the still with extended use?
Use a still built with components that are compatible with your solvents.

Can I upgrade my existing still?
Your vendor may be able to repair, modify, or upgrade your existing distillation unit. Remember that switching to a newer or more efficient piece of equipment may be the most cost-effective solution in the long run.

Cost-Benefit Analysis

There are obvious and not-so-obvious costs and savings to look at when considering a still. The most obvious cost is the price of the still, and the most obvious savings are the reduced disposal fees. For a more accurate analysis you should take into account, at a minimum; capital, installation, the operation and maintenance, raw materials, and disposal costs.

Example Payback Analysis

The following is an example of how to calculate the payback when considering whether to purchase a still:

A shop is considering buying a still for \$6,000, which will cost \$1,700 to install. The shop generates 24 drums of waste solvent per year, which cost \$200 per drum to dispose. They have determined the average percent solids in their waste solvent, and estimate that they will be able to recover 1,056 gallons of solvent a year, and generate 3 drums a year of still bottoms. Because they pay \$4.50 a gallon for the raw solvent, they anticipate saving \$4,752 in raw solvent purchases. The bottoms will cost \$350 a drum to dispose, for an annual total of \$1,050.

They will distill 3 batches of solvent per week. They estimate that this will require 1 hour of staff time per batch and 0.5 hours/week in maintenance, at a salary rate of \$20/hour. Electric power for the still will cost \$0.061 per kWh.

Initial Capital Investment

Distillation unit	\$6,000
Installation	<u>\$1,700</u>
Total Investment	\$7,700

Annual Operations Savings and Costs

Savings on raw solvent	\$4,752
Less disposal of spent solvent	\$4,800
Disposal of still bottoms	(\$1,050)
Labor	(\$3,640)
Utilities	<u>(\$ 228)</u>
Total Annual Savings	\$4,634

$$\text{Payback period} = \frac{\text{capital costs}}{\text{Annual savings}} = 1.66 \text{ years (about 20 months)}$$

Cost Worksheet

Waste Solvent Generated

(A) Gallons per year:

Gals/day ____ x No. of working days/year ____ = ____

(B) Drums per year:

Gals/yr (A) ____ divided by 55 (gals/drum) ____ = ____

Capital Costs

(C) Recovery Unit Cost = ____

(D) Installation Cost (include materials and labor) = ____

Annual Savings in Disposal

(F) Current Disposal Cost:

drums/yr (B) ____ x \$/drum ____ = ____

(G) Future Disposal Cost:

% solids ____ x drums/yr (B) ____ x \$/drum solids ____ = ____

(H) Net Savings for Disposal (F-G) =

Annual Savings in Raw Solvents

(I) Gals/yr (A) ____ x % liquid ____ x \$/gal new solvent ____ = ____

Annual Operating Costs

(J) Operation Labor:

hours/week x rate/hr ____ x ____ weeks/yr = ____

(K) Maintenance Labor:

hours/week ____ x rate/hr ____ x ____ weeks/yr = ____

(L) Power Costs:

Power req'd (kWh) ____ x operating hrs/yr ____ x %/kWh ____ =

(M) Water and Sewer if needed: =

(N) Total Operating Costs (J + K + L + M) = ____

Net Annual Savings

(O) Disposal and solvent savings less operating costs (H + I) - M =

Projected Payback Period

(P) Capital Costs (E) divided by Net Annual Savings (O): (E/O) = ____

Complying with the *Dangerous Waste Regulations*

Fire Code

Fire code requires that distillation units have a UL 2208 label for operation inside your building. Without this label, the unit must operate inside an H2 room (explosion proof switching, 4 hr. firewalls, etc.) or be operated outside your building. The unit as a whole needs the rating label, not just the parts.

Labor & Industries

Any solvent which comes off the still is considered a product and must have its own specific Material Safety Data Sheet (MSDS). You cannot simply copy the MSDS from the solvent which was originally used, you must determine what the distilled solvent is made up of and list those ingredients into a new MSDS.

Containers must be clearly labeled, identifying the contents, whether it's recycled/reclaimed, and any applicable hazards warnings (toxic, flammable, etc.).

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Containers

All containers with waste solvent for recycling should be labeled as a hazardous waste with the risk factor for that waste (i.e., flammable). All containers must be closed except when contents are being added or removed. Containers must be in good condition and not damaged (dents, rust).

Still Bottoms

Still bottoms must be designated to determine if they are hazardous waste. If hazardous, they must be put into a container and labeled with a hazardous waste label, the date accumulation started and the risk label (i.e., flammability). Still bottoms should not be air-dried.

Distilling Outside Your Building

If you own or purchase a still that does not have a UL 2208 label on it you will have to distill solvents with the unit outside. These precautions should be followed;

1. Containment of the distillation operation area is required.
2. It (the still or the operation area?) should be protected from weather.
3. Spill equipment should be immediately available nearby.
4. All waste containers should be closed except when transferring liquids from accumulation containers to the still.
5. Remove still bottoms only after they have cooled.
6. Do not air dry still bottoms.

