SESSION 8

RCRA HAZARDOUS WASTE IDENTIFICATION:

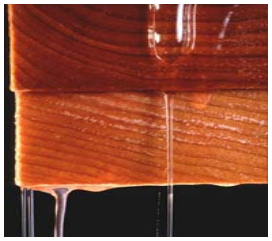
Listed Hazardous Waste

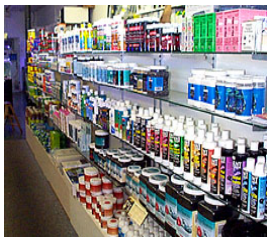
Agenda: Listed Hazardous Waste

- General Introduction
- F Listed Hazardous Waste
- K Listed Hazardous Waste
- P and U Listed Hazardous Waste
- Review

EPA uses four listing categories

- All listed hazardous waste can be found in one of these four lists
  - F list – Non-industry specific process wastes (§261.31)
  - K list – Industry specific process wastes (§261.32)
  - P and U list – Discarded unused chemicals (§261.33(e) and (f))





- When EPA created the hazardous waste listings they divided them into the four categories or lists presented on the slide.

Hazard codes represent EPA's basis for listings

- Ignitable waste – (I)
- Corrosive waste – (C)
- Reactive waste – (R)
- Toxicity characteristic waste – (E)
- Acute hazardous waste – (H)
- Toxic waste – (T)

40 CFR §261.30(b)

- The hazard code represents EPA's basis for the listing. They can be found at 261.30(b).

- **The hazard codes correspond to the listing criteria in §261.11** The hazard codes **I,C,R and E** all derive from the listing criteria - which states that EPA can list any waste which exhibits a hazardous waste characteristic **(I, C, R, E),** or is acute (**H**), or toxic **(T**).

- **(T) Toxic waste is different than toxicity characteristic (E) waste** because **E** is based on the Toxicity Characteristic Leaching Procedure (TCLP); while **T** is based on the presence of toxic (or hazardous) constituents and poses substantial risk

- The basis for hazardous waste listings are presented in 40 CFR Part 261, Appendix VII. This appendix indicates the hazardous constituents for which a waste was listed.

F Listed Hazardous Waste

F list hazardous wastes codes are from non-specific sources

- Seven groups make up the F list
  - Spent solvent wastes
  - Electroplating and other metal finishing wastes
  - Dioxin-containing wastes
  - Chlorinated aliphatic hydrocarbons production wastes
  - Wood preserving wastes
  - Petroleum refinery wastewater treatment sludges
  - Multi-source leachate

40 CFR §261.31(a)

- **The F listings (non-specific sources)** refer to 'processes only' rather than specific industries" and includes wastes from common industrial and manufacturing operations.

- You can think of the **F list as seven different groups**. The listing descriptions don't really designate these groups, but we will identify and highlight these seven groups.

- Because the F listed wastes aren't industry specific, they are **generated by huge numbers of facilities**.

F Listed Hazardous Waste

Spent solvent wastes include hazardous waste codes F001 – F005

- For a solid waste to be F001 – F005 the solvent must meet certain criteria:
  - It must be used as a solvent
  - It must be spent
  - It must meet a specific before-use concentration

40 CFR §261.31(a)

- The first category we are going to cover is the **spent solvent wastes.**

- Examples of solvents include: benzene, toluene, methylene chloride, and methanol.

- There are 3 general criteria to be met for the solvent listings to apply. A solvent must meet all of these criteria in order to meet the listing . See the slide.

- First, the waste must be **used for its solvent properties** - that is to solubilize (dissolve) or mobilize other constituents.
- Second, the solvent must be **spent** – that is it has been used, and is no longer fit for use without being regenerated, reclaimed, or otherwise reprocessed
- Third, is the before-use concentration. It is discussed on the following slide.

- **Finally, the 3rd criterion is found in each of the listing descriptions.** After each listing of the solvent constituents, EPA specifies the before use criterion**. See the text on the slide.**

- **The following applies to F001, F002, F004, and F005.** These solvent mixtures are treated differently for the F001,2,4, and 5 listings <u>and</u> the F003 listing.

- The solvents must meet or exceed a certain <u>threshold concentration</u> *before being used* for their solvent properties. Thus, if the solvent formulation is diluted **below 10% before he uses it**, the spent solvent would NOT meet the solvent listing listing.

