

# Solvents in the Workplace

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## How to Determine If They Are Hazardous Waste

September 2016

Version 2

## DISCLAIMER

This guide is not a regulation, nor can it be considered a substitute for the actual regulations, related laws, and applicable court decisions. This guide presents EPA's interpretation of the federal RCRA hazardous waste regulations; the reformatted Code of Federal Regulations (CFR) language in this guide is not a substitute for the CFR or its requirements.

**Note to Reader:** Version 2 corrects typographical errors, a few caused by formatting problems in Table 1, further clarifies solvents that still can be used are nevertheless considered to be a spent material if they are instead sent for reclamation, and further describes and clarifies the discussion of F003 solvents and land disposal restriction requirements. This version also adds a Question and Answer on substituting alternative or non-hazardous solvents for hazardous solvents as effective substitutes, and clarifies the air emission requirements for solvents recycled on-site.

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## About this guide

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Thousands of American workers use solvents every day in industrial, commercial, and other non-residential settings. Many of these solvents become hazardous wastes when they can no longer be used for their intended purpose and are discarded. A hazardous waste must be managed safely from its point of generation through recycling or disposal. When one of your solvents can no longer be used, it is your responsibility to determine whether it is a hazardous waste.

The purpose of this guide is to make people who use and discard solvents aware of the Resource Conservation and Recovery Act (RCRA) hazardous waste regulations and assist them in making correct hazardous waste determinations for solvents.<sup>1</sup> This guide also includes information about resources to help you reduce your use of solvents or select alternative less-hazardous solvents.

When viewed electronically, this guide contains two types of links. The first link type, in [blue](#), indicates a link to additional information available on EPA's website. The other link type, in [green](#), indicates a link to additional information on the topic included elsewhere in the document. When accessing [green](#) links, you can use the document navigation feature on the left side of your screen to return to your previous place in the guide if you wish to do so.

This guide is provided by EPA for the convenience of the regulated community, states, and EPA regions. This guide addresses requirements for hazardous waste determination applicable to generators of hazardous waste solvents, but does not address the management standards if the solvent is found to be a hazardous waste. Information about the management of a hazardous waste solvent can be found at EPA's [Hazardous Waste Generators](#) website.

If you [use solvents in your workplace](#), this guide can help you:

- Understand the RCRA hazardous waste rules.
- Improve your understanding of the RCRA hazardous waste regulations associated with solvents.
- Characterize and determine if your waste solvents are classified as hazardous wastes subject to RCRA regulations.
- Answer commonly asked questions about solvents and RCRA.

Most states are authorized to manage their own hazardous waste generator regulatory programs. Therefore, there may be state regulations that apply in lieu of the federal hazardous waste regulations. While most state hazardous waste regulations are based on the federal requirements, some states have developed regulations that are more stringent than the federal requirements or broader in scope. For example, a state's program may identify additional solvents when discarded subject to their regulations. For state regulations, contact your state's environmental regulatory agency or department or visit [EPA's State Programs Web page](#).

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<sup>1</sup> The Occupational Safety and Health Administration (OSHA) also has authority to regulate solvents during use when they pose a risk to workers.

EPA recommends you contact your authorized state agency or [EPA regional office](#) should you have any concerns or doubts about whether your solvent may be a hazardous waste when it can no longer be used and needs to be discarded.

## **1. What are solvents and how are they used?**

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Generally, a solvent is a liquid that is either a single chemical or a mixture of chemicals used to dissolve a substance or material. This property allows solvents to be used as cleaning agents, or in chemical manufacturing, or as ingredients in other products.<sup>2</sup>

Common uses of solvents include:

- Industrial cleaning and degreasing;
- Dry cleaning;
- Paint thinning and coating;
- Fabric scouring;
- Auto and airplane manufacturing and maintenance; and
- Many other uses.

## **2. Why do I need to know about solvents?**

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Many common solvents may be hazardous wastes when they are spent, or can no longer be used. Also, many commercial chemical products are solvents and are considered a hazardous waste if they are unused when discarded. (See Section 6.B. *Scope of P- and U-listings.*) Under the [RCRA hazardous waste regulations](#), you are responsible for determining if your spent solvents are hazardous wastes and subject to hazardous waste requirements. If the solvents are hazardous wastes, they must be managed and disposed of (or recycled) properly. If not, you could put yourself, your coworkers, and the general public at risk, and there may be legal consequences for violating the RCRA hazardous waste requirements.

## **3. Do I use solvents in my facility?**

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Solvents are used in a variety of applications across many industries. If you are unsure whether solvents are used in your facility or are uncertain about the types of solvents used in your facility's processes, consider asking facility or plant managers or health and safety personnel, who are good sources of information and may be able to assist you.

Additionally, your employer may be required to provide information if hazardous chemicals are being used in the workplace, under [Occupational Safety and Health Administration's \(OSHA\) Hazard Communications regulations at Title 29 of the CFR in section 1910.1200](#).

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<sup>2</sup> A solvent may contain either organic or inorganic chemicals. Organic solvents always contain the element carbon while inorganic solvents do not. The most common solvent, water, is an example of an inorganic solvent.

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### Examples of Industries That Typically Use Solvents

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Adhesives manufacturing	Ink formulation
Autobody repair	Metal fabrication
Automotive manufacturing	Metal finishing and plating
Circuit board manufacturing	Paint manufacturing and use
Defense	Personal care product manufacturing
Dry cleaning	Pharmaceutical manufacturing
Electronics manufacturing	Printing
Electroplating	Pulp and paper manufacturing
Fiber-reinforced plastic manufacturing	Rubber manufacturing
Film developing	Semiconductor manufacturing
Furniture manufacturing	Wood staining and varnishing

#### **4. When is a solvent considered a solid waste?**

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Under the RCRA hazardous waste regulations, a solvent must first be classified as a [solid waste](#) before it can be considered for classification as a hazardous waste. Under RCRA, the term “solid waste” includes solid materials, liquids, and contained gases. Solvents are solid wastes when they are discarded or recycled in a certain manner, such as when burned for energy recovery. Solvents are considered solid wastes when they are:

- “Spent” – contaminated through use and no longer able to be used for their intended purpose without first being regenerated, reclaimed, or otherwise reprocessed;<sup>3</sup>
- Expired and can no longer be used;
- Off-specification commercial chemical products and can no longer be used;
- Unwanted and/or unused and destined for disposal; or
- Residues, contaminated soil or water, or other debris resulting from cleanup of a solvent spill.

If you are unsure if the solvents in your facility are solid wastes, you can use EPA’s [Definition of Solid Waste Decision Tool v2](#),<sup>4</sup> which walks you through a series of decisions to help you determine whether a material meets the definition of a solid waste.

- If you have determined that one or more solvents in your facility are solid wastes, [proceed to the next section](#) to determine whether they are also hazardous wastes.

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<sup>3</sup> Under EPA’s 2015 Definition of Solid Waste rule, solvents reclaimed in a specified manner may be excluded from regulation as a solid and hazardous waste. States are not required to adopt this rule. [See EPA’s Definition of Solid Waste Web page](#) for more information.

<sup>4</sup> The DSW Decision Tool is currently housed in EPA’s Archive and may not load properly in all Internet browsers. We suggest using Internet Explorer to access the tool. This tool is being updated as of the date of this publication to incorporate the 2015 Definition of Solid Waste rule changes. We expect to have it operational soon with a link on the Hazardous Waste Generator webpage.

- If you have determined that the solvents in your facility are not solid wastes, then they are also not hazardous wastes. You have completed the solvent hazardous waste determination process. Note that your material or the conveyances and systems that handle your material may be subject to other environmental regulation.

## **5. I've determined my solvent is a solid waste; now when is it a hazardous waste?**

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If you have determined that one or more solvents in your facility are solid waste, you should next determine whether they are also hazardous waste. Hazardous waste requires special handling and proper disposal if it is:

- A *listed hazardous waste* specifically listed in [Title 40 CFR part 261, subpart D](#) and/or
- A *characteristic hazardous waste* (i.e., ignitable, toxic, reactive, or corrosive) as described in [40 CFR part 261, subpart C](#).

RCRA requires you to determine if you have generated a listed and/or characteristically hazardous waste as soon as the solvent becomes a solid waste, also known as the point of waste generation.

You cannot make this initial hazardous waste determination later in the process when other materials may have been mixed with the waste or when the waste has changed its physical characteristics as a result of time elapsing. These factors can affect the accuracy of the hazardous waste determination. This standard must be met even if another entity, such as a waste management facility, makes the waste determination on your behalf.

You will need specific information on the chemical composition and other attributes of your solvent in order to determine whether it is a listed hazardous waste and/or a characteristic hazardous waste. If you wish to learn more about identifying the types of information and data sources that you should use in making a hazardous waste determination about your solvents, click [here](#).

- Proceed to the following sections to determine whether your solvent is a [listed hazardous waste](#) or a [characteristic hazardous waste](#).
- If you still have questions about solvents, solid waste, and hazardous waste, consider [seeking further assistance](#). However, remember that as the generator of the waste, you are ultimately responsible for making the correct determination for your solvents.
- If you already know that your solvent is a hazardous waste, click [here](#) for information on how to [manage your hazardous waste in accordance with RCRA regulations](#).

