

V. Hazardous Waste Characteristics

According to The Code of Federal Regulations, Title 40, Paragraph 261.20, a substance is a hazardous waste if it exhibits any of the following 4 hazardous waste characteristics: TCLP, Ignitability, Corrosivity, or Reactivity.

TCLP - Toxicity Characteristic Leaching Procedure

In days of old, waste products were characterized as hazardous under the under the E.P. Toxicity rule. On November 7, 1986 the EPA revised the TCLP rule and promulgated (made known officially) as part of the land disposal restriction.

Like the EP TOX, the TCLP rule requires that the laboratory take the solids from a sample, mix with a buffer solution at a ratio of 1:20 for 18 hours, filter the slurry, and analyze the liquid portion for certain listed constituents. This procedure was developed to simulate landfill conditions. Here, we are primarily concerned with any waste that could potentially contaminate the groundwater.

The EPA procedure number for the TCLP preparation is SW-846 Method 1311.

Ignitability

A solid waste exhibits the characteristics of ignitability if the flashpoint is less than 60° C (140° F). The EPA procedures for ignitability are SW-846 Methods 1010 & 1030. Note that 1010 applies only to liquids; 1030 can be used to determine the characteristic of ignitability but is not mandated as the required method.

Reactivity

A waste exhibits the characteristics of reactivity if it has any of the following properties:

- a) Normally unstable and readily undergoes violent change without detonating;
- b) Reacts violently with water
- c) Forms potentially explosive mixtures with water
- d) When mixed with water, it generates toxic gases, vapors or fumes
- e) It is a cyanide- or sulfide-bearing waste which, when exposed to pH conditions between 2 and 12.5, can generate toxic gases, vapors or fumes

The procedure for reactivity can be found in the SW-846 Methods manual, Chapter 7.3, although the RCRA program has rescinded the use of these methods due to inherent issues with accuracy and reproducibility of the results.

Corrosivity

A waste exhibits the characteristic of corrosivity if it is aqueous and has a pH less than or equal to 2 or greater than or equal to 12.5 as determined by a pH meter, or exhibits a corrosivity to steel in excess of 635 mm/yr.

Corrosivity as pH can be found in SW-846 Methods 9040 and 9045; corrosivity to steel is SW-846 Method 1110.

Hazardous Waste Characteristics, cont.

TCLP Notes

1. The procedure for the TCLP extraction states that if a waste contains less than 0.5% solids, then no extraction procedure is performed. The sample is filtered through the TCLP apparatus, but essentially the total and the TCLP values are identical.
2. A solid is defined as anything that will not pass through a 0.45 micron filter. In some cases, heavy oil may be considered as 100% solid.
3. The TCLP recommends the use of 100 grams of solid material for each extraction performed. For example, should a sample contain 10% solids, we would be required to filter 10 liters of the solution to obtain 100 grams of solid. (Please keep this in mind when sampling.) Following the extraction process, the filtrate and original liquid portion of the sample are mixed together prior to analysis.
4. In some cases, it may be advantageous to perform a total analysis prior to performing a TCLP analysis. If the total amount of a contaminant present is less than the TCLP allowable limit, no TCLP extraction is required.
5. The TCLP result cannot, ever, be greater than the total value.
6. In theory, the TCLP result cannot be greater than 1:20 of the total (assuming 100% solid), due to the dilution which occurs when extraction fluid is added to the sample.
7. No estimates of total values can be made from knowing only the TCLP value. There can be anywhere from 0 to 100 % of the constituent bound and never "leached." It is a common instance to see the total result be extremely high and a negligible TCLP result
8. Due to the difficulty in separating m- and p- cresol, a listing for total cresol (D026) has been allowed by the rule.
9. Some samples (especially oils and other petroleum wastes) may require multiple sets of analyses to determine a final TCLP result. In cases where distinct phases are present in a sample and *both* will pass through the TCLP filtration process, each phase must be analyzed independently and the results combined mathematically to determine the final TCLP value. (Keep this in mind when budgeting for analytical results associated with these matrices!)