- This is NOT the concentration of solvent at disposal, but *before use*.

- If a generator had a solvent formulation which consisted of 15% chlorobenzene (which is an F002 solvent constituent) which he used to clean his paint brushes, once spent, the solvent would meet the F002 listing because it contained more than 10% of an F002 constituent-- that is the before use threshold for F002.

Here is an example of a solvent before-use concentration

25% carbon tetrachloride (F001)

+ 75% water

25% total listed solvent constituents

Spent solvent is F001

- If our painter used a solvent mixture to clean his brushes which contained:
  - » 25% carbon tetrachloride; and
  - » 75% water,

- The **F001** code applies because it has been used as a solvent, is spent, and contained a total of more than 10% of F001 listed solvent constituents before use.

F Listed Hazardous Waste

Here is second example of a solvent mixture before-use concentration

5% carbon tetrachloride (F001)

3% cresylic acid (F004)

2% toluene (F005)

+ 90% water

10% total listed solvent constituents

Spent solvent is F001, F004, F005

- In this example:
  - » 5% carbon tetrachloride (F001 solvent),
  - » 3% cresylic acid (F004 solvent),
  - » 2% toluene (F005 solvent) and
  - » 90% water,

- **F001, F004, and F005** applies because it has been used as a solvent, is spent, and contained a total of 10% or more of the listed solvent constituents before use and includes solvents from all three listings.

F Listed Hazardous Waste

Here is third example of a solvent mixture before-use concentration

30% toluene (F005)

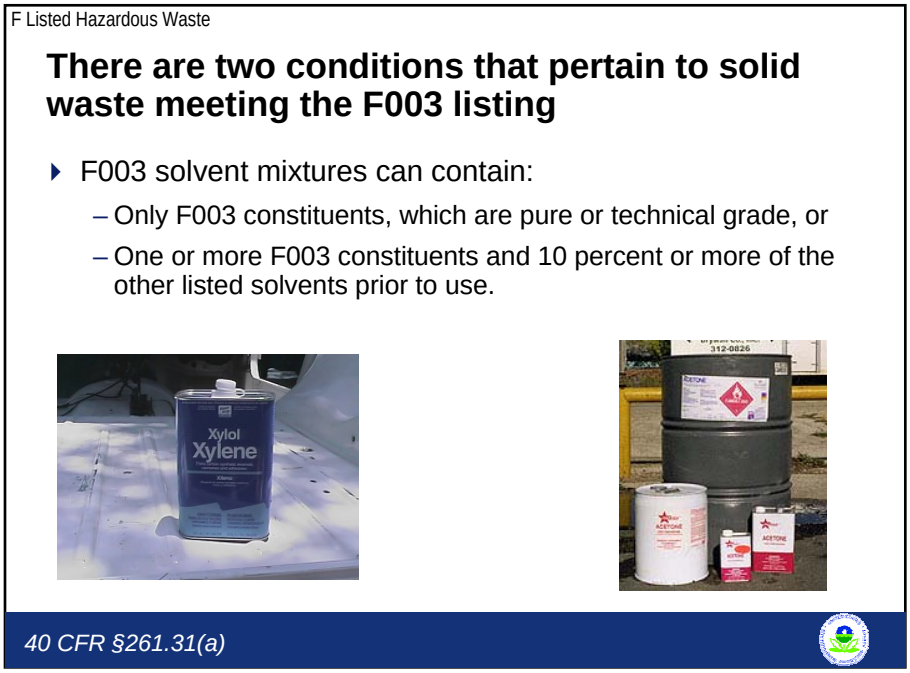
1% trichlorofluoromethane (F002)

+ 69% unlisted solvent constituents

31% total listed solvent concentration

Spent solvent is F005, F002

- The solvent mixture, once spent, would meet both listing descriptions.
- **F002 and F005** because it has been used as a solvent, is spent, and contained a total of more than 10% of the listed solvents before use and includes solvents from these two listings.
- This is similar to the last example, but the point to be made is that even though there is a **large percentage** of one waste code, and a very **tiny percentage** of another, once you trigger that 10% level, all waste codes apply.

