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Hazardous Waste Identification

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Module 1: Introduction

Learning Objectives

By the end of this section, you will be able to:

- **Identify** the core role of hazardous waste characterization within the RCRA regulatory framework.
- **Evaluate** the scope of the hazardous waste identification process, including the transition from solid waste to hazardous waste definitions.

Executive Summary: Proper waste identification is the fundamental "gatekeeper" of the RCRA program; if a material is not accurately characterized as hazardous waste, it falls entirely outside of RCRA Subtitle C regulation.

The Role of Identification

Determining whether a waste stream is a **hazardous waste** regulated under the **Resource Conservation and Recovery Act (RCRA)** is the most critical step in environmental compliance. Because the RCRA regulations establish a complex and multi-layered definition, the process of **characterizing** waste requires a systematic approach to avoid mismanagement or regulatory non-compliance.

Course Scope and Application

While the complete identification process involves several preliminary steps—such as determining if a material meets the definition of a **solid waste** and checking for specific **exclusions**—this module focuses specifically on the final determination: the definition of a hazardous waste.

The following core concepts are essential for a Professional Engineer to master to ensure legally defensible waste characterization:

- **Hazardous Waste Listings:** Specific waste streams pre-determined by the EPA to be hazardous.
- **Hazardous Waste Characteristics:** Properties (such as ignitability or toxicity) that render a waste hazardous regardless of its source.
- **The "Mixture" and "Derived-From" Rules:** Regulatory logic that governs how hazardous status carries over during treatment or mixing.
- **The "Contained-In" Policy:** Specific applications for contaminated environmental media and debris.
- **Hazardous Waste Identification Rules (HWIR):** Regulatory frameworks aimed at adding flexibility to the system.

⚠ Safety Constraint: You **shall** determine if a waste is hazardous before any treatment, storage, or disposal occurs, as non-hazardous materials are not subject to the stringent requirements of RCRA Subtitle C.



Design Tip: While this section focuses on the definition of hazardous waste, engineers **should** always verify the "Solid Waste" status and applicable "Exclusions" in secondary modules to ensure the identification process is complete.

Checkpoint Quiz

1. Why is hazardous waste identification considered the "key" to the RCRA program?

- a) It determines the tax rate for waste disposal.
- b) It dictates whether the waste falls under RCRA regulation at all.
- c) It provides a list of approved disposal vendors.
- d) It replaces the need for an EPA ID number.

Answer: (b). If something is not hazardous waste, it is not regulated under RCRA.

2. According to the identification process, what must occur before evaluating if a waste is "listed" or exhibits a "characteristic"?

- a) The waste must be neutralized.
- b) The waste must be definitively identified as a "solid waste" and not be otherwise excluded.
- c) A TCLP test must be completed and failed.
- d) The waste must be moved to a staging pile.

Answer: (b). Characterization only proceeds after confirming the material is a solid waste and checking for regulatory exclusions.

3. Which regulatory concept specifically addresses how hazardous waste status applies to contaminated soil or groundwater?

- a) The Mixture Rule.
- b) The Derived-From Rule.
- c) The Contained-In Policy.
- d) The Universal Waste Rule.

Answer: (b). This policy governs the identification of environmental media and debris contaminated with hazardous waste



Module 2: Regulatory Overview

Learning Objectives

By the end of this section, you will be able to:

- **Evaluate** waste materials using the four-step RCRA identification process defined in 40 CFR §262.11.
- **Select** the appropriate hazardous waste list (F, K, P, or U) for classifying industrial and chemical waste streams.
- **Analyze** the regulatory status of waste mixtures and residues using the Mixture and Derived-From rules.

Executive Summary: Under RCRA, any person generating a waste is legally mandated to determine if it is hazardous using specific EPA-defined steps; failure to correctly identify waste leads to total exclusion from Subtitle C management standards or, conversely, unnecessary and costly over-regulation.

