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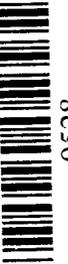
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# LOW-LEVEL MIXED WASTE A RCRA PERSPECTIVE FOR NRC LICENSEES

## DISCLAIMER

This booklet presents only an overview of RCRA requirements for commercially-generated low-level mixed waste. For specific requirements and further information, refer to the statute, federal and state regulations, and the information sources listed in the back of this document.



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Office of Solid Waste and Emergency Response  
Washington, D.C.

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## MIXED WASTE: A RCRA PERSPECTIVE

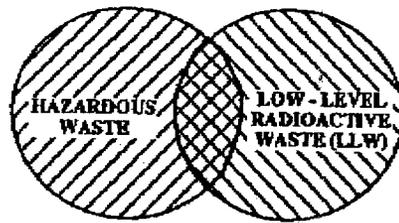
The purpose of this booklet is to introduce specific Resource Conservation and Recovery Act (RCRA) requirements to potential commercial mixed waste generators and treatment, storage, and/or disposal facilities. In particular, it is designed for Nuclear Regulatory Commission (NRC) licensees who may not be familiar with the Environmental Protection Agency (EPA) regulations that apply to their waste products. Most commercially generated mixed waste consists of low-level radioactive waste (LLW) and hazardous waste combined in a single waste matrix. These wastes are generally produced in small quantities.

RCRA establishes a regulatory framework to ensure the proper management of solid and hazardous wastes. The RCRA program's goals are to:

- Protect human health and the environment
- Reduce solid waste and conserve energy and natural resources
- Reduce or eliminate the generation of hazardous waste as expeditiously as possible.

Under the RCRA Subtitle C program, the U.S. EPA regulates the management of hazardous waste from its generation through ultimate

### Potential commercial low-level mixed waste universe

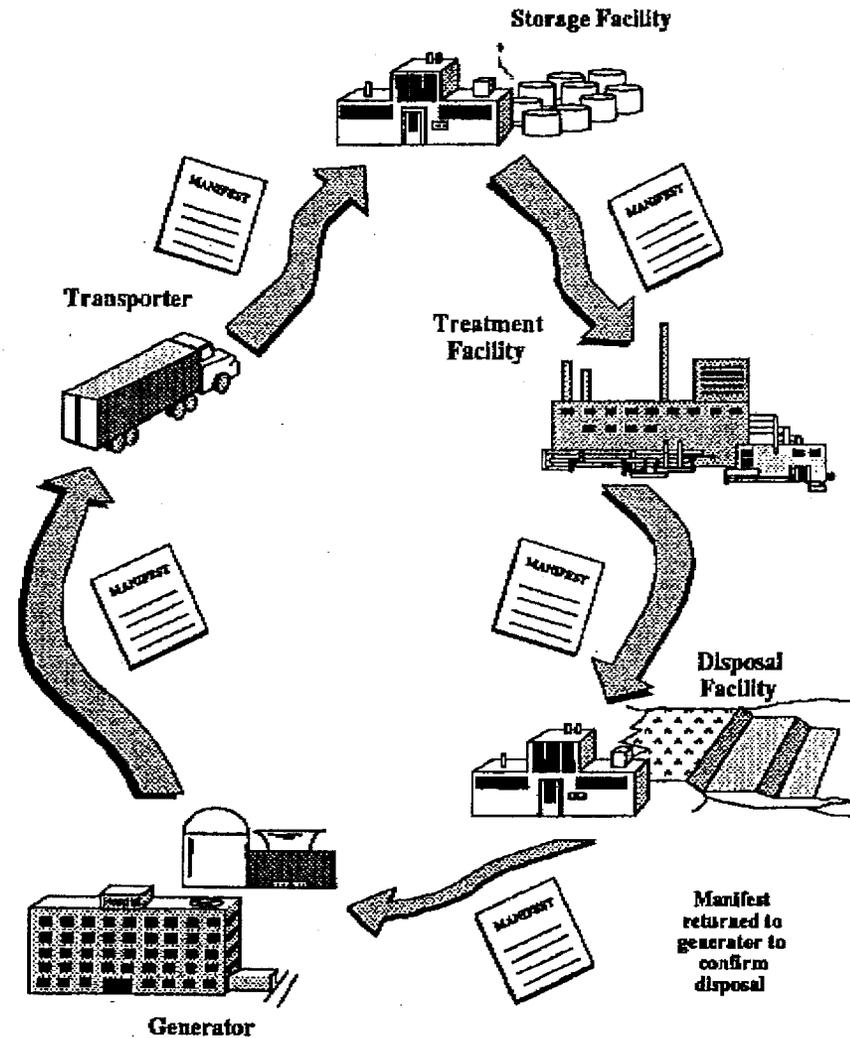


disposal. This "cradle-to-grave" approach ensures the proper handling and management of hazardous waste at every step in the waste cycle, including documentation of every transfer of the waste through manifests.