## **6. How do I determine if my solvent is a listed hazardous waste?**

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This section will walk you through determining whether your solvent is a *listed* hazardous waste. In order to complete this determination, you will need the chemical composition and/or other identifying information about your solvent. Assistance with the kinds of information you may

need to have in order to make this type of determination is provided in later [sections](#) in this document.

The first source of information you should examine or review is the actual listing description for hazardous wastes.<sup>5</sup> There are four lists of hazardous wastes:

- The F-list (non-specific source wastes);
- The K-list (source-specific wastes);
- The P-list (discarded commercial chemical products); and
- The U-list (additional discarded commercial chemical products).

The listed solvents of concern in this guide relate to spent solvents found in the F-list, and unused but discarded commercial chemical product solvents found in P-list, and/or U-lists. These lists are found at [40 CFR part 261, subpart D](#).

K-listed wastes generally represent industrial process wastes from specific sources, for example, “Wastewater treatment sludges from the production of chrome yellow and orange pigments” (waste code K002). A complete list of K-listed wastes is found at [40 CFR 261.32](#). Because the K-listed wastes do not include the types of solvent wastes of interest here, they are not addressed in this guide.

[Appendix A](#) provides a table of F-listed hazardous solvents and P- or U-listed solvents, as well as characteristically hazardous solvents.<sup>6</sup> The scope of these listings as they apply to solvents is described below.

#### *6.A. Scope of F-Listings*

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F-listed hazardous waste solvents (EPA Hazardous Waste Numbers: F001, F002, F003, F004, and F005) are generated from a variety of sources, including industrial and commercial sources. The F-list is composed of approximately 30 solvents that include certain chlorinated or oxygenated solvents. Table 1 provides listing descriptions for F-listed solvents. These F-listed solvents have an associated EPA Hazardous Waste Number—sometimes called a hazardous waste code—for waste identification, manifesting, and other recordkeeping and reporting purposes. [Appendix B](#) provides examples of frequently asked questions about making hazardous waste determinations for solvents when they can no longer be used and are discarded.

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<sup>5</sup> For a complete description of F-listing background documents, [see Regulations.gov docket number EPA-HQ-RCRA-2004-0016](#). A listing of P-listed and U-listed wastes is available at [40 CFR section 261.33](#).

<sup>6</sup> Note that some hazardous constituents found in [Appendix A](#) that are U-listed solvents may be used in ways other than as a solvent. For example, in addition to being solvents, cresols can be used as biocides. Therefore, a hazardous constituent’s intended use, other than as a solvent, only affects the F-listing, not the U-listing.

**Table 1. Listing Description for F-Listed Solvents**

F001	<p>The following spent halogenated solvents used in degreasing:</p> <ul style="list-style-type: none"> <li>• tetrachloroethylene</li> <li>• trichloroethylene</li> <li>• methylene chloride</li> <li>• 1,1,1-trichloroethane</li> <li>• carbon tetrachloride</li> <li>• chlorinated fluorocarbons</li> </ul> <p>All spent solvent mixtures/blends used in degreasing that contain, before use, a total of 10 percent or more (by volume) of one or more of the above halogenated solvents or those solvents listed in F002, F004, and F005. Still bottoms from the recovery of the above spent solvents and spent solvent mixtures.</p>
F002	<p>The following spent halogenated solvents:</p> <ul style="list-style-type: none"> <li>• tetrachloroethylene</li> <li>• trichloroethylene</li> <li>• ortho-dichlorobenzene</li> <li>• methylene chloride</li> <li>• 1,1,1-trichloroethane</li> <li>• trichlorofluoromethane</li> <li>• chlorobenzene</li> <li>• 1,1,2-trichloroethane</li> <li>• 1,1,2-trichloro-1,2,2-trifluoroethane</li> </ul> <p>All spent solvent mixtures/blends containing, before use, a total of 10 percent or more (by volume) of one or more of the above halogenated solvents or those listed in F001, F004, or F005. Still bottoms from the recovery of the above spent solvents and spent solvent mixtures.</p>
F003	<p>The following spent non-halogenated solvents:</p> <ul style="list-style-type: none"> <li>• xylene</li> <li>• acetone</li> <li>• ethyl acetate</li> <li>• ethyl benzene</li> <li>• ethyl ether</li> <li>• methyl isobutyl ketone</li> <li>• n-butyl alcohol</li> <li>• cyclohexanone</li> <li>• methanol</li> </ul> <p>All spent solvent mixtures/blends containing, before use, only the above spent non-halogenated solvents. <u>All spent solvent mixtures/blends containing, before use, one or more of the above non-halogenated solvents and a total of 10 percent or more (by volume) of one or more of those solvents listed in F001, F002, F004, and F005.</u> Still bottoms from the recovery of the above spent solvents and spent solvent mixtures.</p>
F004	<p>The following spent non-halogenated solvents:</p> <ul style="list-style-type: none"> <li>• nitrobenzene</li> <li>• cresols and cresylic acid</li> </ul> <p>All spent solvent mixtures/blends containing, before use, a total of 10 percent or more (by volume) of one or more of the above non-halogenated solvents or those solvents listed in F001, F002, and F005. Still bottoms from the recovery of the above spent solvents and spent solvent mixtures.</p>
F005	<p>The following spent non-halogenated solvents:</p> <ul style="list-style-type: none"> <li>• toluene</li> <li>• isobutanol</li> <li>• 2-ethoxyethanol</li> <li>• methyl ethyl ketone</li> <li>• pyridine</li> <li>• 2-nitropropane</li> <li>• carbon disulfide</li> <li>• benzene</li> </ul> <p>All spent solvent mixtures/blends containing, before use, a total of 10 percent or more (by volume) of one or more of the above non-halogenated solvents or those solvents listed in F001, F002, or F004. Still bottoms from the recovery of the above spent solvents and spent solvent mixtures.</p>

An F-listed solvent is a hazardous waste when it meets all of the following criteria:

- Criterion 1: The chemical must be used for its solvent properties, which dissolve or mobilize other constituents.

**Example:** Solvents used for their solvent properties in degreasing, cleaning, fabric scouring, diluents, extractants, and reaction and synthesis media are F-listed hazardous wastes when spent.

**Example:** The F-listing does not cover solvents used for other purposes, such as reactants, catalysts, or ingredients in the formulation of a commercial chemical product.<sup>5</sup> Paint formulated with solvents according to manufacturers' specifications would not meet the listing when that paint becomes spent.

- Criterion 2: The solvent must be spent.
  - ❖ The solvent must be so contaminated that it cannot be used purposefully without first being regenerated, reclaimed, or otherwise reprocessed. Note: Solvents that still can be used are nevertheless considered to be a spent material if they are instead sent for reclamation.<sup>8</sup>
- Criterion 3: The solvent or solvent mixture must meet a specific, before-use concentration threshold.
  - ❖ Before use, F001-, F002-, F004-, and F005-listed solvents or solvent mixtures must contain a total of 10 percent or more (by volume) of one or more of the solvents in the listing. For specific conditions applicable to F003-listed solvents, click [here](#).

**Example:** A solvent, before use, containing 100 percent carbon tetrachloride would be assigned an F001 listing waste code.

**Example:** A solvent mixture, before use, containing 9 percent carbon tetrachloride, 5 percent benzene and 86 percent water would be assigned an F001, F005 waste code when spent because the solvent mixture contained (before use) a total greater than 10 percent F001 and F005 solvent constituents.

- ❖ If the solvent is determined to meet the F001, F002, F003, F004 and/or F005 listing, then still bottoms generated from the distillation process for these hazardous solvents would carry the same F-listed EPA Hazardous Waste Number since the still bottoms are included within the hazardous waste listing. In other words, still bottoms (the appearance of which can be different than the original spent solvent waste) generated, for example, from distilling F001 waste are explicitly listed as F001 as well. However, if the solvent is listed solely for a RCRA characteristic (e.g., F003 solvent) then the F003 listing would not apply to the still bottoms if they do not exhibit any characteristic.

<sup>7</sup> 50 FR 53315, December 31, 1985, at page 53316.

<sup>8</sup> "Regarding whether a material must be nonfunctional to meet the definition of spent material, the fact that a material can continue to be used for its original purpose is not relevant to the issue of whether or not it is a spent material when it is clear from the facts that the material will not be used but instead will be treated by reclamation." See RCRA Online 11822, March 24, 1994.

- ❖ Generators must also determine if their listed spent solvent, including a solvent mixture may be a [characteristically hazardous waste](#).

**Example:** If a solvent mixture, when spent, has a flash point of less than 140 degrees F, then it is characteristically hazardous for ignitability and must be assigned a hazardous waste code of D001.

If an F-listed solvent meets the three criteria above, it is considered a hazardous waste.

Some solvents exist in multiple F-listings.

**Example:** Methylene chloride is a halogenated solvent found in both the F001 and F002 listings. To be classified as an F001 listed hazardous waste solvent, it must not only meet the above three criteria, but also be used in degreasing operations. However, for methylene chloride to be a F002-listed solvent, it must meet the above three criteria but be used for solvent purposes other than degreasing operations.

