

Virginia Department of Environmental Quality
Hazardous Waste Program
The F List: Wastes from Non-Specific Sources
Spent Solvent Wastes

March, 2016

Purpose

The purpose of this document is to provide compliance assistance to Virginia facilities that generate hazardous waste and how such hazardous waste should be managed to meet the requirements of the [Virginia Hazardous Waste Management Regulations](#) (VHWMR).

This information is provided for compliance assistance purposes only by the Virginia Department of Environmental Quality (DEQ). This is not a regulation and, therefore, does not add, eliminate, or change any existing regulatory requirements. The statements in this document are intended for informational purposes only.

Discussion

THE F LIST: WASTES FROM NONSPECIFIC SOURCES

The F list designates as hazardous particular waste streams from certain common industrial or manufacturing processes. F list wastes usually consist of chemicals that have been used for their intended purpose in an industrial process. That is why F list wastes are known as the "manufacturing process wastes." The F listed wastes can be divided into seven groups, depending on the type of manufacturing or industrial operation that creates them. The first category of F-listed wastes which include spent solvent wastes (F001 - F005) will be discussed in this document.

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Waste codes F001 - F005 apply to waste streams from the use of certain common organic solvents. Solvents are chemicals with many uses, although they are most often used in degreasing or cleaning. The solvents covered by the F listings are commonly used in industries ranging from mechanical repair to dry cleaning to electronics manufacturing. EPA decided that only certain solvents used in certain ways produce waste streams that warrant a hazardous waste listing. Therefore, a number of key factors must be evaluated in order to determine whether the F001 - F005 waste codes apply to a particular waste solvent. First, one or more of the 31 specific organic solvents designated in the F001 - F005 listing description must have been used in the operation that created the waste. Second, the listed solvent must have been used in a particular manner – it must have been used for its "solvent properties," as EPA defines that expression. Finally, EPA decided that only a waste stream created through use of

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concentrated solvents should be listed. Thus, the concentration of the solvent formulation or product before its use in the process that created the waste is also a factor in determining the applicability of the F001 - F005 listing.

The F001 - F005 spent solvent listings provide a good illustration of a principle common to all listed hazardous wastes. To determine whether a waste qualifies as listed, knowledge of the process that created the waste is essential, while information about the waste's chemical composition is often irrelevant. For example, the F005 listing description can allow two different wastes with identical chemical contents to be regulated differently because of subtle differences in the processes that created the wastes. EPA considers use as a cleaner to be "use as a solvent;" use as an ingredient does not qualify as solvent use. As you can see, knowledge of the process that created a waste is the key in evaluating whether a waste can be a hazardous spent solvent or other listed hazardous waste.

What are F001-F005 spent solvents?

The F001-F005 RCRA waste codes (40 CFR 261.31) encompass the common halogenated and non-halogenated industrial solvents that, as a result of their use in some process, are spent.

The F001 code includes the following halogenated solvents that have become spent because of their use in degreasing activities: tetrachloroethylene, trichloroethylene, methylene chloride, 1,1,1-trichloroethane, carbon tetrachloride, and chlorinated fluorocarbons. For example, 1,1,1-trichloroethane is sometimes used in vehicle maintenance shops to remove grease from parts. When spent, it would bear the F001 waste code.

The F002 code includes some of the same solvents as F001, but these have become spent from activities other than degreasing (activities in which the chemicals were still used for their solvent properties). The following are constituents regulated under this category: tetrachloroethylene, trichloroethylene, methylenechloride, 1,1,1-trichloroethane, chlorobenzene, 1,1,2-trichloro-1,2,2-trifluoroethane, ortho-dichlorobenzene, trichlorofluoromethane, and 1,1,2-trichloroethane. Methylene chloride when spent because of use as a paint stripper would be an F002 waste.

The F003 code includes common non-halogenated solvents. These solvents are listed as hazardous waste because of their ignitability, when generated it must have a flash point less

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than 140°F. Regulated constituents include the following: xylene, acetone, ethyl acetate, ethyl benzene, ethyl ether, methyl isobutyl ketone, n-butyl alcohol, cyclohexanone, and methanol. Using methanol to remove water from glassware is an example of an activity that produces an F003 solvent. The solvent becomes spent because of the water that contaminates it. If the spent methanol has a flash point less than 140°F, the spent solvent meets the definition of F003.