One particularly challenging aspect of the RCRA program is the management of mixed waste, which contains both RCRA-regulated hazardous waste and radioactive components in one waste matrix. This presents unique issues for waste handlers and regulators. The hazardous waste is subject to regulation by EPA under RCRA and the radioactive component is subject to regulation by the NRC or the Department of Energy (DOE) under the Atomic Energy Act (AEA). Because mixed waste generally cannot be physically separated into hazardous and radioactive components, a single waste management approach must address both RCRA and AEA waste handling and disposal requirements. DOE or

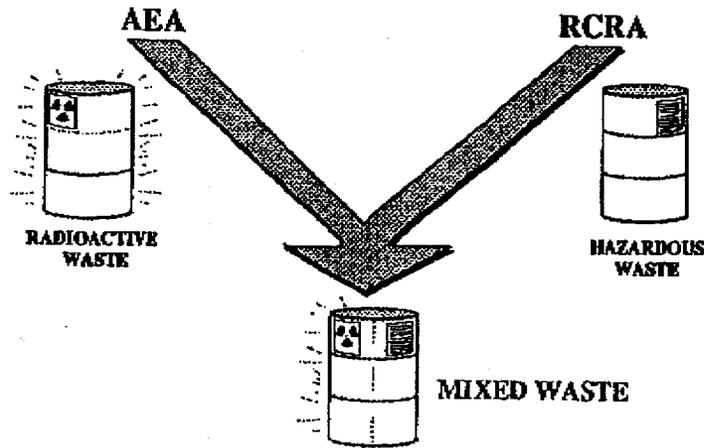
state requirements may also apply. This booklet provides an overview of the applicability of RCRA requirements to commercially generated mixed waste, including information on the types of facilities that are likely to generate mixed waste, the RCRA regulatory

framework and requirements, and opportunities for pollution prevention. For specific requirements and further information, refer to the statutes, federal and state regulations, and the sources listed in the back of this booklet.



The cradle-to-grave management system tracks hazardous waste from its generation through ultimate disposal

# MIXED WASTE DEFINITION



Mixed waste contains radioactive material subject to the AEA and hazardous waste subject to RCRA.

A dual regulatory framework exists for mixed waste, with EPA or authorized states regulating the hazardous waste and NRC, NRC agreement states, or DOE regulating the radioactive waste. NRC generally administers the AEA for commercial and non-DOE federal facilities while DOE regulates radioactive materials at DOE facilities.

The dual regulatory framework for mixed waste stems from the RCRA definition of solid waste. Hazardous waste is defined as a subset of solid waste. RCRA specifically excludes from the definition of solid waste "source, special nuclear, or byproduct material as defined by the Atomic Energy Act of 1954, as amended" [RCRA Section 1004 (27)]. The AEA

regulates source material, special nuclear material, and byproduct material. Classes of radioactive waste are transuranic waste, high-level waste, low-level waste, and spent nuclear fuel. These wastes are subject to regulation by the NRC.

Any class of radioactive waste that contains a hazardous waste as defined under Subtitle C of RCRA is considered mixed waste. The radioactive component of commercial mixed waste will generally be low-level radioactive waste.

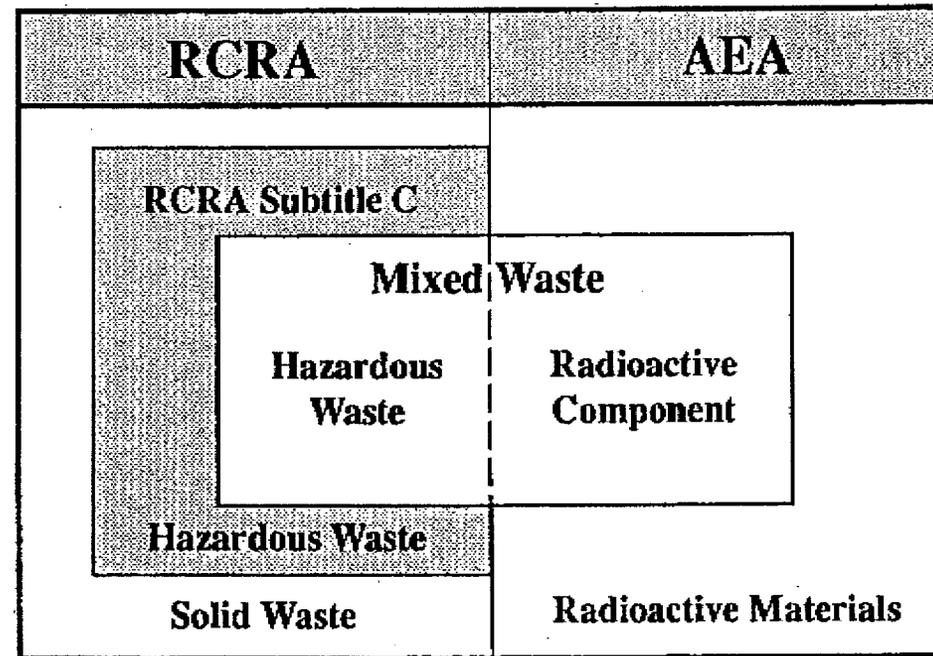
For more information regarding the NRC regulations resulting from AEA, consult Title 10 of the Code of Federal Regulations.

