Guide to On-Site Distillation

How to Choose and Operate an On-Site Distillation Unit

Hazardous Waste and Toxics Reduction Program

Washington State Department of Ecology

Olympia, Washington

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DEPARTMENT OF ECOLOGY
State of Washington

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Related Information

- Publication 19-04-023: Focus on: Labeling Dangerous Waste[1]
- Publication 19-04-029: Focus on: Satellite Accumulation Areas[2]
- Publication 20-04-010: Counting Dangerous Waste Under the Dangerous Waste Regulations[3]
- Dangerous waste annual reporting webpage[4]

Contact Information

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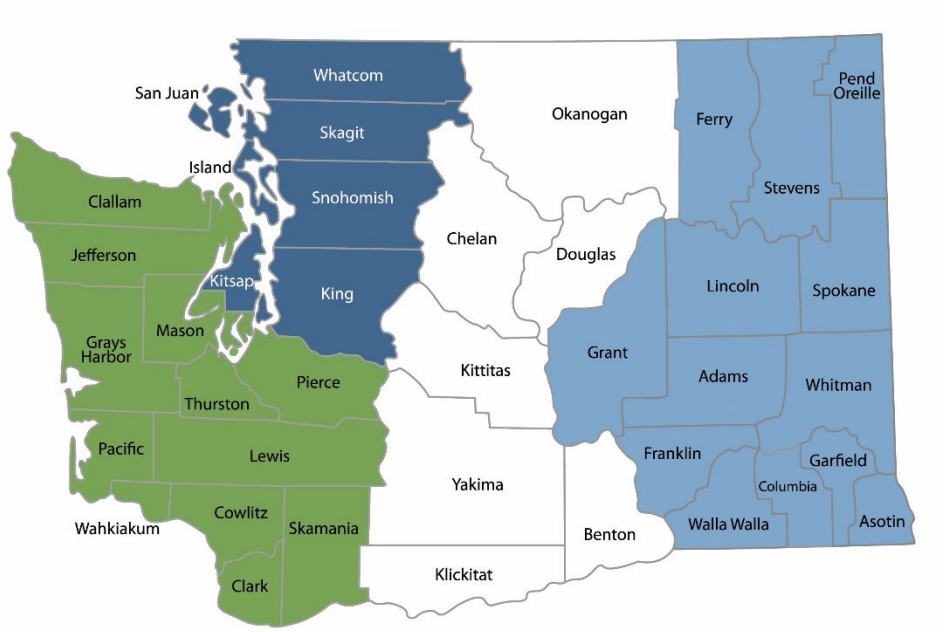
[1] https://apps.ecology.wa.gov/publications/SummaryPages/1904023
[2] https://apps.ecology.wa.gov/publications/SummaryPages/1904029
[3] https://apps.ecology.wa.gov/publications/SummaryPages/2004010
[4] https://ecology.wa.gov/DWReport
[5] www.ecology.wa.gov/contact
[6] www.ecology.wa.gov/accessibility

Department of Ecology's Regional Offices

Map of Counties Served



Southwest Region 360-407-6300	Northwest Region 206-594-0000	Central Region 509-575-2490	Eastern Region 509-329-3400

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Northwest	Island, King, Kitsap, San Juan, Skagit, Snohomish, Whatcom	PO Box 330316 Shoreline, WA 98133	206-594-0000
Central	Benton, Chelan, Douglas, Kittitas, Klickitat, Okanogan, Yakima	1250 W Alder St Union Gap, WA 98903	509-575-2490
Eastern	Adams, Asotin, Columbia, Ferry, Franklin, Garfield, Grant, Lincoln, Pend Oreille, Spokane, Stevens, Walla Walla, Whitman	4601 N Monroe Spokane, WA 99205	509-329-3400
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Is On-site Distillation Right for You?

Distillation is a common way to recover solvents for reuse. Consider these options when choosing and operating an on-site distillation unit (also called a still) to recycle[7] your spent solvents.