Hazardous Waste Identification Process

The success of the hazardous waste management program depends on proper identification. Professional Engineers must turn to **40 CFR §262.11** as the regulatory roadmap for this process.

The Four-Step Identification Sequence

You must evaluate any generated waste through these sequential steps:

1. **Is it a "Solid Waste"?** Any waste—solid, semisolid, or liquid—must first meet the definition of solid waste.
2. **Is it Excluded?** Certain wastes (e.g., household waste) are specifically exempted from RCRA regulation regardless of their hazard level.
3. **Is it a "Listed" Waste?** You must check if the waste matches a narrative description on the EPA hazardous waste lists.
4. **Is it a "Characteristic" Waste?** If not listed, you must determine if the waste exhibits specific hazardous properties.

Definition of Hazardous Waste

RCRA distinguishes between a broad **statutory definition** and a precise **regulatory definition**.

- **Statutory Definition (RCRA §1004(5)):** General guideline defining waste that increases mortality or poses a substantial hazard to health.
- **Regulatory Definition:** The practical framework used by engineers to identify wastes subject to Subtitle C regulations via listings and characteristics.



Hazardous Waste Listings

Listings are narrative descriptions of specific waste streams. If a waste fits the description, it is hazardous regardless of its specific chemical composition or laboratory analysis.

Advantages and Disadvantages of Listings

Feature	Impact on Identification
Ease of Use	Only knowledge of waste origin is required to determine if it is listed; laboratory analysis is generally unnecessary.
Lack of Flexibility	Wastes matching a narrative description are regulated as hazardous regardless of their actual chemical composition or negligible risk level.
Resource Intensive	The EPA must study each waste stream extensively before listing it, meaning the lists cannot address all potentially dangerous wastes produced.

Hazardous Waste Characteristics

Unlike listings, characteristics focus on properties that make a waste dangerous. Identification typically depends on standardized analytical tests (e.g., flash point for ignitability).

Listed Hazardous Wastes

EPA maintains four distinct lists found in **40 CFR Part 261, Subpart D**.

- **The F List (Nonspecific Sources):** Wastes from common industrial processes, such as spent solvents (F001–F005) or wood preserving (F032, F034, F035).
- **The K List (Specific Sources):** Wastes from specific industrial sectors, such as petroleum refining or pesticide manufacturing.
- **The P and U Lists (Unused Chemicals):** Pure or commercial-grade formulations of unused chemicals that are discarded.

Listing Criteria and Hazard Codes

EPA uses four criteria to list a waste: Toxicity, Acute Hazard, Characteristic, or meeting the Statutory Definition. Each listing is assigned a code indicating the basis for regulation.

Hazard Codes for Listed Wastes

- **Toxic Waste:** (T)
- **Acute Hazardous Waste:** (H)
- **Ignitable Waste:** (I)
- **Corrosive Waste:** (C)



- **Reactive Waste:** (R)
- **Toxicity Characteristic Waste:** (E)

⚠ **Safety Constraint:** Acute hazardous wastes (H) are subject to significantly stricter management standards than most other hazardous wastes.

Characteristic Hazardous Wastes

When wastes are not listed, they must be evaluated against four characteristics in **Part 261, Subpart C**.

Ignitability (D001)

Applies primarily to liquid wastes with a flash point (the lowest temperature at which it ignites) that warrants regulation. Non-liquids are only ignitable if they spontaneously catch fire and burn vigorously.

Corrosivity (D002)

Aqueous wastes are corrosive if they have a **pH less than or equal to 2**, or a **pH greater than or equal to 12.5**.

Reactivity (D003)

Defined by narrative criteria, as reliable test methods are often unavailable. A waste is reactive if it:

- Explodes or reacts violently with water.
- Generates toxic gases (sulfide or cyanide) at a pH between 2 and 12.5.
- Is classified as an explosive by the DOT.

Toxicity Characteristic (TC)

Identifies wastes likely to leach dangerous chemical concentrations into groundwater³⁵. This is determined using the Toxicity Characteristic Leaching Procedure (TCLP).



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