## Low-Level Mixed Waste Contains:

- Low-level waste (LLW), defined in 10 CFR 61.2 as "radioactive waste not classified as high-level radioactive waste, transuranic waste, spent nuclear fuel, or byproduct material as defined in section 11e.(2) of the Atomic Energy Act"

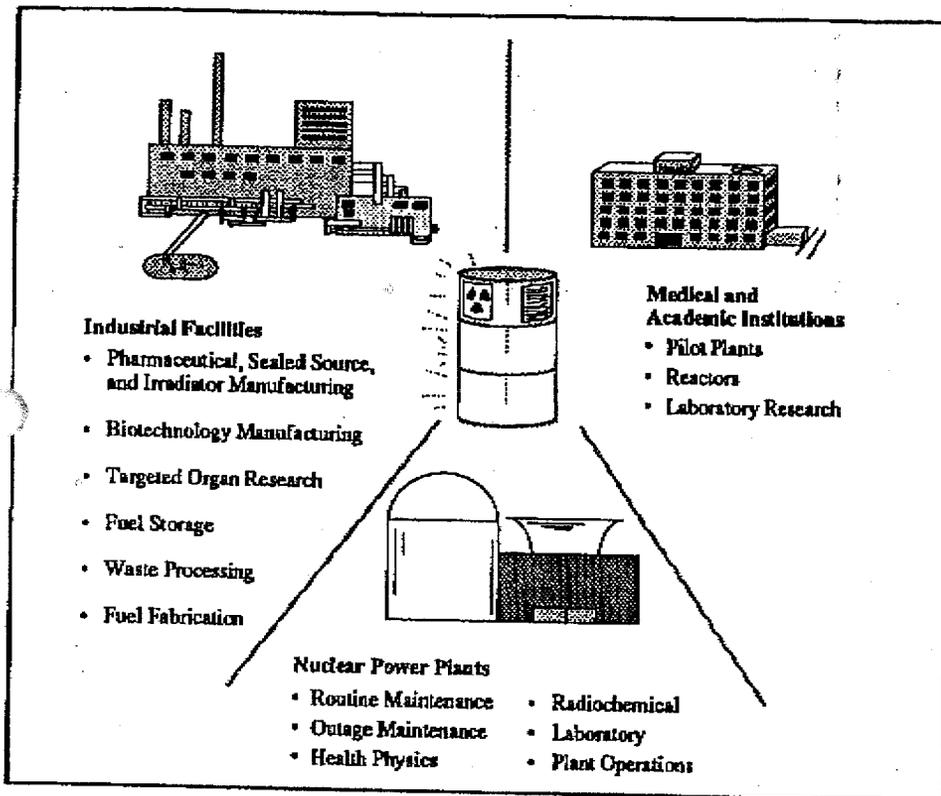
and

- Hazardous waste that is either listed as a hazardous waste in Subpart D of 40 CFR Part 261.31-33 or which exhibits any of the hazardous waste characteristics identified in Subpart C of 40 CFR Part 261.20-24 (ignitability, corrosivity, reactivity, toxicity).



## MIXED WASTE REGULATORY FRAMEWORK

# COMMERCIAL MIXED WASTE GENERATORS



Typical practices that generate mixed waste and associated constituents are shown in the matrix on the next page. These practices usually involve the removal of radioactivity from equipment or system components or the manufacture of radioactive materials or products.

The hazardous waste components of mixed waste typically are organic solvents, metallic lead, chromate and cadmium wastes, or corrosive liquids. Waste oil may also be subject to

RCRA requirements if it exhibits the hazardous characteristics or contains hazardous constituents specified in 40 CFR Part 261. EPA's adoption of the Toxicity Characteristic Leaching Procedure (TCLP) for determining toxicity (55 FR 11798) resulted in the addition of 25 organic chemicals to the list of hazardous constituents, some of which may be found in significant concentrations in used oil. State requirements should also be reviewed to determine the regulatory status of waste oil.