TCLP vs. E.P. TOX

The most significant differences between the EP toxicity test and the TCLP test are as follows:

1. The TCLP list has an additional 25 organic chemicals. (Originally 38 organics were on the list. Final action was postponed on 13 compounds which tended to break down during the extraction procedure.)
2. Zero Headspace Extraction (ZHE) is employed for the analysis of 10 volatile organic chemicals. The entire extraction process from mixing, filtering and analyzing is done with the waste and filtrate coming in contact with minimal air.
3. The TCLP requires use of a more acidic leaching fluid for alkaline wastes.
4. The extraction time is 18 hours for TCLP as opposed to 24 hours for EP-Tox.

The TCLP rule was finalized on March 29, 1990. All large quantity generators must classify their wastes according to the TCLP guidelines, small quantity generators were to have complied by March 29, 1991. The rule is now codified in 40 CFR Part 261, Appendix II.

SPLP vs. TCLP

SPLP (Synthetic Precipitate Leaching Procedure) is identical to the TCLP with regards to the sample processing and extraction process. The difference between the procedures lies in the extraction fluid used. While the TCLP fluids are highly buffered and mildly acidic using acetic acid, the SPLP uses an unbuffered solution of sulfuric and nitric acids, at a slightly more acidic pH. The SPLP typically is employed to more closely simulate groundwater leaching effects than the TCLP.

The EPA procedure number for the SPLP preparation is SW-846 Method 1312.

Hazardous Waste Characteristics, cont.

TCLP Sampling Requirements

<u>Parameter</u>	<u>Volume Required</u>	<u>Container</u>
TCLP Metals	1 L (liquid) * 100 g (Solid)	Plastic or Glass Plastic or Glass
TCLP Volatiles	120 mL (liquid) * 50 g (solid)	3 x 40 mL Vials soil VOC jar
TCLP Semivolatiles	2 L (liquid) * 100 g (solid)	Glass Glass
TCLP Pesticides	1 L (liquid) * 100 g (solid)	Glass Glass
TCLP Herbicides	1 L (liquid) * 100 g (solid)	Glass Glass

Preservation:

Samples taken for TCLP analysis should be refrigerated at 4°C from time of sampling until sample preparation, unless refrigeration causes irreversible changes to the sample (ex: precipitation of solids).

Use caution to avoid freezing, especially with the volatile sample containers.

* Note Regarding Liquid Samples: Since it is the solid portion of the samples that is used for the extraction, care must be taken to submit enough material to the laboratory for analysis. Example: On a sample with an estimated 10% solids, it would take 10 liters of sample to obtain 100 g, the recommended minimum sample size. *It is possible to use less material, however it should be noted that the representativeness of the results is proportional to the sample volume used for the analysis.*

Hazardous Waste Characteristics, cont.

TCLP Regulatory Levels

Parameter	EPA HW No.*	Extraction Procedure	EPA Method Reference	Regulatory Level (mg/L)
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TCLP SEMI-VOLATILE ORGANICS

Acid Extractables

o-Cresol	D023	NVE	8270	200.0
m-Cresol	D024	NVE	8270	200.0
p-Cresol	D025	NVE	8270	200.0
Total Cresol #	D026	NVE	8270	200.0
Pentachlorophenol	D037	NVE	8270	100.0
2,4,5-Trichlorophenol	D041	NVE	8270	400.0
2,4,6-Trichlorophenol	D042	NVE	8270	2.0

Base/Neutral Extractables

1,4-Dichlorobenzene	D027	NVE	8270	7.5
2,4-Dinitrotoluene	D030	NVE	8270	0.13
Hexachlorobenzene	D032	NVE	8270	0.13
Hexachloro-1,3-butadiene	D033	NVE	8270	0.5
Hexachloroethane	D034	NVE	8270	3.0
Nitrobenzene	D036	NVE	8270	2.0
Pyridine	D038	NVE	8270	5.0

TCLP PESTICIDES

Chlordane	D020	NVE	8080	0.03
Endrin	D012	NVE	8080	0.02
Heptachlor (and its epoxide)	D031	NVE	8080	0.008
Lindane (gamma-BHC)	D013	NVE	8080	0.4
Methoxychlor	D014	NVE	8080	10.0
Toxaphene	D015	NVE	8080	0.5

TCLP HERBICIDES

2,4-D	D016	NVE	8150	10.0
2,4,5-TP (Silvex)	D017	NVE	8150	1.0

If o-, m-, and p-Cresol cannot be differentiated, the Total Cresol (D026) concentration is used.