### 6.A.1. F003 Solvents

F003-listed solvents are very different than the other F-listed solvents and more difficult to understand. As seen in [Table 1](#) above, the F003 listing includes a description not found in the other solvent F-listings, i.e., “all spent solvent mixtures/blends containing, before use, only the above spent non-halogenated solvents.” This distinction is important for defining the scope of the F003 listing.

Solvent mixtures containing F003 solvents are hazardous wastes under only two conditions:

1. The solvent mixture contains only F003 constituents (which are pure or technical grade).

**Example:** A solvent mixture containing 99.9% xylene (technical grade) (F003) + 0.1% water before use would carry the F003 waste code when spent because the mixture contains only the technical grade F003 solvent xylene.

**Example:** Conversely, for a solvent mixture containing 15% acetone (F003) + 85% water before use, no listing would apply when spent because the solvent mixture is **neither pure nor technical grade** and does not contain any other listed solvent constituents.

2. The mixture contains one or more F003 constituents (at any concentration) and 10 percent or more of the other F-listed solvents before use.

**Example:** A solvent mixture containing 15% tetrachloroethylene (F001) + 1% xylene (F003) + 84% water would carry both the F001 and F003 waste codes. The F001 waste code would apply because it contains more than 10% F001 solvent before use, while the F003 listing applies because it contains more than 10% F001, F002, F004, or F005 and **any** amount of F003 solvent constituents before use.

**Example:** Conversely, a solvent mixture containing 9% tetrachloroethylene (F001) + 1% xylene (F003) + 90% water would not carry neither an F001 nor an F003 listing waste code.

F003-listed solvents are listed solely because of their ignitability characteristic. Note that there is an exemption for wastes listed only for an ignitability (I), corrosivity (C), or reactivity (R) characteristic in [40 CFR section 261.3\(g\)\(1\)](#), which states:

“A hazardous waste that is listed in subpart D of this part solely because it exhibits one or more characteristics of ignitability as defined under §261.21, corrosivity as defined under §261.22, or reactivity as defined under §261.23 is not a hazardous waste, if the waste no longer exhibits any characteristic of hazardous waste identified in subpart C of this part.”

Thus, if the spent solvent does not exhibit the characteristic of ignitability at the point of generation, the waste would not be designated as an F003 solvent.<sup>9</sup>

**Warning:** Dilution to change a waste’s properties may be prohibited.

However, if the F003 solvent did not exhibit the ignitability characteristic (for which it was listed) at the point of generation, but exhibited some other hazardous waste characteristic (for example, the toxicity characteristic for lead (D008)), then the waste would be regulated as a D008 hazardous waste.

There is one additional caveat to the F003 listing to be aware of: when using a solvent that has been listed solely because it exhibits a characteristic of ignitability, corrosivity, or reactivity, such as a F003 solvent, and when spent that waste does not exhibit any hazardous waste characteristic at the point of generation, then that waste is not subject to the land disposal restriction (LDR) requirements of [40 CFR Part 268](#) because the F003 spent solvent was never considered to be hazardous and is thus not subject to 40 CFR part 268 (See 66 FR 27286).<sup>10</sup> However, if the F003 solvent does express a characteristic at the point of generation and is subsequently de-characterized, then the solvent waste is still subject to Part 268 LDR

**Example:** If an F003 solvent is mixed with water prior to being used for its intended purpose, and subsequently becomes spent through use, then LDRs would or would not apply depending upon whether that spent solvent exhibited the characteristic of ignitability at the point of generation (See 66 FR 27269, column 3, May 16, 2001.).

**Example:** If that spent F003 solvent is not characteristically hazardous at the point of generation but is subsequently mixed with a solid waste to generate a waste that contains lead at a concentration warranting the D008 (lead) characteristic code for toxicity, then LDR requirements would apply to both the F003 waste and lead (D008). As a result, the generator would need to treat this hazardous waste for the regulated hazardous constituents found in F003 as well as any underlying hazardous constituents reasonably expected to be present since lead is not a regulated constituent in F003.<sup>12</sup>

requirements per 40 CFR 261.3 (g)(3).<sup>11</sup> Similarly, the generator would be subject to 40 CFR 268.7(a)(7) and must place a one-time notice in its files “describing such generation, subsequent exclusion from the definition of hazardous or solid waste or exemption from RCRA Subtitle C regulation, and the disposition of the waste.”

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<sup>9</sup> Note that [40 CFR section 261.3\(g\)](#) was promulgated as a result of the May 16, 2001 revisions to the mixture and derived-from rules (See 66 FR 27266). Since this provision was less stringent than existing regulations, states may not have adopted and received authorization for these regulations. Generators should contact their state to determine if this section of RCRA applies to them.

<sup>10</sup> This Guide does not cover the Land Disposal Restrictions (LDRs) requirements in any detail, and readers should consult resources identified later in this guidance for further information. However, a key point to remember is that complying with the LDR rules requires proper hazardous waste identification, including for spent solvents.

<sup>11</sup> See 66 FR 27286 and letter from Devlin to Nebrich, March 1, 2013, RO 14836.

Frequently asked questions and other examples of the scope of F-listed wastes are available [here](#). If you are still unclear on whether your solvent is an F-listed waste, consider reading through the examples [here](#).

### 6.B. Scope of P- and U-listings

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Another category of listed hazardous wastes, which can include solvents, are the P- and U-listed hazardous wastes. The P- and U-listed hazardous wastes are specific unused commercial chemical products (CCPs) or manufacturing chemical intermediates that are discarded or intended to be discarded. The difference is that the chemicals on the P list are identified as acute hazardous wastes and those on the U list are identified as toxic hazardous wastes, unless otherwise designated. These chemicals are found in the regulations at [40 CFR section 261.33\(e\) and \(f\)](#).

Unused CCPs can become wastes for a number of reasons, including but not limited to:

- If they are accidentally spilled;
- If their shelf life expires (based on expiration date) and they cannot be used;
- If they are off-specification; or
- If they can no longer serve the purpose for which they were produced.

In addition, in order for any CCP (including a solvent) to be a P- or U-listed hazardous waste, the chemical on the P- or U-list must be manufactured or formulated for commercial or manufacturing use. Commercial or manufacturing use consists of the commercially pure form, any technical grades of the chemical that are produced or marketed, and all formulations in which the chemical is the sole active ingredient.

- An active ingredient is defined as a component or mixture that performs the function of the product, even if it is present at a very low concentration. If the CCP has two or more active ingredients, it is not defined as a P- or U-listed waste under the federal RCRA program.

**Warning:** Some state programs may be different in this regard.

The complete lists of all P-listed and U-listed CCPs are found at [40 CFR section 261.33\(e\) or \(f\)](#). You should refer to these lists to determine if solvent products you have in your inventory will be hazardous waste when they are spilled or discarded.

Using information about your solvent and the information in this section, you should be able to determine if your solvent is an F-listed, P-listed, or U-listed hazardous waste.

- If your solvent is a listed hazardous waste, proceed to determining whether it is also a [characteristic hazardous waste](#). You should do this because the solvent listing may not address all of the constituents of your solvent. It is important to know whether your solvent is solely a listed hazardous waste, or a listed hazardous waste that also exhibits hazardous characteristics.
- If your solvent is not a listed hazardous waste, or you are unsure, you should determine whether it is a [characteristic hazardous waste](#).

- Frequently asked questions and other examples of the scope of P-listed and U-listed wastes are available [here](#). If you are still unclear on whether your solvent is a P-listed or U-listed waste, consider reading through the examples [here](#).
- If you feel uncertain about the language and topics discussed in this section and may require additional assistance with making a hazardous waste determination, consider clicking [here](#).

## 7. How do I determine if my solvent is a characteristic hazardous waste?

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Now that you have determined whether or not your solvent is a listed hazardous waste, you must determine if your solvent also exhibits a hazardous waste characteristic. You must do this regardless of whether your solvent is a P-, U-, or F-listed waste.

Determining if your solvent is characteristically hazardous is necessary because the solvent listing might not address all of the potential constituents in either the spent (F-listed) or unused (U- or P-listed) solvent. These other constituents may be important for determining how to comply with other requirements (e.g., LDRs). According to [40 CFR section 261.3\(b\)\(3\)](#), a solid waste can become a hazardous waste when it exhibits one or more hazardous waste characteristics. As a practical matter, this means that persons handling solvents that have become solid wastes must determine whether they meet the characteristics of hazardous waste.

This is particularly true for F-listed spent solvents that may have become contaminated through use with materials that exhibit another characteristic, such as toxicity. For example, solvents often become contaminated with constituents such as fine particles, dirt, or grease that could contain heavy metals such as lead, cadmium, or chromium.

Whether a solvent is a listed hazardous waste only, or is a listed hazardous waste that also exhibits hazardous characteristics is important for purposes of a generator's compliance with the Land Disposal Restriction (LDR) regulations in [40 CFR Part 268](#) (see [40 CFR section 262.11\(c\)](#)). The LDR regulations impose different requirements for listed waste versus characteristic waste. If the solvent is both a listed hazardous waste and exhibits hazardous characteristics, it must meet treatment standards for both its listed and characteristic waste codes prior to land disposal.<sup>12</sup>

To make a hazardous waste determination, refer to the sections below that describe the types of information that [may help you make the determination](#). Using knowledge of your process that generated the waste, or testing your waste, may be especially helpful in determining whether your waste has hazardous characteristics.