HAZARDOUS WASTES	FACILITY TYPE						
	Pharmaceutical Manufacturing	Biotechnology Manufacturing	Medical/Academic Institutions	Other Manufacturing	Nuclear Power Plants	Fuel Storage	Reactor Waste
Organic solvents of liquid scintillation cocktails	•	•	•	•	•		•
Organic chemicals	•	•	•	•	•		•
Lead wastes	•		•	•	•		•
Chromate and cadmium wastes					•		•
Chlorinated fluorocarbon wastes (CFC)			•		•		•
Aqueous corrosive liquids						•	•
Waste oil *			•	•	•		•
Phenol/chloroform				•			
<b>WASTE GENERATING PRACTICES</b>							
Laboratory counting procedures	•	•	•	•	•		
Residue from research and manufacturing/spent reagents	•	•	•	•			
Cleaning of laboratory equipment	•	•	•	•	•		
Cleaning of contaminated components	•		•	•	•		•
Decontamination of lead shielding					•		
Lead contaminated during process	•	•	•	•	•		•
Equipment/tool decontamination					•		•
Laundering garments					•		
Backflush of resin filters and changeouts		•			•	•	
Cleaning of spent fuel casks and welding rods					•	•	

\* If waste oil meets RCRA characteristics for a hazardous waste or contains listed constituents.

# THE SCOPE OF RCRA

## STATUTORY CHRONOLOGY

Solid Waste Disposal Act	1965
Resource Recovery Act	1970
Resource Conservation and Recovery Act (RCRA)	1976
RCRA Amendments	1980
Hazardous and Solid Waste Amendments (HSWA)	1984

Congressional concern about waste management began with enactment of the Solid Waste Disposal Act of 1965. Since then, Congress has responded to changing waste management problems by amending the Act several times. RCRA and the Hazardous and Solid Waste Amendments (HSWA) set the regulatory framework to deal with solid waste problems in an environmentally sound manner. The RCRA statute (42 U.S.C. 6901 et seq.) includes Subtitles A through J, listed on the following page. Hazardous waste is addressed by Subtitle C and the regulations pursuant to Subtitle C in Title 40 of the Code of Federal Regulations (CFR).

Subtitle C of RCRA establishes the "cradle-to-grave" management program for hazardous waste. EPA regulates hazardous waste from its generation through its ultimate disposal. The hazardous component of mixed waste is subject to Subtitle C regulations.

RCRA defines solid waste as "any garbage, refuse, sludge from a waste treatment plant, water supply treatment plant, or air pollution control facility and other discarded material, including solid, liquid, semisolid, or contained gaseous material resulting from industrial, commercial, mining, and agricultural operations, and from community activities," but does not include "source, special nuclear, or byproduct material as defined by the Atomic Energy Act of 1954..." [RCRA Section 1004(27)]. EPA, NRC, and DOE interpret the exception for source, special nuclear, or byproduct material as referring only to the radionuclide component, and not to the entire waste mixture. The radionuclides within the waste matrix are subject to regulations pursuant to the AEA.

A hazardous waste is defined in the statute as "...a solid waste, or combination of solid wastes, which

## ORGANIZATION OF THE RCRA STATUTE

Subtitle	Provisions
A	General Provisions
B	Office of Solid Waste and Emergency Response; Authorities of the Administrator
C	Hazardous Waste Management (includes mixed waste)
D	State or Regional Solid Waste Plans
E	Duties of the Secretary of Commerce in Resource and Recovery
F	Federal Responsibilities
G	Miscellaneous Provisions
H	Research Development, Demonstration, and Information
I	Regulation of Underground Storage Tanks
J	Demonstration Medical Waste Tracking Program

because of its quantity, concentration, or physical, chemical, or infectious characteristics may..." pose a "substantial present or potential hazard to human health or the environment when improperly... managed." [RCRA Section 1004(5)].

The Subtitle C regulations listed on the next page set forth the framework to identify and manage hazardous wastes. Waste handlers should consult the appropriate regulatory agencies and guidance to determine if they have mixed waste.

Once a waste is determined to be a mixed waste, the waste handler must

comply with both AEA and RCRA regulations.

The requirements of RCRA and AEA are generally consistent and compatible. However, the provisions in Section 1006(a) of RCRA allow the AEA to take precedence in the event provisions or requirements of the two acts are found to be inconsistent. EPA interprets "inconsistencies" as being limited to actual conflicts in the regulations, RCRA requirements that are inconsistent with national security interests protected by the AEA, cases of technical infeasibility, and cases where a RCRA requirement can be shown to violate the AEA policy that

## ORGANIZATION OF THE RCRA HAZARDOUS WASTE REGULATIONS

40 CFR Part 260	Hazardous Waste Management System: General
40 CFR Part 261	Identification and Listing of Hazardous Waste
40 CFR Part 262	Standards Applicable to Generators of Hazardous Waste
40 CFR Part 263	Standards Applicable to Transporters of Hazardous Waste
40 CFR Part 264	Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities
40 CFR Part 265	Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities
40 CFR Part 266	Standards for the Management of Specific Hazardous Wastes and Specific Types of Hazardous Waste Management Facilities
40 CFR Part 267	Interim Standards for Owners and Operators of New Hazardous Waste Land Disposal Facilities
40 CFR Part 268	Land Disposal Restrictions
40 CFR Part 270	EPA Administered Permit Programs: The Hazardous Waste Permit Program
40 CFR Part 271	Requirements for Authorization of State Hazardous Waste Programs
40 CFR Part 272	Approved State Hazardous Waste Management

radiation exposures be limited to "as low as reasonably achievable."