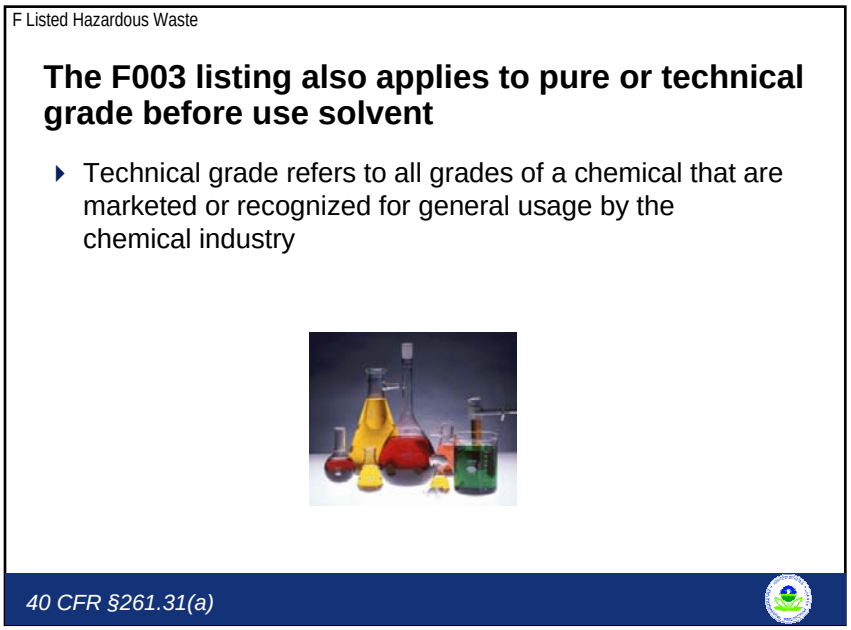


- The before use concentration is different for the F003 listing.

- Mixtures containing **F003 solvents are only covered under <u>two conditions</u>.**
-
- 1. the mixture contains **only F003 constituents** (Pure or Technical Grade) **OR**
- 2. the mixture contains one or more F003 constituents <u>and</u> 10% or more of the other listed solvents prior to use

- The first condition, only F003 constituents, refers to both **pure and technical grade** mixtures. Doesn't say "technical grade" in regulations. We have memos that clarify that, such as the June 1994 <u>Monthly Report Question</u>.

- A **pure mixture** is simply 100% solvent;
- **Technical Grade** is on the next slide.



- The term **"technical grade"** refers to all grades of a chemical which are marketed or recognized for general usage by the chemical industry**.**

- EPA has not established specific percentages or other criteria for use in determining when a concentration is technical grade.

- If our painter has a 99.5% xylene (which is an F003 constituent) solvent formulation and he is wondering whether he is within the cutoff range for technical grade - he should refer to EPA's description of technical grade.
-
- **Technical grade is the concentration at which the formulation is marketed for normal usage.** So, if xylene is normally sold as 99.5% formulation, then that is the technical grade, and it's F003.

- **The second condition :** (The mixture contains one or more F003 constituents <u>and</u> 10% or more of the other listed solvents prior to use), **all applicable waste codes apply as in the first example.**

- There is no percentage cutoff or de minimis level for an amount of the F003 constituent, any amount will cause the waste to be F003.