Process knowledge that may help you determine whether your waste has hazardous characteristics may include:

- Information about chemical feedstocks and other inputs to the production process;

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<sup>12</sup> The exception to this is when a treatment standard for a listed waste also contains the constituent that caused the waste to exhibit a characteristic; in this case, the treatment standard for the listed waste would operate instead of the characteristic treatment standard (thus there would be no need to meet treatment standards for underlying hazardous constituents). See [U.S. EPA, Offices of Emergency Response & Enforcement and Compliance Assurance, Land Disposal Restrictions: Summary of Requirements, Revised August 2001, EPA530-R-01-007](#).

- Knowledge of products, byproducts, and intermediates produced by the manufacturing process;
- Chemical or physical characterization of wastes;
- Information on the chemical and physical properties of the chemicals used or produced

#### Definition of “Characteristic Hazardous Waste”

A RCRA characteristic hazardous waste is a solid waste that exhibits at least one of four characteristics defined in [40 CFR 261, subpart C](#). These hazardous waste characteristics are:

- **Ignitable** (EPA Hazardous Waste No. D001) wastes can create fires under certain conditions, can spontaneously combust, or have a flash point less than 60 °C (140 °F). These wastes can be liquids, solids, compressed gas, or oxidizers. A waste exhibits the characteristic of ignitability if it is a liquid, other than an aqueous solution, containing less than 24 percent alcohol by volume and has flash point less than 60 °C (140 °F). An ignitable solid can cause fire through friction, absorption of moisture, or spontaneous chemical changes. It creates a hazard by burning vigorously and persistently under standard temperature and pressure. See [40 CFR section 261.21](#) for a complete set of criteria and lists of applicable test methods.
- **Corrosive** (EPA Hazardous Waste No. D002) wastes are aqueous-based acids or bases (pH less than or equal to 2, or greater than or equal to 12.5) and/or liquids that can corrode steel, such as storage tanks, drums, and barrels, based on a specific test method. Battery acid is an example of a corrosive hazardous waste. See [40 CFR section 261.22](#) for a complete set of criteria and lists of applicable test methods.
- **Reactive** (EPA Hazardous Waste No. D003) wastes are normally unstable and readily undergo violent change without detonating. They react violently or form potentially explosive mixtures with water. When mixed with water, reactive wastes generate toxic gases, vapors, or fumes that present a danger to human health or the environment. They are also cyanide- or sulfide-bearing wastes that can generate toxic gases, vapors, or fumes that present a danger to human health or the environment. These wastes are capable of detonation or explosive reaction, or are certain forbidden explosives. For more details, see [40 CFR section 261.23](#). The rules do not currently identify any specific test methods regarding these properties.
- **Toxic** (EPA Hazardous Waste Nos. D004–D043) wastes are harmful or fatal when ingested or absorbed. Examples include eight metals (D004–D011); cancelled pesticides (D012–D017); and toxic organics (D018–D043), including 12 with solvent applications. When toxic wastes are land-disposed, the contaminated material may leach and pollute ground water. Toxicity is defined through a laboratory procedure called the [Toxicity Characteristic Leaching Procedure \(TCLP\) Method 1311](#). The TCLP helps identify wastes likely to leach concentrations of contaminants that may be harmful to human health or the environment. For more details, see [40 CFR section 261.24](#).

by the processor or otherwise contained in the waste;

- Testing that illustrates the properties of the waste; or
- Other reliable and relevant information about the properties of the waste or its constituents.

Your process knowledge can also account for situations that include startups, shutdowns, upsets, and malfunctions.

Additionally, RCRA regulations require that some characteristics, such as ignitability, undergo a specific test. When properly performed and compared with regulatory thresholds, the results of that test are definitive for determining whether the waste is hazardous. The tests specified by the regulations are available in EPA’s [Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, EPA Publication SW-846](#).

[Appendix A](#) provides a table of listed solvents that may be characteristically hazardous.

Given this information, you should be able to determine whether your solvent is a listed and/or characteristic hazardous waste.

- The previous two sections provided information on the definitions of [listed hazardous wastes](#) and [characteristic hazardous wastes](#). You will need to use information on your solvent to determine whether or not it is a hazardous waste. For assistance on what types of information you should use as the basis for your determination, see the [following section](#).
- If you already know that your solvent is a hazardous waste, Section 10 provides information on how to [manage your hazardous waste in accordance with RCRA regulations](#). Section 11 also provides information about recycling your listed or characteristically hazardous solvents.
- If you already know that your solvent is neither a listed nor a characteristic hazardous waste, then your solvent is not a hazardous waste. You have completed the solvent hazardous waste determination process. However, please note that your waste may be subject to other environmental regulations, such as state regulations.
- Frequently asked questions and other examples about characteristically hazardous wastes are available [here](#). If you are still unclear on whether your solvent is a characteristically hazardous waste, consider reading through the examples [here](#).
- If you feel uncertain about the language and topics discussed in this section and may require additional assistance with making a hazardous waste determination, consider clicking [here](#).

## 8. What information should I use as the basis for my hazardous waste determination?

This section will walk you through a series of information sources that are commonly used to make hazardous waste determinations for solvents. As you proceed through the following steps, you may find that you have sufficient information on your solvent to determine whether it is a listed or characteristic hazardous waste. If this is the case, you may proceed directly to the following section, which provides information on how to [manage your hazardous waste in accordance with RCRA regulations](#).

Step 1: Review your safety data sheet (SDS) or material safety data sheet (MSDS) for chemical composition or environmental information. Look for information on your solvent on its SDS, which should be available from your supplier, or otherwise provided as part of your workplace hazard communication program under OSHA. [Note: some suppliers have not yet transitioned to an SDS format and may be using an MSDS instead.] SDSs or MSDSs can provide essential information such as:

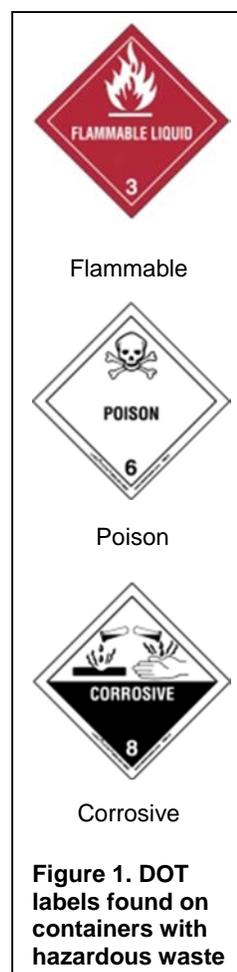


Figure 1. DOT labels found on containers with hazardous waste

- The names of all chemicals that pose a threat to human health. These chemicals must be identified if they are present in a concentration greater than 1 percent, or 0.1 percent if they are carcinogenic. In addition to their names, the Chemical Abstracts Service (CAS) number must also be provided. The CAS number is important because it provides a reliable system for identifying chemicals. Though some chemicals can have different names, the CAS number will always be the same regardless of the name used.
- The specific concentrations of the product's chemical constituents.
- What environmental or health hazards may exist.
- Whether potential characteristic hazards, such as toxicity or ignitability, may exist.
- Whether the solvent product had to be shipped from the manufacturer in compliance with U.S. Department of Transportation (DOT) hazardous material regulations and the class of material.

The shipping container for your solvent may also display hazard pictograms (Figure 1) that can provide *indicators* of hazardous characteristics.

This information, if available, can serve as a reference or as supplemental information in determining whether the solvent will be a hazardous waste when it can no longer be used and is discarded. SDS information detailing the solvent product's concentration and constituents will help make a hazardous waste determination, but it will not be the only information you can rely on in making the waste determination.

**Warning:** SDSs cannot support a hazardous waste determination in cases where a particular chemical's concentrations are too variable to make a determination with certainty, or in cases where a chemical's concentration is too low to identify on the SDS.

The SDS does not always identify chemicals below a concentration of 1 percent (0.1 percent in the case of chemicals that are carcinogens). However, a chemical could have a lower concentration than 1 percent or 0.1 percent and still be considered characteristically hazardous.

**Example:** The solvent benzene has a toxicity characteristic regulatory level of 0.5 mg/l and thus may result in a characteristically hazardous determination at this concentration even if not identified on the SDS (concentration is below 1 percent).

**Step 2: Use process knowledge.** It is possible that process knowledge may be all that is needed to determine whether your solvent meets a listing description and should be managed as a listed hazardous waste, or whether the solvent is characteristically hazardous. If the SDS or MSDS are not available, or do not provide you with sufficient information to make a hazardous waste determination, consider asking a knowledgeable employee or employer for assistance. They might understand the chemistry associated with your solvent use, including what type or class the solvent is, what hazards its constituents may pose if mismanaged, and whether the solvent is or is not a hazardous waste upon discard.