HSWA significantly expanded the scope of RCRA as it relates to hazardous waste. The expanded requirements that are particularly relevant to mixed waste include land disposal restrictions, minimum technology requirements, and corrective action requirements.

### Land Disposal Restrictions (LDR)

HSWA requires EPA to evaluate all listed and characteristic hazardous

wastes to determine which wastes should be restricted from land disposal. The Agency is required to set treatment standards that will diminish the toxicity of hazardous wastes or reduce the likelihood that hazardous constituents will migrate from a disposal site. EPA may set either a concentration level or a treatment method as the standard. The restricted waste must be treated to the promulgated standard prior to land disposal.

In addition to prohibiting the land disposal of hazardous wastes without

proper treatment, the LDR program prohibits the storage of restricted wastes unless the storage is for the sole purpose of accumulating sufficient quantities for proper recovery, treatment, or disposal of the waste.

LDR regulations currently apply to mixed wastes that contain spent solvents, dioxins, or California list wastes (halogenated wastes, certain metal-bearing wastes, polychlorinated biphenyls, and cyanide and corrosive wastes).

Other hazardous wastes were placed in three groups known as the First, Second, and Third Thirds for which treatment standards were issued on a schedule concluding on May 8, 1990.

On that date, EPA issued a two-year national capacity variance for mixed wastes based upon a determination that there is inadequate treatment capacity available for these wastes. The waste covered under this variance must be stored in accordance with RCRA requirements until treatment or disposal capacity becomes available. This variance applies to all mixed waste except those for which specific treatment technologies are identified and those which fall under the land disposal restrictions for spent solvents, dioxins, and California list wastes.

EPA established four treatability groups for types of mixed waste that cannot be treated with the best demonstrated available technologies (BDAT) for the hazardous waste component

involved. One of the groups addresses high-level mixed waste, the others address low-level mixed waste. They are:

- **Macroencapsulation:** which is the BDAT standard for radioactive lead solids. This entails applying surface coating materials to reduce surface exposure to potential leaching media.
- **Amalgamation:** which is the BDAT for radioactive elemental mercury. Combination with reagents such as copper, zinc, nickel, gold, and sulfur results in a semi-solid amalgam that will reduce potential emissions of mercury vapors.
- **Incineration:** which is the BDA standard for radioactive hydraulic oil contaminated with mercury.

In addition, EPA has determined that mixed waste with metals can be treated through chemical precipitation and stabilization, and mixed waste with organics can be treated by incineration or carbon adsorption.

Finally, the land disposal restriction rule states that the RCRA-regulated hazardous portion of all mixed waste must meet the appropriate treatment standards for all applicable waste codes before land disposal. Problems that arise relating to achieving the treatment levels specified by EPA for the hazardous portion of mixed waste can be addressed through either a

rulemaking or site-specific treatability variance. Mixed waste for which adequate treatment capacity is not available must be stored in accordance with RCRA storage requirements until treatment capacity becomes available or a site-specific variance is granted.

#### Minimum Technology Standards

HSWA also sets forth specific structural and design requirements for Subtitle C treatment, storage, and disposal (TSD) facilities. These minimum technology standards require landfills and surface impoundments to contain two or more liners, a leachate collection system, and a ground water monitoring system. Landfills are required to have two leachate collection systems. Landfills in use prior to promulgation of the minimum technology standards are exempt from these requirements. Existing surface impoundments, however, must be retrofitted to meet the minimum technology requirements or taken out of service. Mixed waste facilities are subject to these minimum technology standards.

EPA's RCRA requirement for a double liner and leachate collection system and NRC's requirement that radioactive waste not come in contact with liquids present unique design challenges for mixed low-level waste disposal facilities. EPA and NRC issued joint guidance on a conceptual design approach that meets minimum technology requirements. This approach includes placing the mixed

low-level waste above the original ground surface in tumulus blended into the site topography. The conceptual design, which would have to be adapted to the site-specific conditions, also fulfills both EPA and NRC requirements to assure long-term stability and require minimal maintenance after site closure.

#### Corrective Action

The corrective action provisions of HSWA apply to facilities that handle mixed waste, and are designed to address releases from waste management operations in a timely manner. Corrective actions are required whenever hazardous waste or constituents from a RCRA-regulated unit or solid waste management unit (SWMU) are released into the environment.

The RCRA corrective action process includes the following stages:

- **RCRA Facility Assessment (RFA):** During the RFA, EPA or state investigators gather information on solid waste management units and other areas of concern at RCRA facilities, evaluate this information to determine whether there are releases that warrant further investigation or action, and determine the need to proceed to a RCRA Facility Investigation.