The F004 code includes other non-halogenated solvents that have become spent. The following constituents are regulated under this listing because they are toxic: cresols, cresylic acid, and nitrobenzene.

The F005 code includes other non-halogenated solvents that have become spent. The following constituents are regulated under this listing because they are ignitable and toxic: toluene, methyl ethyl ketone, carbon disulfide, isobutanol, pyridine, benzene, 2-ethoxyethanol, and 2-nitropropane. The toluene (used because of its solvent Properties) has become spent because of the additional constituents present in it that prevent its reuse as solvent.

Is the concentration of the solvent in mixtures important?

Yes. However, the F001, F002, F004, and F005 codes are dealt with differently than F003, which is listed only because of ignitability. For the spent solvents other than F003, a solvent mixture containing, before use, a total of more than 10% by volume of any one or a combination of solvents listed under F001, F002, F004, and F005 codes is regulated (regardless of the composition of the remaining portion of the mixture, which could include a non-listed solvent, such as mineral spirits, or a contaminant, such as water or oil).

For the F003 code, solvent mixtures are regulated in two cases:

- (1) The solvent, before use, contained only (100%) F003 constituents or was a technical or commercial grade of an F003 constituent;
- (2) The solvent, before use, contained one or more of the F003 constituents (in any amount) and a total of 10% or more by volume of constituents regulated under F001, F002, F004, and/or F005. (In the second case, the waste would carry the F003 and other applicable waste codes.)

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A final requirement for the application of the F003 waste code hinges on the spent solvents meeting the characteristic of ignitability **at the point of generation**. The F003 waste code is listed solely because of its characteristic of ignitability, thus the 'I' in the "Hazard Code" column of the F-list table in [40 CFR 261.31](#). What this means is that even if one of the two above criteria are met but the spent solvent does not have a flash point of <140° F – then the F003 waste code would not apply.

Examples of how the listings would apply:

1. **F001/F002:** A generator has a parts washer with a solvent that has become too dirty to use anymore. The generator must now make a hazardous waste determination on the spent solvent so that it can be properly disposed of. The generator looks at the Safety Data Sheet (SDS) for the solvent and it lists: trichloroethylene (65%) and methylene chloride (35%). These solvents are found both the F001 and F002 lists. The parts washer is not part of a degreasing (large scale cleaning) operation and therefore the F001 listing does not apply. The F002 listing does apply to this waste, since the combination of trichloroethylene and methylene chloride makes up 10% or more of the mixture (in this case 100%). Therefore, this mixture is a listed hazardous waste carrying the F002 waste code.
2. **F005:** A generator uses methyl ethyl ketone (MEK) to thin paint. The waste paint is poured into a 55-gallon drum. The generator also cleans the paint gun and lines with MEK, but this waste is put in a 15-gallon drum that is kept segregated from the waste paint. The generator looks at the F005 listing and sees that MEK that has been used as a solvent is a listed hazardous waste carrying the F005 waste code. Therefore the 15-gallon drum of waste solvent (MEK) is a listed hazardous waste (F005). The 55-gallon drum of waste paint is not a listed hazardous waste because the MEK was used as an Ingredient in the paint; it was not used as a solvent. However, the waste paint may be a hazardous waste if it exhibits the characteristic of ignitability (D001) and/or MEK toxicity (D035). An analysis of a representative sample would be necessary to determine if the waste paint is characteristic for MEK toxicity.
3. **F003:** A generator uses a solvent for cleaning. The SDS shows acetone at 99.9% and water at 0.1%. This would be considered a technical grade for acetone. The generator looks at the F003 list and sees that acetone is on the list. Therefore, the waste acetone would be a listed hazardous waste carrying the waste code F003 (because the waste solvent is

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composed of essentially 100 % F003-listed solvents). In most painting and parts washer applications, F003-listed solvents are not used in pure or technical grade form. These solvents are usually mixed/blended with other solvents. The next three examples will show how to apply the F003 listing for a solvent mixture.