If you use process knowledge to make a hazardous waste determination for your solvent, you must make a record of and maintain the information that can support this determination. (Under

federal regulations, you must maintain records of your affirmative hazardous waste determinations, see [40 CFR section 262.40\(c\)](#).) This is also important if you determine that your solvent is not hazardous under RCRA – in this case, EPA recommends as a best practice (although not required) that you document the reasons or factors why and maintain any information that can support a non-hazardous determination.

Step 3: Consider solvent supplier knowledge. In many cases, your solvent supplier can tell you whether a solvent will be characteristically hazardous, a listed hazardous waste, or both, when it becomes a waste.

You might also encounter difficulty in making a proper determination for a solvent with an F-listed constituent whose concentration range, before use, is sometimes above and sometimes below the 10 percent threshold (e.g., 5 to 25 percent according to the SDS provided by the solvent supplier) for a listed solvent (see [Section 6.A](#) and Question 5 in [Appendix B](#) of this document for an explanation of the threshold and appropriate actions to take.)

Step 4: Testing. Under the federal hazardous waste regulations, you are not legally required to test your waste in making a hazardous waste determination. However, collecting a representative sample and analyzing the waste for constituents and associated concentrations can often be more accurate than using process knowledge or the other data sources listed here to determine if the solvent is a hazardous waste.

For the purposes of testing a waste to make a hazardous waste determination, a representative sample is a sample of a universe which can be expected to exhibit the average properties of the universe or whole. In other words, the sample taken should, for purposes of testing reflect the overall waste being assessed.

The most frequently performed tests are for waste ignitability or toxicity characteristics (see [SW-846 test methods](#)). Most generators will not have their own testing laboratory; if you do not have your own testing laboratory, you can contract with a commercial analytical laboratory or an environmental services company.

Procedures and equipment for obtaining and analyzing samples are described in [Appendix I of 40 CFR part 261](#). Analysis using methods from EPA's *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*, [SW-846](#), third edition or equivalent, may be appropriate when any of the following occur:

- You begin a new industrial process or change an existing one, such that your waste may have changed.
- You have not already provided appropriate laboratory analytical information of the waste to an off-site treatment, storage, and disposal facility (TSDF).
- A TSDF has reason to believe the wastes you shipped were inaccurately identified.
- EPA amends the RCRA waste identification/classification rules.
- A TSDF receives your waste for the first time.

Testing that occurs as a result of any of these scenarios may help you determine whether your solvent is a characteristic hazardous waste.

Summarizing the above, you should make your hazardous waste determination by considering all available information, including information from SDS/MSDS and test results, process and solvent supplier knowledge, and information from any other available resources.

If the methods listed in this section are not available to you, you can manage and dispose of your solvent as a hazardous waste to ensure that you do not manage hazardous waste inappropriately.

Having progressed through Steps 1-4 above, consider whether you are able to make a hazardous waste determination for your solvent.

- If you have reviewed all available information but are unable to make a hazardous waste determination, consider [seeking further assistance](#). However, remember that as the generator of the waste, you are ultimately responsible for making the correct determination.
- If you have sufficient information to make a hazardous waste determination, you may proceed to Section 10, which provides information on how to [manage your hazardous waste in accordance with RCRA regulations](#).

## **9. Who can help me better understand how to make a hazardous waste determination?**

If you were unable to make a hazardous waste determination based on your review of all available information, environmental services companies or other vendors may be available to help you make the determination, although they will likely charge you fees for their services.

Additionally, consider contacting the following for assistance:

- Your state environmental / waste agency;
- Your EPA Region;
- Your state's small business office;
- [EPA Compliance Assistance Centers](#);
- Your trade associations; or.
- Waste services providers

Remember, as the generator of the waste you are ultimately responsible for making the correct determination, regardless of whom you contact for assistance.

- When you have the information and data sources you will use to make a hazardous waste determination in hand, proceed to the following section, which provides information on how to [manage your hazardous waste in accordance with RCRA regulations](#).

## **10. What do I do with my solvent waste once I've determined it is hazardous?**

Once you have determined that your solvent(s) is a hazardous waste, you must manage them (e.g., recycle or dispose) in accordance with the existing RCRA hazardous waste regulations. In particular, as a generator of hazardous waste, you must follow the applicable RCRA regulations regarding storage, handling, transportation, and disposal in [40 CFR part 261](#) and [40 CFR part 262](#). These regulations are also outlined in EPA's guidance document, [Hazardous Waste Generator Regulations: A User-Friendly Reference Document](#).

The extent of RCRA hazardous waste regulations you must comply with is based on how much total hazardous waste (i.e., not just solvent waste) you generate at your site in a calendar month. Under RCRA, you qualify as a “[large quantity](#)” generator, a “[small quantity](#)” generator, or a “[conditionally exempt](#)” small quantity generator and must follow the regulations according to your generator category.

- EPA and the states encourage you to recycle your solvents in an environmentally responsible manner. Learn more about [recycling solvents here](#).
- There are a few [special considerations relating to solvents](#) that you should be aware of:
  - [Wipes contaminated with solvents](#).
  - [Used oil and solvents – don’t mix them!](#)
  - [Solvents used in dry cleaning](#).
  - [Remanufacturing Exclusion for Certain Higher-Value Solvents](#).

## **11. What if I recycle my solvents?**

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EPA and the states encourage you to recycle unused or spent solvents in an environmentally responsible manner. This will better sustain our environment and possibly reduce the amount of hazardous waste you generate, thereby reducing the amount of solvent product you purchase and simultaneously saving you money.

On January 13, 2015, EPA published a final rule that revised several recycling-related provisions associated with the definition of solid waste used to determine hazardous waste regulation under Subtitle C of the Resource Conservation and Recovery Act (RCRA). The purpose of these revisions is to ensure that the hazardous secondary materials recycling regulations, as implemented, encourage reclamation in a way that does not result in increased risk to human health and the environment from discarded hazardous secondary material. Three components of this rule affect the recycling of spent solvents.

First, EPA retained the exclusion for hazardous secondary materials that are legitimately reclaimed under the control of the generator (“generator-controlled exclusion”), with certain revisions from the 2008 DSW final rule. The generator-controlled exclusion (40 CFR section 261.4(a)(23)) excludes certain hazardous secondary materials (*i.e.*, listed sludges, listed by-products, and spent materials) from the definition of solid waste if they are generated and legitimately reclaimed within the United States or its territories under the control of the generator. Therefore, a generator with multiple facilities could send its spent solvent to another facility owned by the same company and have its spent solvent excluded from RCRA regulations provided certain conditions were met, including that the solvent was legitimately recycled.

Second, EPA replaced the exclusions at 40 CFR section 261.4(a)(24) and (25) for hazardous secondary materials that are transferred from the generator to other persons for the purpose of reclamation with an exclusion for hazardous secondary materials sent for reclamation to a verified recycler. . Under this exclusion, generators who want to recycle their hazardous

secondary materials, such as spent solvents, without having them become hazardous wastes must send their materials to either a RCRA permitted reclamation facility or to a verified recycler of hazardous secondary materials who has obtained a solid waste variance from EPA or the authorized state.

Third, EPA also finalized an exclusion from the definition of solid waste for certain higher-value solvents, such as toluene, xylenes, methanol, transferred from one manufacturer to another for recycling. This provision is also discussed in Section 12.D below.

For more information on the solid and hazardous waste recycling regulations, see the [Definition of Solid Waste for RCRA Subtitle C Hazardous Waste](#) web page. Generators may also want to contact a commercial recycler to help them determine if it is feasible to recycle their solvent wastes.

## **12. Are there any special considerations with certain types of solvents?**

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This section presents three special situations that you may encounter. These situations may not apply to all solvent users, but could help some generators make appropriate hazardous waste determinations.

### *12.A. Managing wipes that are contaminated with solvents*

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If you use wipes with solvents that are considered hazardous waste when disposed, the contaminated wipe is also generally considered a hazardous waste.

However, in 2013, EPA published a rule that excludes solvent-contaminated wipes from hazardous waste regulation, but only if the wipes are managed according to certain conditions, including closed containers, labeling, and no free liquids.

For more information on this rule, see the [Solvent-Contaminated Wipes Rulemaking](#) web page.

**Warning:** This rule is not effective in all states. You must check with your state regarding its specific regulations for solvent-contaminated wipes.

### *12.B. Used oil and solvents – don't mix!*

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EPA's hazardous waste and used oil regulations do not prohibit mixing used oil with hazardous solvents, but mixing has consequences. Generators of used oil are subject to a different set of controls that are generally not as stringent as hazardous waste requirements. A mixture is a hazardous waste if a used oil and non-listed hazardous solvent (or used oil and characteristic hazardous waste mixture) exhibit a hazardous waste characteristic. The mixture is a listed hazardous waste if a listed spent solvent is mixed with used oil.

Mixing used oil with a hazardous solvent can increase the cost of managing the waste mixture. Some used oils and hazardous solvents, particularly mineral spirits, have a similar appearance. Both can be amber to dark brown, oily liquids. Mineral spirits can contain listed solvent constituents at low percentage concentrations. Mixing the visually similar used oil and spent mineral spirits increases the volume of hazardous waste to be managed. Mineral spirit formulators are not required to name toxic hazardous constituents on product labels at concentrations below 0.1 percent (equal to 1,000 ppm), but such concentrations are well above the RCRA regulatory threshold for certain toxic constituents of characteristic hazardous waste.