- WHY IS F003 LISTED? **Solely because of the characteristic of ignitability.**

F Listed Hazardous Waste

Here are some examples of F003 before-use solvent concentrations

99.9% xylene (technical grade) (F003) + 0.1% water

YES

15% acetone (non-technical grade) (F003) + 85% water

NO

15% tetrachloroethylene (F001) + 1% ethyl benzene (F003) + 84% water

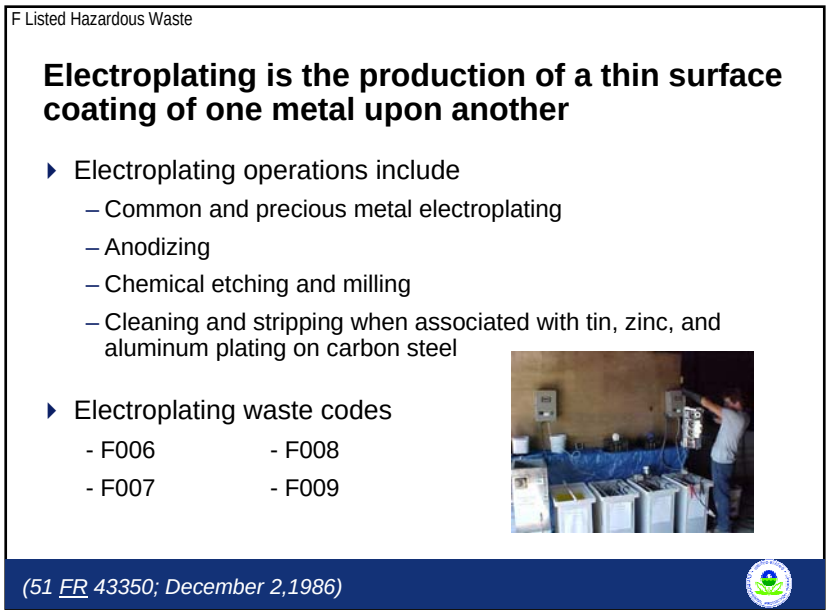
YES (also F001)

- **<u>1st example</u>** - The F003 listing would apply because it is a technical grade formulation

- **<u>2nd example</u>** - No listing would apply because the solvent mixture is neither pure nor technical grade and does not contain any other listed solvent constituents.

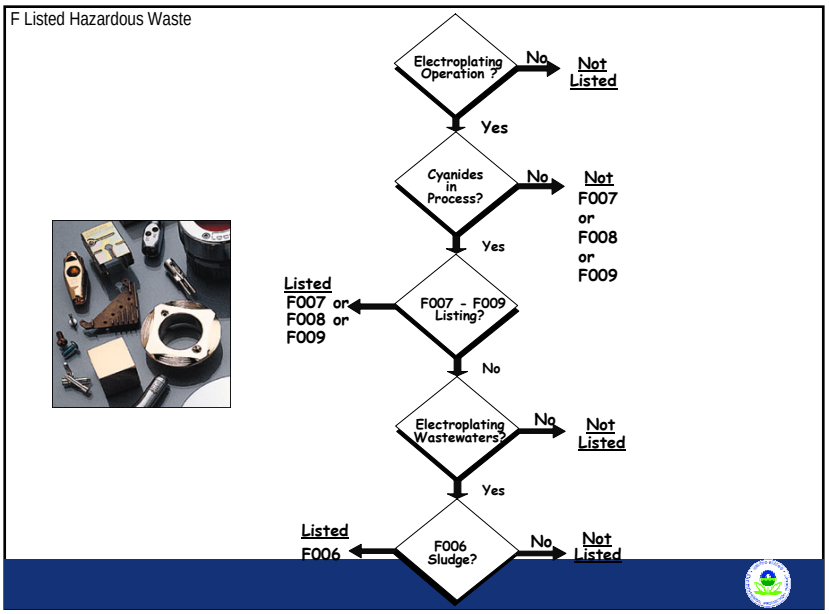
- **<u>3rd example</u>** - In this case, the both the F001 and F003 listings would apply. F001 would apply because it contains more than 10% F001 solvent before use, and the F003 listing applies because it contains more than 10% F001, F002, F004,or F005 and **any** amount of F003 solvent constituents before use.)

- **F001 and F002 have some overlapping constituents**. The difference between F001 and F002 is the scale of the operations.
  - » F001 is appropriate when any of the listed solvents are used in large-scale industrial degreasing operations.
  - » The F002 listing is appropriate when used in equipment cleaning or in smaller scale degreasing operations (such as repair work and drycleaning) **(See the May 1991 <u>Monthly Report Question)</u>**



- **Electroplating and other metal finishing wastes** .
- Industries use **electroplating** to change the surface of metal objects in order to enhance the appearance of the objects, make them more resistant to corrosion, or impart some desirable property to them. *Identifying wastes generated from plating operations requires specific details about the individual process steps.*

- EPA has Defined electroplating operations to include those activities presented on the slide.
- 1. **Common and precious metals electroplating** - a thin surface coating of one metal is applied to another metal by dipping the metal into a metal solution and applying electricity
- 2. **Anodizing** - an oxidation process that enhances properties of the surface layer of the metal
- 3. **Chemical etching and milling**
- 4. **Cleaning and stripping** includes the removal of oil, grease, dirt, and metal oxides with alkaline or acidic solutions .



