

RCRA, Superfund & EPCRA Hotline Training Module

Introduction to:

**Hazardous Waste Incinerators
(40 CFR Parts 264/265, Subpart O)**

Updated October 1999

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The Hotline is open from 9 am to 6 pm Eastern Time,
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HAZARDOUS WASTE INCINERATORS

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1. INTRODUCTION

Incineration is a commonly employed technology used to destroy hazardous waste. When Congress enacted the Resource Conservation and Recovery Act (RCRA) in 1976, it directed EPA to establish performance, design, and operating standards for all hazardous waste treatment, storage, and disposal facilities (TSDFs). EPA promulgated both general facility standards that apply to all TSDFs and requirements for specific types of units (e.g., incinerators, landfills, and surface impoundments) in 40 CFR Parts 264 and 265. The regulations under Parts 264 and 265, Subpart O, apply to owners and operators of facilities that incinerate hazardous waste.

This training module introduces the concept of burning hazardous wastes in units regulated under RCRA and outlines the requirements for one type of device — the incinerator. When you have completed this module you will be able to explain what an incinerator is, understand how incinerators are regulated, and apply the appropriate regulations when assisting Hotline callers. Specifically, you will be able to:

- State the conditions under which an owner/operator may be exempt from Subpart O
- Define principal organic hazardous constituent (POHC) and describe the criteria under which a POHC is selected
- Define destruction and removal efficiency (DRE)
- Describe the interaction between compliance with performance standards and compliance with incinerator operating conditions established in a permit
- Understand the definition and purpose of a "trial burn."

Use this list of objectives to check your knowledge of this topic after you complete the training session.

2. REGULATORY SUMMARY

Waste materials are burned in incinerators, boilers, and industrial furnaces for various purposes. The purpose of the burning is directly related to the type of device. Incinerators are used primarily for the destruction of hazardous constituents; however, some energy or material recovery may occur. Boilers and industrial furnaces, on the other hand, may burn wastes not only for destruction, but also to achieve significant energy or materials recovery. The regulations that apply to each activity vary with the type of waste that is burned, the type of combustion device, and the purpose of the burning.

The Subpart O standards for hazardous waste incinerators primarily regulate the emissions that result from the combustion process. Specifically, the regulations restrict the emissions of organics, hydrogen chloride (HCl), and particulate matter (PM), as well as fugitive emissions. A very important aspect of the regulations is that compliance with operating conditions specified in the permit is deemed to be compliance with the limits for organics, HCl, and PM.

Incinerators in existence on May 19, 1980, were allowed to continue burning hazardous waste if the units complied with the Part 265, Subpart O, interim status standards. On November 8, 1989, however, interim status terminated for all existing hazardous waste incinerators unless the owner/operator had submitted a Part B permit application by November 8, 1986 (§270.73(f)). Due to this deadline, there are very few incinerators presently operating under interim status. This module, therefore, focuses primarily on the requirements for permitted, rather than interim status, incinerators. There is a comparison of the requirements for permitted and interim status incinerators at the end of this module.

2.1 OVERVIEW OF COMBUSTION

To facilitate an understanding of the Subpart O regulations, it is important to be familiar with the combustion process itself. Incineration is the controlled burning of substances in an enclosed area. During a burn, wastes are fed into the incinerator's combustion chamber. As the wastes are heated, they are converted from solids and liquids into gases. These gases pass through the flame and are heated further. Eventually, the gases become so hot that the organic compounds in the gases break down into their constituent atoms. These atoms combine with oxygen and form stable gases that are released to the atmosphere after passing through air pollution control devices (APCDs).

For incineration to be an effective method for destroying wastes' hazardous properties, combustion must be complete. Three critical factors ensure the completeness of

combustion in an incinerator: (1) the temperature in the combustion chamber, (2) the length of time wastes are maintained at high temperatures, and (3) the turbulence, or degree of mixing, of the wastes and the air. Operating conditions are specified in each incinerator permit to ensure that these factors are present to promote complete combustion.

The stable gases produced by incineration are primarily carbon dioxide and water. Depending on waste composition, however, small quantities of carbon monoxide, nitrogen oxides, HCl, and other gases may form. Also, if combustion is not complete compounds known as product of incomplete combustion (PICs) may be emitted. RCRA regulations control the amount of HCl released from the APCD.