- **RCRA Facility Investigation (RFI):** The RFI generally includes characterization of the hydrogeological setting, the type and concentration of hazardous waste released, the rate and direction at which the contaminants are migrating, and the extent of migration that has occurred. Information generated during the RFI is used to determine the potential need for corrective measures and to aid in the selection and implementation of these measures.

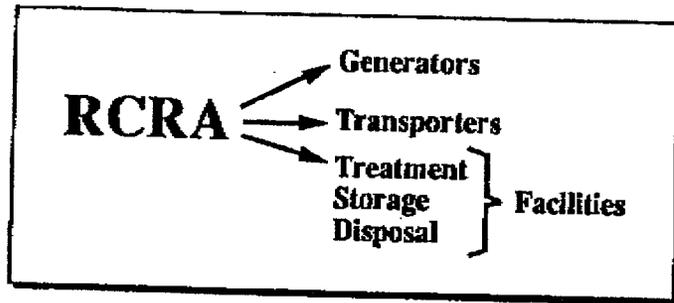
- **Corrective Measures Study (CMS):** If the potential need for corrective measures is verified during the RFI process, the owner or operator is then responsible for performing a CMS. During the

CMS, the owner or operator identifies, evaluates, and recommends specific corrective measures based on a detailed engineering evaluation.

- **Corrective Measures Implementation (CMI):** The CMI includes designing, constructing, operating, maintaining, and monitoring the performance of the corrective measure(s).

EPA has the authority to require corrective actions at permitted and interim status facilities and to impose fines for violations or noncompliance.

# RCRA REQUIREMENTS



## Generators

Under RCRA regulations, mixed waste generators, like other hazardous waste generators, must determine if their waste is hazardous and must oversee its ultimate disposition.

- The generator must obtain an EPA identification number for each facility at which hazardous waste is generated.
- Department of Transportation requirements for transport of hazardous and radioactive waste must be followed.
- Generators must prepare a Uniform Hazardous Waste Manifest (EPA Form 8700-22) that will accompany the waste to its final destination and will be returned to the generators to verify that the waste has been treated and disposed of.
- Every 2 years, generators must report on their hazardous mixed waste activities to the authorized state agency or EPA.

- Generators may accumulate wastes in accordance with certain requirements up to 90 days (180 or 270 days for Small Quantity Generators, depending on distance transported) without a permit.

In addition, all generators must comply with the basic requirements for labeling, marking, recordkeeping, and reporting specified in 40 CFR 262. If the generator is also a treatment, storage, or disposal facility, it must meet the requirements for emergency preparedness, ground water protection, closure, and other requirements specified in 40 CFR 264 or 265.

Currently, under the RCRA Subtitle C program, there are three categories of generators based on the total quantity of hazardous waste, not just mixed waste, that is produced in one calendar month:

Conditionally-exempt small quantity generators (< 100 kg/mo). Facilities that generate no more than 100 kilograms (about 220 pounds or 25 gallons) of hazardous waste and no

more than 1 kg (about 2 pounds) of acutely hazardous waste in any calendar month. Conditionally exempt SQGs (generating less than 100 kg of hazardous waste in a calendar month) are required to identify the hazardous waste generated, send this waste to an approved hazardous waste facility, and never accumulate more than 1000 kg of waste on the property.

Small quantity generators (100-1000 kg/mo). Facilities that generate more than 100 kg and less than 1000 kg (between 220 and 2200 pounds) of hazardous waste and no more than 1 kg of acutely hazardous waste in any month. Small quantity generators are exempt from some of the RCRA offsite disposal requirements for larger generators. Exemptions include, for example, reduced recordkeeping requirements and extended accumulation times (before interim status or a permit is required).

Large quantity generators (> 1000 kg/mo). Facilities that generate 1000 kg (about 2200 pounds) or more of hazardous waste or more than 1 kg of acutely hazardous waste in any month.

Acutely hazardous wastes have been determined by EPA to be so dangerous in small amounts that they are subject to the same requirements as large amounts of hazardous waste. Examples include wastes from pesticide formulators and some dioxin-containing wastes.

For further information on the regulations that apply to mixed waste generators, consult 40 CFR Part 262 Standards Applicable to Generators of Hazardous Waste.

## Treatment, Storage, and Disposal Facilities

Treatment, storage, and disposal (TSD) facilities that handle mixed waste are subject to EPA's permitting system to ensure safe operations. The three functions are defined in 40 CFR Part 260.10 as follows:

Treatment: Any method, technique, or process, including neutralization, designed to change the physical, chemical, or biological character or composition of any hazardous waste so as to neutralize such waste; or so as to recover energy or material resources from the waste or render such waste non-hazardous or less hazardous; safer to transport, store, or dispose of; amenable for recovery amenable for storage; or reduced in volume.

Storage: The holding of hazardous waste for a temporary period, at the end of which the hazardous waste is treated, disposed of, or stored elsewhere.