- This slide is a flowchart to help you with the electroplating operations listings.

- **F007** - Spent cyanide plating bath solutions from electroplating operations
- **F008** - Plating bath residues from the bottom of plating baths from electroplating operations where cyanides are used in the process
- **F009** - Spent stripping and cleaning bath solutions from electroplating operations where cyanides are used in the process

- These listings **<u>only apply if cyanides</u>** are used in the process (flowchart)

- The second set of metal finishing wastes is generated from **metal heat treating operations.**

- **Metal heat treating operations** involve the addition of carbon to the surface of steel for hardening - the process is similar to electroplating in that the metal is dipped into a chemical bath, but rather than adding electricity, the bath has a high temperature.

- These listings **only apply if cyanides** are used in the process

- **F010** - Quenching bath residues from oil baths from metal heat treating operations where cyanides are used in the process

- **F011** - Spent cyanide solutions from salt bath pot cleaning from metal heat treating operations

- **F012** - Quenching wastewater treatment sludges from metal heat treating operations where cyanides are used in the process

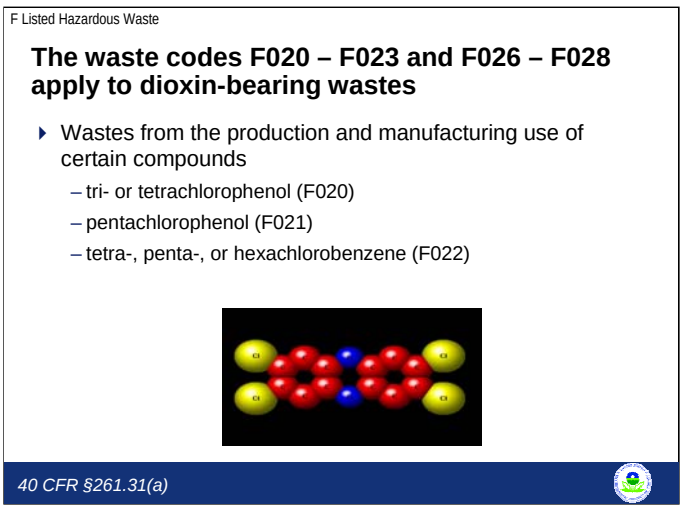
F Listed Hazardous Waste

Wastes generated from chemical conversion coating of aluminum are listed hazardous wastes

- Chemical conversion coating relies on electrochemical potential between the bath and the metal, rather than an electric current, to coat the surface of aluminum
- Chemical conversion coating processes apply a coating to the metal for increased corrosion protection, lubricity, or preparation of the surface for additional coatings
- Chemical conversion coating is not electroplating
- Chemical conversion coating waste code
  - F019

40 CFR §261.31(a)

- The final electroplating operation which is covered is the **chemical conversion coating process**
- **Chemical conversion coating** is similar to anodizing in that it changes the surface of the metal for increased corrosion protection, lubricity, or preparation of the surface for additional coatings or formulation of a special surface appearance



- **WHAT IS SO SPECIAL ABOUT DIOXINS**? they are incredibly potent and lethal; highly mobile and persistent; soluble in fats; labeled as potential carcinogen, studies investigate reproductive and immune system problems.

- **Dioxins are most often found as *unwanted contaminants*** in a variety of manufactured chemicals, process intermediates, and process wastes.

- **there are not any waste codes specific to dioxins alone**--dioxins will be regulated under RCRA if they happen to be present in some of waste streams--hence, dioxin containing waste.

- **These listings address wastes that are likely to contain dioxins. There are <u>4 sets of dioxin listings</u>** which we will discuss over the next slides

- **THE FIRST SET, F020-F022** is wastes from the production and manufacturing use of certain compounds. Dioxins are known or expected to present in the waste streams as a result of the ***production and manufacturing use* of the following compounds:**
- **Tri or tetrachlorophenol (F020)**;
- **Pentachlorophenol (F021)**
- and the *manufacturing use* of **tetra, penta, or hexachlorobenzenes (F022**)

F Listed Hazardous Waste

The waste codes F020 – F023 and F026 – F028 apply to dioxin-bearing wastes (cont.)