Hazardous waste mixtures must be managed in compliance with all applicable hazardous waste regulations. The hazardous waste mixture rules for used oil are found at [40 CFR section 279.10\(b\)](#) and in the definition of hazardous waste at [40 CFR section 261.3](#). A hazardous waste mixture rule applicable only to conditionally exempt small quantity generators (CESQGs) of hazardous waste is found at [40 CFR section 261.5\(j\)](#). The corresponding used oil – CESQG hazardous waste mixture rule is found at [40 CFR section 279.10\(b\)\(3\)](#).

- Frequently asked questions and other examples about used oil and solvents are available [here](#). If you need more information on the implications of mixing used oil and hazardous solvents, consider reading through the examples [here](#).

### *12.C. Solvents used in dry cleaning*

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Tens of thousands of dry cleaners nationwide use solvents to clean clothing and other textiles. Many dry cleaning operations use tetrachloroethylene, also known as perchloroethylene (or "Perc"). Perc is found under both the F001 and F002 listings, but for purposes of dry cleaning, any Perc spent solvent would be an F002-listed waste because it is not being used in a degreasing operation. Dry cleaners also use other petroleum-based solvents, as well as newer solvent products such as glycol ethers liquid silicone, liquid CO<sub>2</sub> and brominate solvents.

Dry cleaning wastes include sludge, spent filters, and separator water. Dry cleaners should understand the solvents they use and examine the solvent wastes they generate to determine if their wastes are listed, characteristically hazardous, or possibly non-hazardous.

- Frequently asked questions and other examples about solvents used in dry cleaning are available [here](#). If you need more information on considerations relating to solvents used in dry cleaning, consider reading through the examples [here](#).

### *12.D. Remanufacturing Exclusion for Certain Higher-Value Solvents*

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As part of 2015 Definition of Solid Waste rulemaking, EPA also finalized an exclusion from the definition of solid waste for certain higher-value solvents, such as toluene, xylenes, methanol, transferred from one manufacturer to another for the purpose of extending the useful life of the solvent by remanufacturing the spent solvent back into the commercial grade solvent. This remanufacturing exclusion helps promote sustainable materials management by extending the productive use of these materials, which reduces the need for raw materials used and the environmental impacts associated with production of these materials. Generators should consider this exclusion if using these solvents. See the [Definition of Solid Waste for RCRA Subtitle C Hazardous Waste](#) web page for more information.

## **13. What if I still require additional assistance?**

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RCRA is a complex program, particularly when it comes to making a hazardous waste determination. This guidance is meant to provide you with some tools and information you can use in determining if your solvent is a hazardous waste. If you are just starting a new business, this information may still be difficult to understand. We recommend you contact your state or a waste management services company who may be able to help you in determining if you have generated a hazardous waste.

## Glossary

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**Commercial Chemical Products (CCP) or Manufacturing Chemical Intermediates:** For the purposes of the P- and U-lists of hazardous wastes, a chemical substance that is manufactured or formulated for commercial or manufacturing use, which consists of the commercially pure grade of the chemical, any technical grades of the produced or marketed chemical, and all formulations in which the chemical is the sole active ingredient.

**Listed solvent:** Unused CCP solvents that are P- or U-listed hazardous wastes when discarded and F-listed spent solvents.

**Safety Data Sheet (SDS):** A recently adopted standard that OSHA promulgated through regulation requires chemical manufacturers, distributors, or importers to communicate the hazards of hazardous chemical products; contains valuable information about the names of the chemical, its concentration or range of concentrations, and potential hazards; may also include additional information in Section 13 (“Disposal Considerations”); and contains contact information (e.g., name and telephone number) for questions about the product. Information found on SDSs can help support hazardous waste determinations. SDSs replaced MSDSs.

**Solvent:** A substance, generally liquid, used to dissolve a solute.

**Spent solvent:** A solvent product that has been used and as a result of contamination can no longer serve the purpose for which it was produced without processing.

**Technical grade:** Refers to all commercial grades of a chemical, which in some cases may be marketed in various stages of purity. There are no exact criteria, such as percent purity, to define a substance’s technical grade. The technical purity of a substance will vary from compound to compound.

## References and other resources

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[State Pollution Prevention Programs](#)

[Definition of Solid Waste Decision Tool v2<sup>13</sup>](#)

[Toxicity Characteristic Leaching Procedure \(TCLP\) Method 1311](#)

[Hazardous Waste Generator Regulations: A User-Friendly Reference Document](#)

[DSW Final Rule: Resources for Implementation page](#)

[Solvent-Contaminated Wipes Rulemaking page](#)

[Definition of Solid Waste Compendium Volume H: Spent Materials](#)

[RCRA Training Module – Hazardous Waste Identification](#)

[RCRA Training Module – Land Disposal Restrictions](#)

[Land Disposal Restrictions – Summary of Requirements](#)

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<sup>13</sup> The DSW Decision Tool is currently housed in EPA’s Archive and may not load properly in all Internet browsers. We suggest using Internet Explorer to access the tool. This tool is being updated as of the date of this publication to incorporate the 2015 Definition of Solid Waste rule changes. We expect to have it operational soon with a link on the Hazardous Waste Generator webpage.

## Appendix A: F-Listed Solvents and Corresponding P or U Waste Code, Hazard Code, and TC Code

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This appendix lists F001–F005 listed spent solvents, associated CAS numbers, corresponding P- or U-listed waste codes, hazard codes—ignitable (I) or toxic (T)—and whether the listed solvent appears on the toxicity characteristic list of chemicals.

CAS No.	Constituent <sup>14</sup>	F-Listed Code	P- or U-Listed Waste Code <sup>15</sup>	Hazard Code <sup>16</sup>	TC Code <sup>17</sup>
56-23-5	Carbon tetrachloride	F001	U211	(T)	D019
75-71-8	Chlorinate fluorocarbons <sup>18</sup>	F001		(T)	
108-90-7	Chlorobenzene	F002	U037	(T)	D021
95-50-1	1,2-dichlorobenzene	F002	U070	(T)	
75-09-2	Methylene chloride	F001, F002	U080	(T)	
127-18-4	Tetrachloroethylene	F001, F002	U210	(T)	D039
79-01-6	Trichloroethylene	F001, F002	U228	(T)	D040
71-55-6	1,1,1-trichloroethane	F001, F002	U226	(T)	
79-00-5	1,1,2-trichloroethane	F002	U227	(T)	
76-13-1	1,1,2-trichlorotrifluoroethane	F002		(T)	

<sup>14</sup> Many of these F-listed chemicals have other names. For example, carbon tetrachloride is also known by tetrachloromethane or carbon “tet” in the cleaning industry. (See Wikipedia description for other examples.) For purposes of this guide, we have chosen to use only the name of the chemical found in the listing document.

<sup>15</sup> In addition to the P- and U-listed chemicals in this table, the P- and U-lists may include other chemicals that are also used as solvents.

<sup>16</sup> (T) refers to the solvent being also potentially characteristically hazardous for toxicity; (I) as being potentially characteristic for ignitability.

<sup>17</sup> The EPA Hazardous Waste Number if the solvent is found to be characteristically hazardous for toxicity.

<sup>18</sup> The F001 listing identifies chlorinated fluorocarbons; dichlorodifluoromethane is an example. Other chlorofluorocarbons are explicitly identified in the F002 listing.

CAS No.	Constituent <sup>14</sup>	F-Listed Code	P- or U-Listed Waste Code <sup>15</sup>	Hazard Code <sup>16</sup>	TC Code <sup>17</sup>
75-69-4	Trichlorofluoromethane	F002	U121	(T)	
67-64-1	Acetone	F003	U002	(I)	
71-36-3	Butanol/n-Butyl Alcohol	F003	U031	(I)	
108-94-1	Cyclohexanone	F003	U057	(I)	
141-78-6	Ethyl acetate	F003	U112	(I)	
100-41-4	Ethyl benzene	F003		(I)	
60-29-7	Ethyl ether	F003	U117	(I)	
67-56-1	Methanol	F003	U154	(I)	
108-10-1	Methyl isobutyl ketone	F003	U161	(I)	
1330-20-7	Xylenes (total)	F003	U239	(I)	
1319-77-3	Cresols: o-cresol (D023), m-cresol (D024), p-cresol (D025), cresol mixture (D026)	F004	U052	(T)	D023, D024, D025, D026
98-95-3	Nitrobenzene	F004	U169	(T)	D036
71-43-2	Benzene	F005	U019	(I,T)	D018
75-15-0	Carbon disulfide	F005	P022	(I,T)	
110-80-5	2-ethoxyethanol/ Ethylene glycol monoethyl ether	F005	U359	(I,T)	
78-83-1	Isobutyl alcohol/ 1-propanol, 2-methyl	F005	U140	(I,T)	
78-93-3	Methyl ethyl ketone	F005	U159	(I,T)	D035
79-46-9	2-nitropropane	F005	U171	(I,T)	
110-86-1	Pyridine	F005	U196	(I,T)	D038
108-88-3	Toluene	F005	U220	(I,T)	

## Appendix B: Examples of Solvents and whether they are subject to RCRA Hazardous Waste Regulation

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This appendix provides selected examples of frequently asked questions about making hazardous waste determinations for solvents. These examples can also be found in the [RCRA Frequent Questions Database](#). If you do not see an example that relates to your specific circumstance, you can search the Frequent Questions Database for answers to other common questions related to solvent disposal. If you still cannot find a relevant example using the database, you can also [submit your question](#) to the RCRA customer care team.