Decide if a still is the best choice for your business before you invest. If you can eliminate or reduce your solvent use—or use less-toxic solvents—distillation may **not** be necessary. We can help[8] if you have questions.

Benefits of on-site distillation

On-site distillation can reduce:

- The amount of new solvents you need to buy.
- The amount of dangerous waste you generate and accumulate on site.
- Your dangerous waste generator category and regulatory requirements.
- Long-term liability related to transporting spent solvents off site for treatment and disposal.

Do you need a distillation unit?

You may be able to reduce your solvent use without a distillation unit through good housekeeping, preventative maintenance, proper waste management, and inventory control.

Ask yourself these five questions. If the answer to any of them is "yes," you may **not** need a distillation unit.

- **Can you use one solvent for several purposes?** Using fewer types of solvents produces less waste.
- **Is there a less toxic alternative?** Before buying any solvent, check the Safety Data Sheet (SDS) provided by the product manufacturer. Try to choose a non-hazardous or less-hazardous water-based cleaner.
- **Can you filter your solvent?** Filtering reduces the amount of solids and prolongs the solvent's life. Place a mesh screen in the opening of the drum for a simple way to filter the solvent.
- **Can you change your procedures to eliminate your need for solvents?** Compare the cost of implementing new procedures with the costs of purchasing solvents and managing them as waste.
- **Can you produce a reusable solvent by decanting, simple filtration, or centrifuging?** Determine if one of these simpler and less expensive waste treatment options is right for you. Refer to the on-site distillation regulations section to learn more about this option.

[7] **Recycle** means to use, reuse, or reclaim a material.
[8] https:// ecology.wa.gov/EfficiencyConsulting

How to Choose a Distillation Unit

Conduct a cost-benefit analysis

When considering equipment for on-site distillation, factor costs and savings into your choice. The still itself is expensive, but reduced disposal fees can result in noticeable savings. For a more accurate analysis, take into account capital, installation, operation, maintenance, raw materials, and disposal costs.

Key questions to ask your vendor

Before purchasing a distillation unit for your facility, ask your vendor some important questions like the ones below.

What safety features does the unit come with?

Look for these important safety features:

- **Automatic shutoff** in case of water failure, or if condenser water or distillation chamber temperatures get too hot.
- **Pressure relief valve** with automatic activation in case of extreme pressure.
- **Sensors** to detect when all solvent is distilled and only contaminants remain.
- **Lid lock** to prevent employees from opening the unit before contents have cooled.
- **Safety training** for your employees, provided by the vendor.

If you're using flammable solvents, make sure you purchase an explosion-proof electrical still.

What is the still's UL standard?

Choosing a distillation unit with a UL 2208 rating for the solvents you plan to recycle allows you to operate it inside your facility. Without this rating, you can only operate the unit outside your facility because of fire codes.

What are the costs for setting up and operating the still at my facility?

Identify any special requirements—and the associated costs—needed for proper installation and operation, such as electricity, a water system, or fireproofing.

How efficient is the still?

Ask your vendor to distill a sample of your waste to help you evaluate the quality of the reclaimed product and determine how much solvent you can successfully recover.

What kind of maintenance is required?

Make sure the maintenance procedures are provided by the vendor in a written manual. Consider potential costs that may factor into regular maintenance.

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

If the answer is yes, make sure your employees understand the procedure for separating solvents.

How should I remove still bottoms?

Still liners collect sludge left in the bottom of a still, allowing for easier disposal. Without them, sludge must be removed by scooping, which requires personal protective equipment (PPE).

Don't scoop out hot still bottoms. Their vapors could explode if ignited.

Would a vacuum unit make the still more efficient?

Although they are more expensive to purchase, vacuum units can make the still more economical and energy efficient when distilling solvents with a high boiling point. They do this by reducing the atmospheric pressure, which lowers the boiling point of the solvent.