- Wastes on equipment previously used for production and manufacturing use of
  - tri- or tetrachlorophenol (F023)
  - tetra-, penta-, or hexachlorobenzene (F026)
- Discarded unused formulations containing
  - tri-, penta-, or tetrachlorophenol, or 2,4,5-trichlorophenoxypropionic acid (silvex) (F027)
- Residues from the incineration or thermal treatment of soil contaminated with dioxin bearing waste (F028)

40 CFR §261.31(a)

- **THE SECOND SET** addresses wastes ***on equipment previously used*** **for the production or manufacturing use of certain chemicals**; waste code applies ***not*** *to the actual equipment*, **but** the waste generated using the equipment.

- If you use the same equipment to produce different chemicals/products, **the dioxins or other contaminants may still be present on the equipment, and therefore contaminate the new process.**

- Tri- and tetrachlorophenols (F023) **;**

- Tetra-, penta-, and hexachlorobenzene (F026) **;**

- **THIRD SET:** Discarded unused forumulations containing tri-, penta-, or tetrachlorophenols, or 2,4,5-trichlorophenoxypropionic acid (silvex)* **(F027)**
  - » this listing is **unique among the F listings** because it is not a manufacturing process waste, but rather an **unused multi active ingredient formulation (a CCP)** that is being discarded.

F Listed Hazardous Waste

The F024 and F025 hazardous waste codes apply to chlorinated aliphatic hydrocarbon production wastes

- Chlorinated aliphatic hydrocarbons are
  - Commonly used as pesticides and fire retardants
  - A class of organic compounds
  - Limited to carbon chain lengths 1 – 5
  - Varying numbers of chlorine atoms
- Chlorinated aliphatic hydrocarbon wastes are also present on the K-list
  - K174
  - K175

40 CFR §261.31(a)

- **<u>Examples</u>** of CAHs include vinyl chloride & carbon tetrachloride

- <u>Hydrocarbon:</u> organic compound composed of H and C atoms
- <u>Aliphatic:</u> refers to type of bond formed between C atoms (single, 2, 3 covalent)
- <u>Chlorinated:</u> H atoms in the aliphatic hydrocarbon substituted with Cl- atom

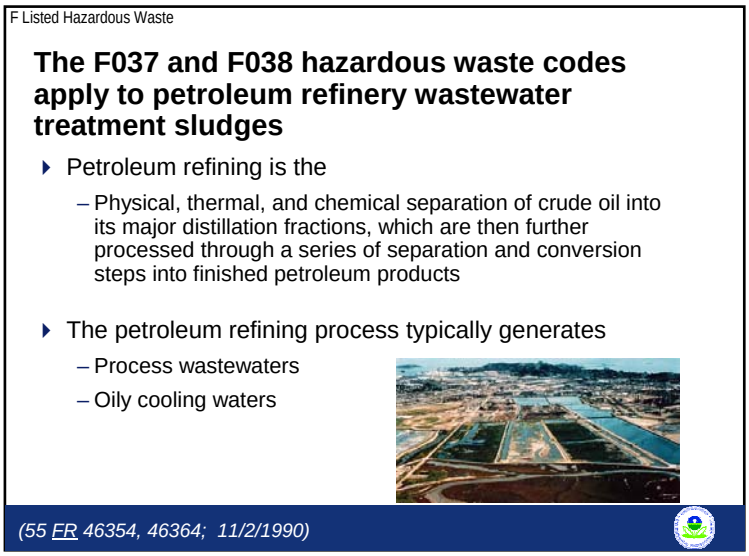
F Listed Hazardous Waste

The F032, F034, and F035 hazardous waste codes apply to wood-preserving wastes

- Wastewaters, process residuals, preservative drippage, and spent formulations from wood-preserving plants that use
  - (Or have previously used) chlorophenolic formulations are F032
  - Creosote formulations are F034
  - Inorganic preservatives containing arsenic and chromium are F035
- Determining the applicable waste code depends on the preserving solution used

40 CFR §261.31(a)

- EPA established <u>3 listings</u> for wood preserving wastes.
- 1)Wastewaters, process residuals, preservative drippage, and spent preservatives from wood preserving plants that use:
  - » *use* **chlorophenolic formulations (F032)** or have *previously used*
  - » *use* **creosote formulations (F034)**
  - » *use* **inorganic preservatives containing arsenic or chromium (F035)**
- 2) The second point is that F032 includes wastes from wood preserving processes generated at plants that **currently use or have previously used** *chlorophenolic formulations*.
- **WHY?** Because these wastes may be **cross contaminated** with chlorinated dioxins which may cause them to pose a significant hazard. This **dioxin hazard** is unique to chlorophenol and F032.