Disposal: The discharge, deposit, injection, dumping, spilling, leaking or placing of any solid waste or hazardous waste into or on any land or water such that the waste or any constituent thereof may enter the

environment or be emitted into the air or discharged into any waters, including ground waters. TSD is the last link in the cradle-to-grave hazardous waste management system. In order to handle mixed wastes, they must obtain a permit and abide by TSD regulations.

There are two sets of TSD regulations:

**Interim Status Standards** - These are self-implementing requirements which are found in 40 CFR Part 265. Interim status allows owners and operators of certain existing facilities to continue operating until their permit application is issued or denied (40 CFR 265.1). The applicability of interim status requirements to mixed waste is clarified in 53 FR 37045 (see references).

**Permit Standards** - These are facility-specific "design and operating" requirements incorporated into a facility permit. The performance standards in the regulations serve as guidelines for permit writers in setting the specific design and operating requirements through "best engineering judgment."

The permit system ensures that mixed waste facilities meet RCRA standards for proper waste management. TSD facilities must, among other things:

- Analyze and identify wastes prior to treatment, storage, or disposal (waste analysis plan)

- Prevent the entry of unauthorized personnel into the facility by installing fences and surveillance systems and by posting warning signs
- Periodically inspect the facility to identify any problems
- Adequately train employees
- Prepare a contingency plan for emergencies and establish other emergency response procedures
- Comply with the manifest system and with various reporting and recordkeeping requirements
- Comply with technology requirements, such as installing double liners and leachate detection and collection systems
- Undertake any necessary corrective action for the site.

Permits will also contain requirements specific to the particular mixed waste facility.

RCRA also specifies stringent requirements associated with closing down of mixed waste facilities to minimize the potential for adverse environmental consequences after closure. RCRA requires owners to:

- Acquire sufficient financial assurance mechanisms (such as trust funds, surety bonds, letters of credit, closure insurance, or

financial test and corporate guarantee) to pay for closing of the facility

- Be prepared to pay for 30 years of ground water monitoring, waste

system maintenance, and security measures after the facility closes

- Obtain liability insurance to cover third-party damages that may arise from accidents or mismanagement.

### RCRA TECHNICAL REQUIREMENTS FOR TSDs

#### Permit Standards - 40 CFR Part 264

Containers	Subpart I	264.170-264.178
Tanks	Subpart J	264.190-264.199
Surface Impoundments	Subpart K	264.220-264.231
Waste Piles	Subpart L	264.250-264.259
Land Treatment	Subpart M	264.270-264.283
Incinerators	Subpart O	264.340-264.351
Landfill	Subpart N	264.300-264.317
Miscellaneous Unit	Subpart X	264.600-264.603

#### Interim Status Standards - 40 CFR Part 265

Containers	Subpart I	265.170-265.177
Tanks	Subpart J	265.190-265.201
Surface Impoundments	Subpart K	265.220-265.230
Waste Piles	Subpart L	265.250-265.257
Land Treatment	Subpart M	265.270-265.282
Landfills	Subpart N	265.300-265.316
Incinerators	Subpart O	265.340-265.352
Thermal Treatment	Subpart P	265.370-265.383
Underground Injection	Subpart R	265.430
Chemical, Physical, & Biological Treatment	Subpart Q	265.400-265.406



# RCRA ENFORCEMENT



## Enforcement Authorities

RCRA has three main types of statutory enforcement authorities, all applicable to the hazardous component of mixed wastes. These include inspection and information gathering, compliance, and corrective action authorities:

- **Inspections and Information Gathering:** Section 3007 of RCRA provides authority to EPA and authorized states to inspect facilities or obtain information from anyone who has handled or is handling hazardous waste, including mixed waste, in order to determine compliance with RCRA. Under Section 3013 of RCRA, EPA may require monitoring, analysis, and testing by the owner of any site where hazardous waste is stored, treated, or disposed.

- **Compliance:** Section 3008(a) of RCRA gives EPA authority to enforce federal or RCRA-authorized state requirements under Subtitle C. Section 3008(a) is used to bring a hazardous waste facility into compliance and can be used to assess a penalty of up to \$25,000 per day for each violation.
- **Corrective Action:** Section 3008(h) of RCRA is the interim status corrective action authority which allows EPA to respond to a release of hazardous waste or hazardous constituents into the environment by requiring corrective action. EPA may shut down a facility's operations under this section and can assess a penalty of up to \$25,000 per day for each violation. Section 3004(u) provides similar authority for releases at permitted facilities, including requiring a schedule for compliance and assurances of financial responsibility for completing the corrective action. Section 3004(v) states that corrective action must be taken beyond the facility boundary if necessary to protect human health and the environment. Section 7003 allows EPA to act in the event that a hazardous waste presents an imminent and substantial endangerment to health or the environment.

- **Citizen Suits:** Under the authority of Section 7002, citizens may commence civil actions against violators of RCRA requirements.