Ask your vendor if a vacuum unit is ideal for your solvent.

What kind of condenser do I need?

What is a condenser?

A still boils solvent into vapor by adding heat. The **condenser** removes this heat from the vapor to form a liquid (distilled solvent).

An inefficient condenser will allow uncondensed vapor to escape into the atmosphere, lowering the efficiency of the still.

Types of available condensers

- **Water-cooled condensers** are typically the most efficient and provide consistent solvent recovery year round. Consider reusing the water for another purpose.
- **Air-cooled condensers** are less effective at controlling vapor temperatures, but can be sufficient for certain situations.

How long will the distillation unit last?

To maintain your unit's longevity, perform preventative maintenance and repairs in a timely manner. Also, choose a still made of materials that are compatible with your solvents.

Can I upgrade my existing unit?

Your vendor may be able to repair, modify, or upgrade your existing distillation unit. However, switching to a newer or more efficient still may be the most cost-effective solution in the long run. Your vendor may help you compare costs.

Have customers provided feedback about the equipment?

Ask your vendor if they can provide a customer user list, referrals, or letters of recommendation. Find out if others in the area are using the vendor's equipment and request their feedback.

Managing Solvents: Getting the Most Out of Your Still

Recovering quality solvents

One benefit of on-site distillation is reusing the recovered solvent. Follow this guidance to maintain the quality of your solvent.

- **Don't** mix different types of spent solvents in the same container; distill them separately.
- **Don't** contaminate the solvents with water.
- Make sure the still has the proper temperature range, capacity, and processing time for the solvents you want to recycle.
- Filter out solids.
    - A lower concentration of solids allows the still to operate more efficiently.
    - A higher concentration insulates the heat source from the solvent, reducing the efficiency.
- Choose an employee to be responsible for collecting, recycling, and ensuring solvents are reused.
- Maintain the still's gaskets and seals to keep evaporated solvents from escaping during operation.
- Reclaimed solvents may **not** be as effective as pure solvents. If the reclaimed solvents **can't** be used in the original process, look for other possible uses, such as cleaning painting equipment.

Reducing still bottoms

Recover the maximum amount of solvent by filtering out solids before distillation and following proper operating procedures.

In some cases, still bottoms can be reused in the manufacturing process. For example, boat builders can use ground up still bottoms as filler. Also, some vendors can recycle the still bottoms from paints and inks.

On-Site Distillation Regulations

You're legally and financially responsible for properly handling your dangerous waste.

Dangerous waste is regulated until it enters the recycling process. Before spent solvent enters the still, you must follow the Dangerous Waste Regulations[9] for proper accumulation, handling, and storage.

- Most residues or still bottoms left after distilling substances like spent paint, solvent, or ink are regulated as dangerous waste.
- Reclaimed, useable solvent **isn't** regulated as dangerous waste.

You **don't** need a permit from Ecology to use a still at your facility—you're allowed to recycle on site.

Spent solvent containers

All containers holding spent solvent for recycling must:

- Be properly labeled with:
  - The words "dangerous waste" or "hazardous waste."
  - The applicable hazards for that waste (for example "flammable" or "toxic").
  - The date you began putting solvent in the container.

  See our Focus on: Labeling Dangerous Waste[10] publication for additional guidance.
- Remain closed except when contents are being added or removed.
- Be in good condition, **not** leaking, and **not** damaged (such as dented or rusted).

There are more rules about container management than the ones listed above. Remember it's your responsibility as a generator to know the regulations about containers. Refer to the following sections:

- Medium quantity generator conditions for exemption.[11]
- Large quantity generators conditions for exemption.[12]
- Satellite accumulation area—you cannot treat your waste in satellite accumulation areas.[13]

[9] https://apps.leg.wa.gov/WAC/default.aspx?cite=173-303
[10] https://apps.ecology.wa.gov/publications/SummaryPages/1904023
[11] WAC 173-303-172
[12] WAC 173-303-200
[13] WAC 173-303-174

Designating still bottoms

You must designate[14] your still bottoms to determine if they are dangerous waste. If they're dangerous waste, you must put them into a container labeled with the words "dangerous waste" or "hazardous waste," along with the accumulation start date and the associated hazards. **Don't** air-dry still bottoms.