### *Scope of the F-List*

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Question 1: We use a solvent mixture containing greater than 10 percent of nitrobenzene. Each remaining ingredient constitutes less than 10 percent. Is my spent solvent mixture hazardous?

Answer: Your spent solvent mixture is an F004-listed hazardous waste. All spent solvent mixtures containing, before use, a total of 10 percent or more nitrobenzene or other solvents listed in F001, F002, and F005 are classified as F004 spent non-halogenated solvents.

Question 2: I need to dispose of unused paint thinner which contains 80 percent xylene, 9 percent toluene, and 11 percent glycol ethers. Is my unused paint thinner classified as an F003 solvent?

Answer: No. First, an important fact here is that the solvent being disposed is described as *unused*. Unused solvent is not “spent” and would not be classified as an F-listed solvent hazardous waste. You would need to consider whether the unused thinner is a chemical that meets the U- or P-listing (i.e., the hazardous waste listing for discarded unused commercial chemical products, or CCPs). Because the paint thinner is a product containing more than one active ingredient, it would not meet a CCP listing when discarded despite containing two solvents found on the U-list (xylene and toluene). You would need to then determine whether the paint thinner exhibited any of the RCRA characteristics of hazardous waste – ignitability, corrosivity, reactivity, or toxicity.

Question 3: What if I use the paint thinner described in Question 2 as a solvent and generate a spent solvent waste? Is my spent solvent waste an F003 solvent?

Answer: No. Recalling that the concentrations in the paint thinner before use are 80% xylene, 9% toluene and 11% glycol ethers, for a spent solvent to be defined as an F003 hazardous waste, the waste must either be 100 percent (before use) of any chemicals listed in the F003 category, or contain one of the chemicals in the F003 category and 10 percent or more of any chemicals listed in F001, F002, F004, and F005 listing. In this case, while the paint thinner contains greater than 10 percent of the non-halogenated solvent xylene, it contains less than 10 percent of toluene.

Question 4: I have spent solvents that are generated in a laboratory as a result of research work. We use solvents for their solvent properties in various laboratory procedures to dissolve or mobilize other constituents, for example as diluents, extractants and synthesis or reaction media. Are these spent solvents regulated as hazardous waste?

Answer: Generally, yes. Spent solvents generated by analytical or research labs meeting the criteria for any F001–F005 waste are defined as spent solvent hazardous waste and are subject to applicable hazardous waste requirements.

Question 5: In our laboratory we use liquid-liquid extractions to obtain a desired product. During organic liquid-liquid extractions, solvents (e.g. methylene chloride) are used, which are minimally (<2%) soluble in water. Thus, after the extraction and after the aqueous phase has separated from the organic phase, the aqueous phase contains trace amounts of solvent. Does this aqueous phase need to be disposed of as an F002 spent solvent, since the "before use" solvent concentration was greater than 10%?

Also, in other analyses, the extraction of an organic analyte is performed with solvents contained only in the F003 listing, such as methanol. After separation, should the aqueous waste be classified as F003 spent solvent even if it not ignitable?

Answer: In both examples, the aqueous phase from this separation is considered to be analogous to a process stream which has become contaminated with solvent constituents. Therefore, neither aqueous waste is a spent solvent stream and would therefore not be classified as an F-listed solvent. That is, the scope of the solvent F-listings does not include aqueous process waste streams contaminated with solvent.

Question 6: My facility uses batch vessels for a production process. After each batch is complete, the reactor must be thoroughly cleaned with pure xylene. We then distill the resultant contaminated xylene and reuse it as reactor cleaning stock. The still bottoms from the distillation process are disposed of as an EPA waste type D001 since the substance is ignitable. Are we following proper procedures?

Answer: Since your xylene is used solely for the purpose of cleaning out the batch reactor vessel and is not a reactant or ingredient in a production process, the use of your xylene is primarily for its solvent properties. Therefore, your xylene waste is considered an F003 spent solvent, as are the still bottoms generated from the distillation of the spent xylene.

Question 7: What if my solvent supplier provides a concentration range of a chemical of 5 to 25 percent on the Safety Data Sheet (SDS)? How can I determine if it is 10% or more before use?

Answer: Since your SDS does not provide specific chemical concentrations and includes a range that would affect your hazardous waste determination, you have three appropriate choices:

- Call your solvent supplier and ask for more specific concentration information for the solvent;
- Be conservative and assume it is a listed hazardous waste and manage it according to all applicable RCRA hazardous waste regulations; or
- Take a representative sample and pay a laboratory to test and characterize the solvent.

Question 8: I use a solvent blend of carbon tetrachloride, methyl ethyl ketone (MEK), and isopropyl alcohol. The SDS for the solvent blend indicates the percentages of carbon tetrachloride, MEK, and isopropyl alcohol are 8 percent, 7 percent, and 85 percent, respectively. Does my solvent blend meet the 10 percent threshold for the F-listing?

Answer: Carbon tetrachloride is on the F001 listing and MEK is on the F005 listing. To be a listed hazardous waste, your solvent blend must have been used for its solvent properties, be spent, and contain 10 percent or more (by volume) of the listed solvents before use. The concentrations of carbon tetrachloride and MEK total 15 percent, so the mixture is listed for both F001 and F005 because the solvent blend has more than 10 percent (by volume) of F001, F002, F004, and/or F005 solvent constituents. Also note that the D001 waste code for the ignitability

characteristic would apply because the flashpoint would be less than 140 degrees F (also found on the SDS). Therefore, you would correctly determine that you have generated a hazardous waste. For the purposes of managing your hazardous waste, you would need to identify your solvent on the hazardous waste manifest as an F001, F005, and D001 hazardous waste.

### ***Scope of the P- and U-Lists***

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Question 9: Our research facility plans to dispose of a solvent containing chloroacetaldehyde and other P-listed acute wastes found at [40 CFR section 261.33 \(e\)](#). This solvent is unused. Must P-listed solvents be spent before they are classified as hazardous?

Answer: No. P-listed wastes such as chloroacetaldehyde, and U-listed wastes are considered hazardous only where they are unused when discarded. Since your excess solvent is unused, and is included in [40 CFR 261.33\(e\)](#) as a P-listed waste, it is considered a hazardous waste when disposed. A complete listing of other possible P- or U-listed wastes is available in [40 CFR section 261.33 \(e\) or \(f\)](#).

### ***Characteristically Hazardous Examples***

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Question 10: During my company's manufacturing process I mix a trichloroethylene (F001) waste with an ignitable waste (D001). When disposing of this resulting mixture, should I follow F001 or D001 hazardous waste management standards?

Answer: You should follow all applicable standards when you mix any two or more hazardous wastes. In your case, you should follow both F001 and D001 hazardous waste management standards. However, once combined, if the F001/D001 mixture no longer exhibits the characteristic of ignitability, the classification for the mixture would not have to include the D001 waste code, and you could therefore forgo following any applicable D001 hazardous waste management standards. However, under the LDR requirements you may need to keep track of hazardous constituents that may have come from the D001 waste.<sup>19</sup>

Question 11: I noticed that there are four possible ways for determining whether my solvent waste could be characteristically hazardous: ignitability, corrosivity, reactivity, and/or toxicity. What are the best ways to determine if these characteristics apply to my waste?

Answer: Generally, there are two options for determining if your waste is characteristically hazardous. First, you can use "applied or process knowledge" meaning that you can use available information about your solvent, such as what is found on the Safety Data Sheet, which your supplier should be able to provide. Check for specific concentrations of chemical constituents in the product and consider whether or not any environmental or health hazards are associated with the product, like toxicity or ignitability. It may be helpful to know whether the solvent product was shipped from the manufacturer as a DOT hazardous material, and you can check with your solvent supplier to see if it can provide any helpful information.

An alternative option is to test the waste. You may conduct your own sampling and analysis (e.g., for ignitability) following applicable SW-846 analytical methods or any equivalent method. It could also be that your waste management services company has their own set of procedures

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<sup>19</sup> However, if the D001 waste is in the subcategory: high total organic carbon (TOC) ignitable characteristic liquids, then the LDR regulations require the D001 waste to undergo either combustion (CMBST) or recovery of the organics (RORGS), or polymerization (POLYM) identified in 40 CFR 268.40, Table 1.

for waste identification, as part of the process of contracting their services, which could include testing the waste in question (as the generator you are ultimately responsible for making the correct determination).

Question 12: If I washed paint reactor tanks with a mixture of 90 percent xylene and 10 percent mineral spirits, is the resulting sludge an F001–F005-listed spent solvent?