## Enforcement Options

EPA and RCRA-authorized states have several enforcement options available to ensure compliance with RCRA's waste management system. EPA may impose civil and criminal penalties, issue orders, and seek imprisonment of violators if violations of RCRA occur.

- **Administrative actions:** nonjudicial enforcement options which include informal actions such as letters or phone calls from EPA notifying facilities of noncompliance or the issuance of formal administrative orders.

- **Civil actions:** enforcement actions that are filed against a facility through civil law suits.

- **Criminal actions:** lawsuits or other criminal proceedings brought against a facility for a knowing violation of specified hazardous waste requirements. Examples include providing false information to EPA, or transporting hazardous waste without a manifest or to a facility without a permit.

All of these enforcement options are available to EPA and the states and are applicable to mixed waste generators and handlers of all sizes.

## **MIXED WASTE MINIMIZATION**

HSWA mandates that waste minimization be an integral part of the operations of facilities generating and handling hazardous waste, including mixed waste.

EPA has implemented a nationwide, multimedia, pollution prevention policy emphasizing reduction of waste at its source, recycling and reuse of hazardous materials to the maximum extent possible, and minimizing the volume and toxicity of waste that is generated. Waste minimization, part of the overall pollution prevention program, specifically addresses the reduction of hazardous wastes.

Hazardous and mixed waste generators who work toward these goals can realize the benefits of decreased liabilities associated with waste disposal and radiation exposure, and decreased waste management costs. The public image of a company can also be bolstered by its commitment to environmental quality as demonstrated through such pollution prevention practices.

Hazardous waste generators are required to submit biennial reports describing efforts undertaken to reduce the volume and toxicity of the waste they generate and the changes in volume and toxicity actually achieved. Owners and operators of hazardous waste treatment, storage, or disposal facilities must certify that

there is a waste minimization program in place and that the TSD method proposed minimizes the present and future threat to human health and the environment.

A pollution prevention program begins with a waste minimization assessment. This entails a detailed evaluation of the facility's processes and identifies the potential for reducing wastes at the point at which they are actually generated.

The success of a waste minimization program may depend on a commitment by senior management to ensure that the program addresses facility-wide issues and maximizes use of resources within the facility. For example, a nonhazardous material could be substituted for a hazardous material, or the material could be obtained from an onsite source with excess stock that would otherwise have become waste.

Waste segregation can ensure that hazardous wastes are not mixed with nonhazardous wastes, radioactive wastes are not mixed with nonradioactive wastes, and recyclable items are identified.

Recycling includes techniques to return materials to the originating process or to another process. In some cases, materials can be reclaimed from a potential waste for reuse.

## **HAZARDOUS WASTE MINIMIZATION TECHNIQUE**

### **Inventory Management and Improved Operations**

- Inventory and trace all raw materials
- Purchase more nontoxic production materials
- Provide waste minimization/reduction training for employees
- Improve material receiving, storage, and handling practices

### **Modification of Equipment**

- Install equipment that produces minimal or no waste
- Modify equipment to enhance recovery or recycling options
- Redesign equipment or production lines to produce less waste
- Improve operating efficiency of equipment
- Maintain strict preventive maintenance program

### **Production Process Changes**

- Substitute nonhazardous for hazardous raw materials
- Segregate wastes by type for recovery
- Eliminate sources of leaks or spills
- Separate hazardous from nonhazardous and radioactive from nonradioactive wastes
- Redesign or reformulate end products to be less hazardous
- Optimize reactions and raw material use

### **Recycling and Reuse**

- Install closed-loop systems
- Recycle onsite for reuse
- Recycle offsite for reuse
- Exchange wastes

### **Treatment to Reduce Toxicity and Volume**

- Evaporation
- Incineration
- Compaction
- Chemical conversion

## INFORMATION RESOURCES

For further information regarding the management of mixed waste, refer to the documents listed below or contact the appropriate EPA, NRC, or state offices listed on the following pages.

Brookhaven National Laboratory. *An Analysis of Low-Level Wastes: Review of Hazardous Waste Regulations and Identification of Radioactive Mixed Wastes*. NUREG/CR-4406. December 1985.

Brookhaven National Laboratory. *Management of Radioactive Mixed Wastes in Commercial Low-Level Wastes*. NUREG/CR-4450. January 1986.

Brookhaven National Laboratory. *Document Review Regarding Hazardous Chemical Characteristics of Low-Level Waste*. NUREG/CR-4433. March 1986.

Brookhaven National Laboratory. *Evaluation of Potential Mixed Wastes Containing Lead, Chromium, Used Oil, or Organic Liquids*. NUREG/CR-4730. January 1987.

51 Federal Register 24504. *State Authorization to Regulate the Hazardous Components of Radioactive Mixed Wastes Under the Resource Conservation and Recovery Act*. July 3, 1986.

52 Federal Register 15937. *Radioactive Waste; Byproduct Material*. May 1, 1987.

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