Counting Spent Solvents with the Multiple Counting Exemption

You must count stored or accumulated spent solvents on site before they are recycled. There are three reasons for counting these wastes:

- To determine your generator category[15] for that particular month.
- To report the combined monthly total on your Dangerous Waste Annual Report.[16]
- To help with Pollution Prevention[17] planning.

Using the multiple counting exemption[18] may benefit your site because it removes the need to count spent solvents twice when generated in the same month. Frequent recycling increases the benefit from this exemption.

Facilities that reclaim and reuse solvents multiple times during the month:

- May lower their generator category and have fewer regulatory requirements.
- May reduce their Hazardous Waste Planning[19] fees.

Spent materials generated, reclaimed, and reused on site are counted only once per month. Therefore, you **don't** need to count every batch of spent solvent that's distilled during the month.

When are spent solvents counted?

You must record all spent solvents accumulated before recycling on a monthly recycling log;[20] this includes solvents in satellite accumulation containers intended for on-site recycling. At the end of the month, count the largest amount accumulated at any one time during the month, towards your generator category. Spent solvents accumulated and **not** recycled by the end of the month must be carried over into the next month for counting.

In the new month, add the solvent that **wasn't** recycled to any recently generated spent solvents. The combined amount may be the largest amount accumulated in the second month.

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[14] https://ecology.wa.gov/Designation
[15] https://ecology.wa.gov/GeneratorStatus
[16] https://ecology.wa.gov/DWReport
[17] https://ecology.wa.gov/P2Plan
[18] See WAC 173-303-169(5)(b).
[19] https://ecology.wa.gov/PlanningFee
[20] See the monthly recycling log example below.

To avoid this larger count in the second month, you may choose to recycle all waste before the end of the month. End-of-month recycling will eliminate accumulated solvent carry-over into the following month. Most generators find it is easier to recycle often and avoid counting these larger volumes.

You must count any spilled or mishandled waste towards your generator category. You must also count any dangerous waste residues (such as still bottoms) produced from the recycling process.

Monthly recycling log

To determine the largest amount of spent solvent accumulated each month, you need to record the:

- Distillation start date.
- Total amount (in pounds) of spent solvent accumulated on site prior to recycling.
- Amount (in pounds) of still bottoms generated.

Count the total amount of still bottoms and the largest amount of spent solvent accumulated towards your generator category for the month. Because recycling is a treatment activity, you are required to maintain a log.[21]

Don't count lost solvent

During production and cleaning processes, solvents may be "lost" via evaporation. These solvents **shouldn't** be counted. Replenishing the lost solvent with virgin solvent **shouldn't** be counted either.

Minimize evaporative loss

Maintain your distillation unit to minimize solvent loss through evaporation. Air emissions can contain toxic organic compounds as well as ozone pollutants. Perform preventative maintenance on your equipment to maximize performance and reduce environmental risk:

- Replace seals and gaskets when needed.
- Conduct a tightness analysis.
- Repair leaks.
- Regularly clean the still.

Large quantity generators must also meet RCRA Organic Air Emissions Standards[22] depending on the type of waste and unit.

[21] See log requirements in WAC 173-303-170(2)(b)(iv)(B): https://app.leg.wa.gov/WAC/default.aspx?cite=173-303-170.

[22] https://www.epa.gov/hwpermitting/resource-conservation-and-recovery-act-organic-air-emission-standards-treatment-storage

For more information, see our Counting Dangerous Waste Under the Dangerous Waste Regulations[23] publication.