* EPA Hazardous Waste Number

NVE Non-Volatile Extraction



Hazardous Waste Characteristics, cont.

Parameter	EPA HW No.*	Extraction Procedure	EPA Method Reference	Regulatory Level (mg/L)
<u>TCLP METALS</u>				
Arsenic, As	D004	NVE	6010/7060	5.0
Barium, Ba	D005	NVE	6010/7080	100.0
Cadmium, Cd	D006	NVE	6010/7130	1.0
Chromium, Cr	D007	NVE	6010/7190	5.0
Lead, Pb	D008	NVE	6010/7420	5.0
Mercury, Hg	D009	NVE	7470	0.2
Selenium, Se	D010	NVE	6010/7740	1.0
Silver, Ag	D011	NVE	6010/7760	5.0
<u>TCLP VOLATILE ORGANICS</u>				
Benzene	D018	ZHE	8240/8260	0.5
Carbon Tetrachloride	D019	ZHE	8240/8260	0.5
Chlorobenzene	D021	ZHE	8240/8260	100.0
Chloroform	D022	ZHE	8240/8260	6.0
1,2-Dichloroethane	D028	ZHE	8240/8260	0.5
1,1-Dichloroethylene	D029	ZHE	8240/8260	0.7
Methyl ethyl ketone	D035	ZHE	8240/8260	200.0
Tetrachloroethylene	D039	ZHE	8240/8260	0.7
Trichloroethylene	D040	ZHE	8240/8260	0.5
Vinyl Chloride	D043	ZHE	8240/8260	0.2

* EPA Hazardous Waste Number

NVE Non-Volatile Extraction

ZHE Zero Headspace Extraction

Reactive Cyanides Released from Wastes

SW-846 Chapter 7.3

METHOD SUMMARY

An aliquot of the waste is acidified to a pH < 2 in a closed system. The gas generated is then swept into a scrubber. The contained cyanide is then quantified, following typical cyanide analysis techniques.

DETECTION LEVEL: 500 mg/kg or 250 mg/L

PRESERVATIVE: Refrigerate at 4°C, add NaOH to a pH > 12.0

SAMPLING: A minimum of 250 mL or 50 grams is required for the analysis.

HOLDING TIME: 14 days

COMMENTS: This method is applicable to all wastes, with the condition that the waste when combined with acids does not form an explosive mixture. This method provides a way to determine the specific rate of release of hydrocyanic acid upon contact with aqueous acid. This test measures only the hydrocyanic acid evolved under the test conditions. It is not intended to measure forms of cyanide other than those that are evolved under the test conditions (i.e., this may not include the total cyanides in the sample).

PREFERRED SAMPLING CONTAINER: 250 mL amber glass container is preferred for this analysis (waters or soils).

Note: The USEPA has rescinded the use of this method as a RCRA hazwaste characteristic determination due to inherent issues with accuracy and reproducibility of the results.

Reactive Sulfides Released from Wastes

SW-846 Chapter 7.3

METHOD SUMMARY:

An aliquot of waste is acidified to a pH of <2.0 in a closed system. The gas generated is swept into a scrubber where the NaOH traps the H₂S as Na₂S. The sample's sulfide ion activity is then measured utilizing an ion selective electrode.

DETECTION LEVEL: 500 mg/kg or 250 mg/L

PRESERVATIVE: Add NaOH to pH > 12, refrigerate at 4°C.

SAMPLING: A minimum of 500 mL or 50 g is required for analysis.

HOLDING TIME: 28 Days with preservative.

COMMENTS:

This method is applicable to soils, sludges, waters, and wastes with the condition that the waste, when combined with acids does not form an explosive mixture.

PREFERRED SAMPLING CONTAINER: 1 L amber glass for liquids or 8 oz. amber glass jar for soils.

Note: The USEPA has rescinded the use of this method as a RCRA hazwaste characteristic determination due to inherent issues with accuracy and reproducibility of the results.