Another by-product of the combustion process is ash. Ash is an inert solid material composed primarily of carbon, salts, and metals. During combustion, most ash collects at the bottom of the combustion chamber (bottom ash). When this ash is removed from the combustion chamber, it may be considered hazardous waste via the derived-from rule or because it exhibits a characteristic. Some ash, however, is carried up with the gases as small particles, or particulate matter. These particles are also collected in the APCD in accordance with RCRA-established limits.

As a hazardous waste management practice, incineration has several unique attributes. First, if properly conducted, it permanently destroys toxic organic compounds contained in hazardous waste by breaking their chemical bonds and reverting them to their constituent elements, thereby reducing or removing their toxicity. Second, incineration reduces the volume of hazardous waste by converting solids and liquids to ash. Land disposal of ash, as opposed to untreated hazardous waste, is therefore both safer and more efficient. Incineration, however, will not destroy inorganic compounds, such as metals, present in hazardous waste. Residue ash from incinerators is subject to applicable RCRA standards and may need to be treated for metals or other nonorganic constituents prior to land disposal.

2.2 SUBPART O APPLICABILITY

The Subpart O standards apply to units that treat or destroy hazardous waste and which meet the definition of an incinerator. An incinerator is any enclosed device that uses controlled flame combustion and does not meet the criteria for classification as a boiler, sludge dryer, carbon regeneration unit, or industrial furnace (§260.10). Typical incinerators include rotary kilns, liquid injectors, controlled air incinerators, and fluidized bed incinerators. The definition of incinerator also includes units that meet the definition of infrared incinerator or plasma arc incinerator. An infrared incinerator is any enclosed device that uses electric-powered resistance as a source of heat and which is not listed as an industrial furnace. A plasma arc incinerator is any enclosed device using a high intensity electrical discharge as a source of heat which is not listed as an industrial furnace.

All devices classified as incinerators which burn hazardous waste must follow the Subpart O standards, with the following exception. The Regional Administrator must exempt an owner/operator applying for a permit from all of the incinerator standards in Subpart O, except waste analysis and closure, if the hazardous waste fed into an incinerator is considered low risk waste (§264.340(b)). The criteria for defining a waste as low risk are:

- The waste is a hazardous waste listed in Part 261, Subpart D, or identified in Subpart C only for ignitability, corrosivity, or both

or

- The waste is a hazardous waste listed in Part 261, Subpart D, or identified in Subpart C only for reactivity, and will not be burned with other hazardous wastes (this exemption does not apply to wastes that are reactive for generating toxic gases when mixed with water (§261.23(a)(4), or cyanide or sulfide gases (§261.23(a)(5))

and

- The waste contains none of the hazardous constituents listed in Appendix VIII of Part 261.

2.3 PERFORMANCE STANDARDS

The Subpart O standards for hazardous waste incinerators set performance standards which limit the quantity of gaseous emissions an incinerator may release. Specifically, the regulations set limits on the emission of organics, HCl, and PM. The following section outlines the requirements for each of these substances.

ORGANICS

To obtain a permit, an owner/operator must demonstrate that emission levels set for various hazardous organic constituents are not exceeded. EPA's principle measure of incinerator performance is its destruction and removal efficiency (DRE). A 99.99 percent DRE means that one molecule of an organic compound is released to the air for every 10,000 molecules entering the incinerator. A 99.9999 percent DRE means that one molecule of an organic compound is released to the air for every one million molecules entering the incinerator.

Since it would be impossible to monitor the DRE results for every organic constituent contained in a waste, certain principal organic hazardous constituents (POHCs) are selected for monitoring and are designated in the permit. POHCs are selected based on high concentration in the waste feed and difficulty in burning compared to other

organic compounds. If the incinerator achieves the required DRE for the selected POHCs, then it is presumed that the incinerator should achieve the same or better DRE for organic compounds that are easier to incinerate.

RCRA performance standards require a minimum DRE of 99.99 percent for POHCs designated in the permit and a minimum destruction and removal efficiency of 99.9999 percent for dioxin-bearing wastes F020, F021, F022, F023, F026, or F027 (§264.343(a)).