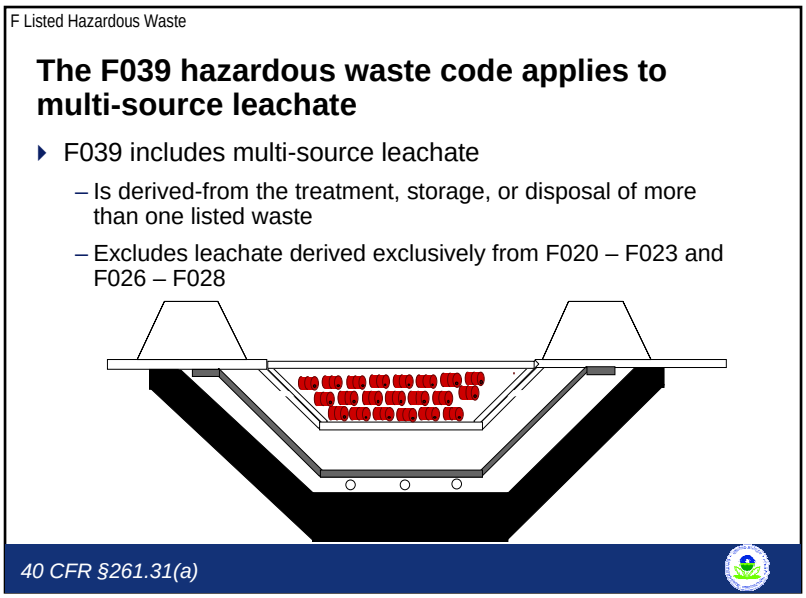
- **PETROLEUM REFINING WASTES.**

- **Petroleum refining** is the physical, thermal, and chemical separation of crude oil into its major distillation fractions, which are then further processed through a series of separation and conversion steps into finished petroleum products.

- The petroleum refining **produces large quantities of contaminated wastewater** which consist of **process wastewater and oily cooling wastewaters**.

- **process wastewaters** -(desalted water, tank emulsion and water draw-offs, condensate from steam stripping operation, pump and gland cooling water, barometric condenser water containing emulsions intermediate and product treating plant wash water. other wastewaters containing emulsions, heavy oils, or tar)

- **oily cooling waters** - (once through cooling water from C6 hydrocarbons and heavier operations, blowdown from cooling towers servicing C6 and heavier operations, uncontrolled oil storm water from refinery processing and tankage areas, controlled oil storm water released from diked areas or surge ponds)



Facilities can dispose of all types of listed wastes in a Subtitle C land disposal unit. The minimum technical standards are designed to prevent leachate from escaping the unit, but in doing this the ***system removes leachate*** **from the unit to keep pressure from building on the liner.**

- **How is this waste regulated?** A facility might not know exactly all the waste codes that this leachate represents. It could be from hundreds of wastes.

- In order to facilitate treatment of residues derived from listed waste disposal and to streamline the HWID process for leachate, **EPA created the listing for multisource leachate from the disposal of listed hazardous waste,** or **F039**.

- **F039 does not include** leachate derived exclusively from F020-F023 and F026-F028. Such leachate is considered single source leachate that is classified as F020-F023 and F026-F028.

K Listed Hazardous Waste

K list hazardous waste codes are from specific sources

- Wood preservation
- Organic chemicals
- Pesticides
- Petroleum refining
- Ink formulation
- Coking
- Veterinary pharmaceuticals
- Inorganic pigments
- Inorganic chemicals
- Explosives
- Iron and steel
- Primary aluminum
- Secondary lead

40 CFR §261.32

- The K wastes in 40 CFR Sec. 261.32 are wastes from specific sources. **These wastes are partially defined by the industry in which they are generated and are often unit specific.**

- The **industry name** for each group of wastes can be found in the EPA waste number column.