Filing your dangerous waste annual report

If you have an active EPA/State ID Number, you must report dangerous waste activities each year on your dangerous waste annual report. This includes notifying us using the Site Identification Form[24] (under Section 10e. State Required Information) if you conduct on-site recycling.

SQGs without an active EPA/State ID Number don't have to notify.

Medium and large quantity generators must report the largest amount of spent solvent accumulated during each month on their Generation and Management (GM) form.

If your recycling activities generate a new waste stream, it must be reported on a separate GM form. For example, if you distill a spent solvent mixture and then remove still bottoms, report the spent solvent waste stream on one GM form and the still bottoms waste stream on another GM form.

See our dangerous waste annual report webpage[25] for more information.

Example of counting spent solvent with the multiple counting exemption

The example below **doesn't** cover every situation or counting method in relation to the multiple counting exemption. It is intended as a guide, but if you have specific questions, please contact your region's Ecology office.[26]

A fiberglass shop recycles spent acetone from cleaning processes on site. Spent solvent is accumulated in 55-gallon drums and distilled three times during the month.

- On January 10, the shop starts distilling 160 pounds of collected spent solvent (counting from January 1). It may or may **not** distill all 160 pounds in a single still run, depending on the capacity of the still.
- Meanwhile, the shop generates more spent solvent. It accumulates 150 pounds and starts distilling it on January 17.
- Again, the shop generates 180 more pounds of solvent and begins distilling it on January 28.

The quantity of spent solvent (**not** including still bottoms) reported for the month should be 180 pounds. This is the largest amount of spent solvent accumulated prior to on-site recycling.

[23] https://apps.ecology.wa.gov/publications/SummaryPages/2004010
[24] https://apps.ecology.wa.gov/publications/SummaryPages/ECY070133
[25] https://ecology.wa.gov/DWReport
[26] https://ecology.wa.gov/contact.html

Maintain a monthly recycling log like the following example to help you determine the monthly reportable quantity of spent solvent.

Monthly recycling log example

Distillation Start Date	Pounds Collected Before Recycling	Pounds of Still Bottoms Generated
January 10	160	20
January 17	150	10
January 28	180	30

How to calculate solvent waste for January:

Add the largest number in column two (the pounds collected before recycling) to the total of column three (the pounds of still bottoms generated).

Pounds collected before recycling: 180
Pounds of still bottoms generated: 60
180 plus 60 equals 240 pounds of solvent waste counted.

Without the multiple counting exemption, a generator would have counted 550 pounds instead of 240 pounds. In this example, evaporative loss from the still is zero. With inefficient stills, this loss may need to be added to your monthly dangerous waste total.

See Appendix A. Flow Diagram Example for a graphic representation of the example above.

Other regulations that apply

Labor & Industries

Any solvent recovered from the still is considered a new product and must have a Globally Harmonized System (GHS) compliant label and its own Safety Data Sheet (SDS). You must determine the constituents in the distilled solvent and list those ingredients on a new SDS. You **can't** copy the SDS from the original solvent.

For more information, see Washington State Department of Labor and Industries' Rules for the Globally Harmonized System of Classification and Labeling of Chemicals.[27]

Fire code

Many local fire departments require distillation units to have a UL 2208 label for operation.

Contact your local fire department to learn about fire code requirements for distillation unit installation and operation.

[27] https://www.lni.wa.gov/safety-health/safety-rules/rules-by-chapter/?chapter=901