HYDROGEN CHLORIDE

HCl is an acidic gas that forms when chlorinated organic compounds in hazardous wastes are burned. An incinerator burning hazardous waste cannot emit more than 1.8 kg of HCl per hour or more than 1 percent of the total HCl in the stack gas prior to entering any pollution control equipment, whichever is larger (§264.343(b)).

PARTICULATE MATTER

PM is tiny particles of ash that are carried along with the combustion gases to the incinerator's stack. The incinerator regulations control metal emissions through the performance standard for particulates, since metals are often contained in or attached to the particulate matter. A limit of 180 milligrams of particulate matter per dry standard cubic meter of gas emitted through the stack has been established in §264.343(c).

2.4 OPERATING CONDITIONS

The goal of setting operating conditions for hazardous waste incinerators is to ensure compliance with the performance standards discussed in the previous section (i.e., for organics, HCl, and PM). An incinerator permit specifies operating conditions that have been shown in a trial burn to result in the incinerator meeting these performance standards. A very important aspect of the regulations is that compliance with the operating conditions specified in the permit is deemed to be compliance with the performance standards for organics, HCl, and PM (§264.343(d)).

A RCRA permit for a hazardous waste incinerator sets operating conditions that specify allowable ranges for, and requires continuous monitoring of, certain critical parameters. Operation within these parameters ensures that combustion is performed in the most protective manner and the performance standards are achieved. These parameters, or operating conditions, include (264.345(b)):

- Maximum allowable carbon monoxide levels in stack emissions
- Allowable ranges for temperature
- Maximum waste feed rates
- Combustion gas velocity

- Limits on variations of system design and operating procedures.

In addition, during the start up and shut down of an incinerator, hazardous waste must not be fed into the unit unless it is operating within the conditions specified in the permit (§264.345(c)). An incinerator must cease operations when changes in waste feed, incinerator design, or operating conditions exceed limits designated in its permit (§264.345(f)).

FUGITIVE EMISSIONS

Operating conditions are also set to control fugitive emissions. Fugitive emissions are gases that escape from the combustion chamber (for example, gases may escape through the opening where wastes are fed into the combustion chamber) and do not pass through pollution control devices. Fugitive emission control methods are (1) maintaining negative pressure in the combustion zone so that air will be pulled into the APCD rather than escaping into the ambient air, or (2) totally sealing the combustion chamber so that no emissions can escape to the environment (§264.345(d)).

2.5 PERMIT PHASES

An owner/operator wishing to operate a new hazardous waste incinerator is required to obtain a RCRA permit before construction of the unit commences.

The purpose of a hazardous waste incinerator permit is to allow a new hazardous incinerator to establish conditions including, but not limited to, allowable waste feeds and operating conditions that will ensure adequate protection of human health and the environment. The incinerator permit covers four phases of operation: pre-trial burn, trial burn, post-trial burn, and final operating conditions (§270.62).

PRE-TRIAL BURN

The pre-trial burn phase of the permit allows the incinerator to achieve a state of operational readiness necessary to conduct the trial burn. The pre-trial burn permit conditions are effective for the minimum time (not to exceed 720 hours) required to bring the incinerator to a point of operational readiness to conduct a trial burn. This phase is often referred to as the shakedown period.

TRIAL BURN

The trial burn can be seen as the "test drive" of the incinerator. It is the time when the owner/operator will bring the unit up to operational readiness, monitor the key operating conditions, and measure the emissions. The trial burn test conditions are based on the operating conditions proposed by the permit applicant in the trial burn

plan submitted to EPA for evaluation. EPA establishes conditions in the permit necessary to conduct an effective trial burn, meaning that the burn will be representational of the incinerator's intended day-to-day operation and will yield meaningful data for analysis.

POST-TRIAL BURN

The post-trial burn period is the time for EPA to evaluate all of the data that was recorded during the incinerators trial burn. To allow the operation of a hazardous waste incinerator following the completion of the trial burn, EPA establishes permit conditions sufficient to ensure that the unit will meet the incinerator performance standards. This post-trial burn period is limited to the minimum time required to complete the sampling, analysis, data computation of trial burn results, and the submission of these results to EPA.