- To determine whether a waste qualifies as a K waste, **it must first be determined whether the waste fits within one of the 13 different K list industries .**

- The **P and U lists** designate as hazardous waste pure and commercial grade formulations of certain unused chemicals that are discarded or intended to be discarded

- Unused chemicals may become wastes for a number of reasons. Some are **spilled by accident**, others are **intentionally discarded because they are off-specification and cannot serve the purpose** for which they were originally produced, and some are discarded simply because they **aren't of any use anymore**

- P listings are acutely hazardous; *U listings* contain *toxic constituents*

- However the presence of a P or U listed chemical alone does not trigger the listing. The P and U lists have a ***narrow applicability*** to unused commercial chemical products (and off-specification ccps) and manufacturing chemical intermediates. Any chemical which has been ***used for its intended purpose***, does not meet a P or U listing.

P & U Listed Hazardous Waste

P and U listed hazardous wastes have not been used for their intended purpose

- The P and U listings apply to
  - Commercial chemical product (CCP) or manufacturing chemical intermediate
  - Off-specification CCPs
  - Residue, soil, or debris contaminated by P or U listed chemicals
  - Container or inner liners removed from a container that held P or U listed chemicals

40 CFR §261.33

- The P and U listings apply only **to the four items** on this **slide** that are found in **261.33(a), (b), (c), & (d)**

- **Read comment after 40 CFR Sec. 261.33(d):**
- *The phrase commercial chemical product or manufacturing chemical intermediate refers to a chemical substance which is manufactured or formulated for commercial or manufacturing use, and which consists of the commercially pure grade of the chemical, any technical grades of the chemical that are produced or marketed, and all formulations in which the chemical is the sole active ingredient ...*

- The three key terms from this definition are **commercially pure grade**, *technical grade*, or sole active ingredient.

- **Pure grade** means 100% pure.

P & U Listed Hazardous Waste

There are specific terms that apply to P and U listed hazardous wastes

- Technical grade
  - Refers to all commercial grades of a chemical, which in some cases may be marketed in various stages of purity
- Sole active ingredient
  - Means the active ingredient is the only chemically active component for the function of the product

(54 FR 31336; July 28, 1989)

- **Technical Grade:** There are **no exact criteria**, such as percent purity, to define a **technical grade** of a substance. The technical purity of a substance will vary from compound to compound.

- **Sole Active Ingredient:**
- **An active ingredient** is defined as a compound or mixture that performs the function of the product. **March 1992 Monthly Report Question**

- ***"Sole active ingredient"*** means the active ingredient is the only chemically active component for the function of the product.

- If a formulation has **more than one active ingredient** the formulation, when discarded, would not be within the scope of the listing in §261.33.

- **Functionally inert components** (which serve an ancillary function, such as mobilizing or preserving the active ingredient or as - fillers, solvents, carriers, propellants) do not prevent formulations which contain a P- or U-listed constituent as the sole active ingredient from being a P- or U-list waste.

The P and U listings include unused pharmaceuticals

- Epinephrine P042
- Nitroglycerine P081
- Chlorambucil U035
- Cyclophosphamide U058
- Diethylstilbestrol U089
- Melphalan U150
- Mitomycin C U010
- Paraldehyde U182
- Resperine U200
- Streptozotocin U206
- Warfarin and Salts, when present at concentrations
  - **> than 0.3%** P001
  - **<= 0.3%** U248

(54 FR 31336; July 28, 1989)

Examples of CCP formulations

Fluorine (P056) - active ingredient

Chlorine (not P or U listed) - active ingredient

Not P or U

Kepone (U142) - 3% concentration, active ingredient

Functionally inert component - 97% concentration

U142

- Example #1: Two active ingredients only one of which is a P or U listed chemical.
  - » The CCP is not listed because it contains two active ingredients; it doesn't matter that only one is on the P or U list

- Example #2: How would an unused formulation of 3% kepone be regulated?
  - » Although the formulation contains only a small percentage of the U listed chemical, it would be regulated because kepone is the sole active ingredient

Review

The hazardous waste identification (HWID) process starts with determining if a solid waste meets a listing description

- F List (non-specific sources)
  - Solvents, electroplating, dioxins
- K List (specific sources)
  - Organic chemical manufacturing, explosives, petroleum refining
- P List
  - Acute CCPs
- U List
  - Non-acute CCPs