Regulatory Reminder

You are legally and financially responsible for properly handling your wastes.

Hazardous wastes are regulated until they actually enter the recycling process. Before the spent solvent enters the still, you are responsible for complying with the regulations on proper accumulation, handling, transportation, and storage for hazardous waste.

While the useful solvent reclaimed from the distillation unit is not regulated as a hazardous waste, most residues or still bottoms coming from the distillation of substances such as spent paints, fiberglass acetone, or ink are regulated as hazardous waste.

Counting Spent Solvents and Determining Generator Status

Businesses that do on-site solvent recycling must count spent solvents as dangerous waste when they are stored or accumulated prior to distillation. Because solvents are often reclaimed and reused multiple times, it is only necessary to count the largest amount of spent solvent that has been accumulated prior to recycling during the month. The main reasons for counting these wastes are to determine your generator status for the month and to report the combined monthly amount on the Dangerous Waste Annual Report (small quantity generators do not have to report solvent recycling activity).

Maintain a Logbook

Every time spent solvents are accumulated and recycled during the month, the quantity accumulated just prior to distillation would be recorded on a generator status form (see example on next page). To track the largest amount of spent solvent accumulated, the form is needed to record:

1. Distillation start date. Keep in mind that an accumulated quantity of spent solvent may be considerably larger than a single run through the still, thus it may require two or more still runs to process the total amount collected. The start date should only record the date when distillation begins on that accumulated quantity, not the date of every single still run required to process that accumulated quantity.
2. Amount in pounds of spent solvent collected prior to recycling.
3. Amount in pounds of still bottoms generated.
4. The total amount of still bottoms generated for the month. Include all residuals, sludges and filters from the reclamation processes.
5. The month's single largest amount of spent solvent collected prior to recycling. If this largest amount is not actually recycled before the end of the month, it is still counted as the month's largest accumulated quantity. If this amount, or any quantity of spent solvent is recycled in the following month, it will need to be counted again prior to recycling. This largest amount of spent solvent plus the total amount of still bottoms will be the total quantity of dangerous waste generated from solvent reclamation processes for the month.

Column 1	Column 2	Column 3
Distillation Start Date	Amount collected prior to recycling (pounds)	Still bottoms generated (pounds)
	Largest value = _____	Total = _____

It is important to properly maintain the still's gaskets and seals to prevent solvent evaporative loss during still operation. Evaporative loss is considered a waste that may need to be calculated if significant. It is not necessary to count new or virgin solvent that has been added to the original stock to make up for losses resulting from manufacturing processes.

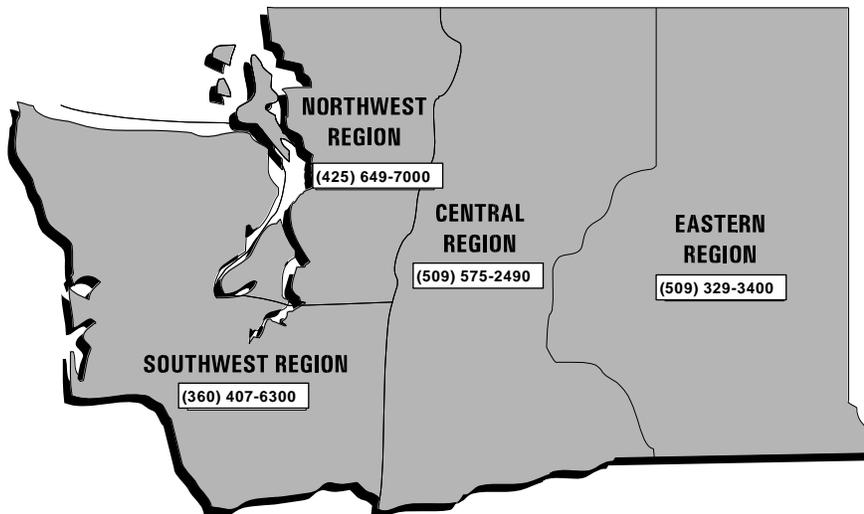
For more information, see "Counting Dangerous Waste Under the Dangerous Waste Regulations" (Ecology publication #98-414, revised October 2002).

Consider a Lease

Small businesses can often save money by leasing solvent recovery equipment for less than their current cost of disposal.

For More Information

Call your nearest Ecology regional office for assistance. Ask for a Toxics Reduction Specialist for information on reducing or recycling hazardous waste, or a Hazardous Waste Specialist if you are uncertain about your responsibilities as a hazardous waste generator. As a public service the Hazardous Waste and Toxics Reduction program maintains a list of vendors who provide equipment and products.



If you need this document in a format for the visually impaired, call the Hazardous Waste and Toxics Reduction Program at 360-407-6700. Persons with hearing loss, call 711 for Washington Relay Service. Persons with a speech disability, call 877-833-6341.