EPA Method 1010
Flashpoint, or Ignitability

METHOD SUMMARY

Seventy milliliters of a liquid sample is loaded into a closed-cup Pensky-Marten flashpoint tester. The sample is heated and stirred. A flame is introduced into the headspace area of the sample at regular intervals and the observed temperature at which the vapors over the sample ignite is recorded.

ANALYTICAL RANGE: 60°F - 200°F (liquids)

SAMPLING: A minimum of 150 mL for liquids. Collect with minimal headspace.

PRESERVATIVE: Refrigerate to 4°C

HOLDING TIME: None listed

COMMENTS:

Liquid samples are reported as a flash point with a temperature value

Note that the referenced procedure applies only to liquid samples capable of being stirred while being heated. The EPA has established method 1030 for the analysis of Ignitability in other matrices than liquids.

If a sample has a measurable flashpoint, the test should be repeated to ensure the accuracy of the first observed result.

PREFERRED SAMPLING CONTAINER: 8 oz glass - liquids

EPA Method 1030
Ignitability for Solids

METHOD SUMMARY

This method is suitable for the determination of the ignitability of solids and is appropriate for pastes, granular materials, solids that can be cut into strips, and powdery substances. This method may be used to meet certain regulatory applications; with respect to the characteristic of ignitability in CFR § 261.21, this method may be used, but is not required, to determine whether a solid waste “when ignited, burns so vigorously and persistently that it creates a hazard.” If it is impractical to perform the test because of the physical form of the sample, generator knowledge should be used to determine the ignitability hazard posed by the material.

SAMPLING: A minimum of 100 g for solids. Collect with minimal headspace.

PRESERVATIVE: Refrigerate to 4°C

HOLDING TIME: None listed

COMMENTS:

Note that the EPA has not referred to this procedure as the definitive measure for the characteristic of “ignitability”.

PREFERRED SAMPLING CONTAINER: 8 oz glass

Waste Oil Testing

The handling and disposal of waste oils and related sludges often places burdensome analytical requirements on contractors. Generator knowledge and final destination of the material (e.g., recycling station, incineration, landfill, etc.) are vital pieces of information in selecting appropriate analyses. Waste oils intended for recycling, oils of unknown origin, and sludges or tank bottoms require individual consideration. For example, oil from a known origin may require testing for halogenated compounds, flash point and pH; whereas oils of unknown origin would require analyses for heavy metals and PCBs in order to best determine an appropriate disposition. Landfill disposal is often the disposal method of choice for tank sludges. Analyses of TCLP listed components are often required to establish potential environmental hazards of landfilled sludges.

ENCO Laboratories is prepared to provide test requirement for all waste oil and sludges. We have developed programs to assure that only the appropriate analyses are performed providing flexibility, quality and cost effective test protocols.

WASTE OIL PROTOCOLS

Oils targeted for recycling

- Total Halogens (TX)
- Flash Point
- Total Metals (4) (As, Cd, Cr, and Pb)
- % Water - Bottom Sediment and Water (BS&W)
- pH

Potential Additional Testing: 8010/8020, BTU, PCBs

Oils of unknown or suspect origin:

- Total Halogens (TX)
- Flash Point
- 8021 (Volatiles)
- TCLP Metals (8) (As, Ba, Cd, Cr, Pb, Hg, Se, Ag)
- PCBs
- BTU (Heat Content)

Potential Additional Testing: TCLP VOA, TCLP Semi-VOA

Waste Oil Testing, cont.

Sludges:

TCLP Volatile Organics

TCLP Metals (8)

Fingerprint Analyses:

Flash Point

pH

Oil and Grease

% Liquids

% Solids

Potential Additional Testing: TCLP Semi-VOA, TCLP Pesticides, TCLP Herbicides, Priority Pollutant Metals, Sulfides, TTO Analysis (to include EPA 624/625/608, cyanide, and phenols).

All tests are subject to client approval and modification. Additional tests may be required depending on generator knowledge and/or requirements of the disposal facilities chosen for the material.

Upon request, ENCO can customize the testing regimen to best meet your objectives.