4. **F003:** A generator uses a solvent for cleaning. The SDS for the solvent shows: acetone (65%), toluene (6%), and MEK (5%). Determining the applicable waste codes can be broken down into the following steps:
 - a. The generator looks at the F005 list and sees that toluene and MEK is 11%, which meets the listing definition of a total of 10% or more. Therefore, the waste solvent is a listed hazardous waste with the waste code F005.
 - b. The generator also looks at the F003 list and sees that acetone is on the list. The generator sees that by definition, the listing applies if the waste (spent) solvent contains one or more of the solvents on the F003 list (in this case, acetone) and a total of 10% or more of one or more of the solvents listed in the F001, F002, F004, and F005 lists (in this case, 11% of F005-listed solvents). Therefore, the waste solvent meets the definition of a F003-listed waste.

The waste solvent in this scenario would carry both the F003 and F005 waste codes. The important thing to remember is that the percentage of the F003-listed solvent does not matter as long as there is 10% or more total of the other F-listed solvents (F001, F002, F004, and/or F005).

5. **F003:** The generator from scenario 4 recycles his solvent in a distillation unit on-site. Still bottoms (i.e. pancakes, still cakes, pugs, solids) are generated from this process. These solids will also be a listed hazardous waste carrying the F003 and F005 waste codes because the definition for both F003 and F005 states that they include “still bottoms from the recovery of these spent solvents and spent solvent mixtures.”
6. **F003:** A generator uses a solvent for cleaning. The SDS for the solvent shows: acetone (25%) and water (75%). The generator looks at the F003 list and sees that acetone is on it. However, based on the SDS, the solvent is not pure or technical grade acetone (because it does not contain essentially 100% F003-listed solvent). Also, the solvent does not contain

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any other listed (F001, F002, F004, or F005) constituents. Therefore, the waste solvent does not meet the definition of an F-listed spent solvent, and does not carry any of those listed waste codes.

7. **F002/F003/F005:** A generator uses a solvent for cleaning paint brushes. The SDS shows: toluene (65%), methylene chloride (5%), xylene (5%), and water (25%). Determining the applicable waste codes can be broken down into the following steps:
- a. The generator finds toluene in the F005 list.
 - b. The generator finds methylene chloride in both the F001 and the F002 lists. The F001 listing applies to the listed solvents used in degreasing (large-scale cleaning) operations. Since the generator is not using the solvent for degreasing, F002 is the applicable code.
 - c. The generator combines the percentages of toluene (65%) and methylene chloride (5%), for a total percentage of 70%. By both the F002 and F005 definitions, the waste solvent would be listed for both waste codes because the solvent contains 10% or more of a solvent, or a combination of solvents, listed in F001, F002, F004, and F005.
 - d. The generator finds xylene in the F003 list. The generator sees that the listing applies if the waste (spent) solvent contains one or more of the solvents on the F003 list (in this case, xylene) and a total of 10% or more of one or more of the solvents listed in the F001, F002, F004, and F005 lists (in this case 70% of F002- and F005-listed solvents). Therefore, the waste solvent meets the definition of an F003-listed waste. The waste solvent in this scenario would carry F002, F003, and F005 waste codes.

Are dilute mixtures, such as wastewaters, regulated as hazardous wastes?

Under the mixture rule, mixtures of spent solvents and solid wastes are hazardous (unless the solvent is listed solely because of a characteristic and the mixture no longer exhibits the characteristic). There are however, several commonly encountered exceptions:

- Wastewaters containing specified solvents not exceeding specified concentrations at the headworks of the wastewater treatment or pre-treatment system that discharges

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through a point regulated under the Clean Water Act (CWA) [40 CFR 261.3(a)(iv)(A) and (B)],

- Wastewaters from laboratory operations containing toxic wastes listed in Subpart D, provided the annual average flow of laboratory wastewater does not exceed 1% of the total wastewater flow into the headwork of the wastewater treatment facility whose discharge is regulated under CWA [40 CFR 261.3(a)(iv)(E)], and
- Wastewaters generated from cleaning out empty containers that once held spent solvents. However, wastewaters generated from cleaning a container that was not empty are hazardous wastes according to the mixture rule.

What if these same constituents are discarded unused?

Most chemicals in the F-listings are also in the P- or U-listings (plus many other chemicals). When these chemicals are discarded unused they are regulated as P- or U-listed wastes. The regulated constituent must be the “sole” active ingredient in the formulation. The formulation could contain other inert ingredients.

For More Information

Please contact the appropriate [DEQ regional staff](#) if you have any questions regarding applicability of these requirements to your facility.