Answer: If the solvent mixture you used to clean out paint reactors contained, before use, 90 percent xylene and 10 percent mineral spirits, the spent solvent waste would not meet the criteria of an F001–F005-listed hazardous waste. When spent, xylene may be an F003-listed hazardous waste. For the F003 spent solvent to be a hazardous waste, the waste must either be 100 percent of any of the chemicals listed in the F003 category, or contain one of the chemicals in the F003 category and 10 percent or more of any chemicals in some other F001–F005 listing.

Your mixture is not composed of 100 percent xylene, so it fails to meet the first possible criterion. The second component of the mixture, mineral spirits, is not an F001–F005-listed waste. As a result, your spent solvent waste does not meet the second possible criterion. However, if your sludge exhibits any signs of a characteristically hazardous waste (ignitability, corrosivity, reactivity, or toxicity), then it would be classified as a D-listed waste and disposal must be conducted in accordance with the hazardous waste regulations.

### ***Reducing the Use of Solvents or Use of Alternative Solvents***

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Question 13: Can I reduce my use of solvents or use alternative solvents?

Answer: While many processes and products will always require the use of a solvent, there are opportunities to optimize solvent choice and use to prevent pollution. Pollution prevention (P2) is any practice that reduces, eliminates, or prevents pollution at its source, also known as "source reduction."

Source reduction means that less hazardous material must be recycled, treated or disposed, and thus is a good choice for the environment and human health. Businesses can reduce pollution at the source by changing their production, operation, and raw materials use. Sometimes these changes are simple and can save money. Some examples:

- Auto repair shops can switch to water-based cleaning or water-borne basecoats.
- Dry cleaners can switch to wet cleaning.
- Printers can select alternative solvents and adopt good house-keeping practices.

Another way to prevent pollution is to practice green chemistry, the design of chemical products and processes that reduce or eliminate the use or generation of hazardous substances. One of the principles of green chemistry is to avoid using solvents when possible and to use safer options when you must use these chemicals. More on green chemistry, including examples of award-winning technologies that have reduced hazardous solvent waste, is available here:

<https://www.epa.gov/greenchemistry>.

Information on pollution prevention and resources for putting pollution prevention into practice can be found at the EPA website: <https://www.epa.gov/p2/what-you-can-do-about-pollution-prevention-business-resources>

Other EPA resources that can assist in reducing, eliminating, or preventing solvent pollution include:

- Toxics Release Inventory (TRI) Program’s Pollution Prevention Search Tool: <https://www.epa.gov/toxics-release-inventory-tri-program/pollution-prevention-p2-and-tri>
- Safer Choice Safer Chemical Ingredients List: <https://www.epa.gov/saferchoice/safer-ingredients>

### *Used Oil Examples*

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Question 14: Does the definition of used oil include materials derived from crude oil, such as petroleum-based solvents or antifreeze?

Answer: Petroleum-based solvents and antifreeze do not meet the standards for the management of recycled used oil. The definition of used oil (See [40 CFR Part 279](#)) includes three requirements:

- Refined from oil—must be refined from crude or synthetic oil;
- Meet use criteria—oil must have been used as a lubricant, coolant, heat (non-contact) transfer fluid, hydraulic fluid, or for a similar use; and
- Contaminated through such use, the oil must be contaminated by physical or chemical impurities. Petroleum-based solvents are not considered to be used oil because they dissolve, a function excluded from the list of possible uses in the definition of used oil.

Question 15: Is a spent petroleum-based solvent that includes oily residues resulting from the solvent’s use to clean machine parts regulated as used oil under [40 CFR Part 279](#)?

Answer. The Agency does not consider such spent petroleum-based solvent to be used oil and did not intend that it be regulated as such. Accordingly, when a petroleum-based solvent is spent (i.e., no longer possesses a solvent property) and/or is taken out of service, it becomes a waste subject to a hazardous waste determination (see [40 CFR section 262.11](#)). Generators may use their knowledge or testing to determine whether a waste is hazardous.

### *Dry Cleaning Examples*

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Question 16: I use perchloroethylene (or tetrachloroethylene) in my dry cleaning process and noticed that tetrachloroethylene appears in the description for both F001 and F002. Would the spent solvent mixture be classified as F001 or F002?

Answer: Your spent tetrachloroethylene is a F002-listed waste because you used it for dry cleaning (See [40 CFR section 261.31](#)). According to the background listing document for F002, tetrachloroethylene used in laundry and dry cleaning operations is regulated as F002 (See [40 CFR section 261.31](#) and [40 CFR section 261.32](#)).

Question 17: I see in the RCRA regulations that wastes containing tetrachloroethylene (“perc”) at concentrations of 0.7 mg/L (using the TCLP method) are defined as characteristic hazardous waste (EPA Waste Code D039). Spent tetrachloroethylene is also F002. How do I know whether my dry cleaning waste is F002 or D039?

Answer: The basic steps that all generators must use for identifying whether their waste is hazardous waste or not is to first determine whether the waste is listed; if it is not listed, the generator then evaluates whether it exhibits a characteristic. Even if the waste is properly defined as a listed hazardous waste, it may be necessary to also determine whether it is characteristic for purposes of compliance with the Land Disposal Restrictions.

Most dry cleaning wastes that contain spent perc will be listed hazardous waste F002, because the solvent has been used for its solvent properties, or is a still bottom from recovering perc (all of the F001-F005 solvents include in their listing description “still bottoms” from recovering solvents). Dry cleaners should seek guidance from their state hazardous waste regulatory authority if they are unsure how the RCRA hazardous waste classification rules apply; most if not all states provide user-friendly guidance for the dry cleaning industry to assist in compliance. Dry cleaners who rely on waste vendors or service providers to assist in managing their wastes should ensure that there is a common understanding as to how their wastes are being classified.

### ***Solvent-Contaminated Wipes***

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Question 18: I routinely use a rag to apply solvent to keep certain equipment clean in my shop. Would this rag be defined as a hazardous solvent waste when I’m ready to get rid of it? Does it matter whether I am sending it through a service to an industrial laundry, or if it is simply being discarded in a landfill?

Answer: As with any of these solvent-related wastes, it is important for you to understand which solvents you are using at your facility, and what types of wastes are being generated as a result, including rags. Solvent-containing rags (or “wipes”) can end up being defined as listed or characteristic hazardous wastes, and this may limit where these can be managed. However, in an effort to provide a more consistent regulatory framework while protecting human health and the environment, EPA published new regulations in 2013 that allow for most solvent-containing wipes to be subject to reduced requirements, provided certain conditions are met. These new provisions address both solvent-contaminated wipes that are generally described as ‘reusable’ (e.g., through an industrial laundry service) as well as those that are disposed of in landfills. Again, as with other solvent wastes, you should know which solvents are being used with rags.

### ***RCRA Air Emission Regulations***

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Question 19. Are hazardous waste solvents accumulated in tanks and containers at a generator facility subject to RCRA air emission regulations?

Yes, while tanks and containers accumulating hazardous waste at small quantity generators (SQGs) and Conditionally Exempt Small Quantity Generators (CESQG) are not subject to RCRA air emission regulations, large quantity generators (LQGs) (generators that generate 1,000 kilograms or more of hazardous waste in a calendar month) that accumulate hazardous waste in containers and tanks are subject to RCRA air emission regulations. RCRA air emission regulations consist of three subparts:

- Subpart AA which is associated with process vents in distillation, fractionation, thin-film evaporation, solvent extraction or air or steam stripping operation units;
- Subpart BB which is associated with equipment such as pumps, compressors, pressure relief devices sampling connecting systems, open-ended valves or lines, valves, flanges and other connectors; and
- Subpart CC which is associated with tanks, surface impoundments, containers and miscellaneous units.

Subpart CC applies to tanks and containers accumulating hazardous wastes at the LQG per 40 CFR 262.34(a). In addition, where an LQG reclaims its spent solvents on-site using a distillation unit, while subpart CC applies to tanks and containers as stated above, the distillation unit itself

might or might not be subject to any RCRA permitting requirements, including air emission requirements, as follows: Recycling units such as distillation units generally are not subject to RCRA permitting requirements per 40 CFR 261.6(c)(1), and if not subject to RCRA permitting, would therefore not be subject to RCRA air emission requirements. However, if that facility has some other RCRA permitted unit on-site, then the distillation unit is in fact subject to Subparts AA and BB air emission requirements per 40 CFR 261.6 (d).

Also, RCRA air emission rules in Subparts AA, BB, and CC exempt any hazardous waste management unit that the owner or operator certifies is equipped with and operating air emission controls in accordance with an applicable Clean Air Act regulation codified under 40 CFR Part 60, Part 61, or Part 63. These exemptions only apply to those units, process vents, or equipment using organic air emission controls that comply with the applicable CAA regulations.<sup>20</sup>

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<sup>20</sup> See [https://trainex.org/web\\_courses/subpart\\_x/epa%20cd%20content/introduction.htm](https://trainex.org/web_courses/subpart_x/epa%20cd%20content/introduction.htm), EPA Region 4's RCRA Information Resource Site for a comprehensive overview of RCRA air emission regulations.