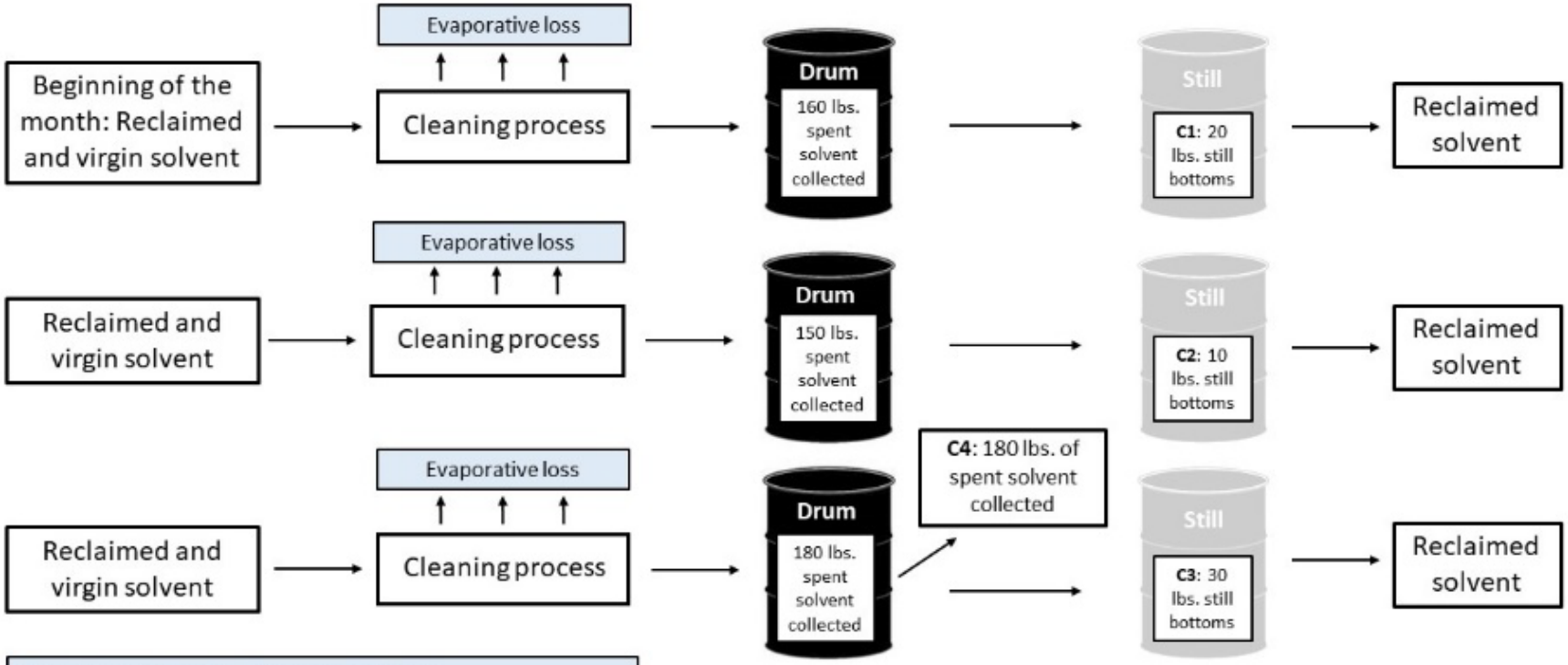
Distilling outside your building

If you own or purchase a still that **doesn't** have a UL 2208 label, you must distill solvents outside of your building. Follow these precautions:

- The still must be inside a spill containment structure.
- Protect the still and solvent containers from weather damage.
- Emergency equipment should be readily available and located nearby.
- Keep spent solvent containers closed, except when transferring liquids to the still.
- Wait for still bottoms to cool before removal.

Appendix A. Flow Diagram Example

This flow diagram summarizes Example 1, as explained in the example of counting spent solvent section.



Monthly Counting of Dangerous Waste	
C1:	20 pounds of still bottoms
C2:	10 pounds of still bottoms
C3:	30 pounds of still bottoms
C4:	180 pounds of spent solvent collected
Total:	240 pounds of dangerous waste

Note 1: Without the multiple counting exemption, a generator would have counted 550 pounds instead of 240 pounds.

Note 2: In this example, evaporative loss from the still is zero, with inefficient stills this loss may need to be calculated and added to monthly dangerous waste total.