FINAL OPERATING CONDITIONS

After reviewing the results of the trial burn, EPA will modify the permit conditions again, as necessary, to ensure that the operating conditions of the incinerator are sufficient to ensure compliance with incinerator standards and protection of human health and the environment. Owners/operators of incinerators must comply with the final permit conditions for the duration of the permit, or until the permit is modified.

DATA IN LIEU OF TRIAL BURN

While most incinerators must undergo a trial burn, it is possible for a facility to submit extensive information in lieu of the trial burn (§270.19(c)). EPA believes that most combustion units will need to conduct trial burns in order to develop operating conditions that ensure compliance with the performance standards. Data submitted in lieu of the trial burn, therefore, must originate from a unit with a virtually identical design that will burn wastes under virtually identical conditions (i.e., located at the same facility).

2.6 WASTE ANALYSIS

During operation, the owner/operator of an incinerator must conduct sufficient waste analyses to verify that the waste feed is within the physical and chemical composition limits specified in the permit. This analysis may include a determination of a waste's heat value, viscosity, and content of hazardous constituents, including POHCs. Waste analysis also comprises part of the trial burn permit application (§264.341). EPA stresses the importance of proper waste analysis to ensure compliance with emission limits.

2.7 MONITORING AND INSPECTIONS

The specific monitoring and inspection requirements for incinerators are found in §264.347. The owner/operator must perform, at a minimum, the following functions while incinerating hazardous waste:

- Monitor the combustion temperature, waste feed rate, and indicator of combustion gas velocity on a continuous basis
- Monitor carbon monoxide on a continuous basis at a point downstream of the combustion zone and prior to release into the atmosphere
- Sample and analyze the waste and exhaust emissions upon request of the Regional Administrator to verify that the operating requirements established in the permit achieve the performance standards
- Conduct daily visual inspections of the incinerator and associated equipment
- Test the emergency waste feed cut-off system and associated alarms at least weekly unless otherwise directed by the Regional Administrator — at a minimum operational testing must be conducted monthly
- Place monitoring and inspection data in the operating log.

2.8 MANAGEMENT OF RESIDUES

If an incinerator burns a listed hazardous waste, the ash is also considered a listed waste. The derived-from rule states that any solid waste generated from the treatment, storage, or disposal of a listed hazardous waste, including any sludge, spill residue, ash, emission control dust, or leachate, remains a hazardous waste unless and until delisted (§261.3(c)(2)(i)). The owner/operator must also determine whether the ash exhibits any characteristics of a hazardous waste.

If an incinerator burns waste that only exhibits a characteristic of a hazardous waste, the owner/operator must determine whether the ash exhibits any characteristics. Ash that exhibits a characteristic must be managed as a hazardous waste.

2.9 CLOSURE

At closure, the owner/operator must remove all hazardous waste and hazardous residues from the incinerator equipment site. In addition, as throughout the operating period, if the residue removed from the incinerator is a hazardous waste, the owner or operator becomes a generator of hazardous waste and must manage the residue in

accordance with the applicable requirements of Parts 262 through 266. (The module entitled Closure/Post-Closure provides more detailed information on general hazardous waste unit closure standards.)

2.10 COMPARISON OF PERMITTED AND INTERIM STATUS INCINERATORS

The requirements for interim status incinerators are very similar to the already discussed regulations for permitted units. The interim status regulations, however, are designed to be self-implementing as the facilities are already in operation on the effective date of the standards.

Figure 1 compares the requirements for permitted and interim status incinerators.

**Figure 1
COMPARISON OF PARTS 264 AND 265
INCINERATOR REQUIREMENTS**

PART 264, PERMITTED	PART 265, INTERIM STATUS
WASTE ANALYSIS (§264.341)	WASTE ANALYSIS (§265.341)
Heating value Viscosity Appendix VIII	Heating value Waste halogen and sulfur content Waste lead and mercury content
PERFORMANCE STANDARDS (§264.343)	PERFORMANCE STANDARDS (§§265.345 and 265.352)
99.99% DRE for POHCs 99.9999% DRE for POHCs for dioxin-bearing wastes 1.8 kg/hr or 1% HCl emissions 180 mg/dscm PM	Burn hazardous waste only during steady state operations 99.9999% DRE and certification for dioxin-bearing wastes
MONITORING & INSPECTIONS (§264.347)	MONITORING & INSPECTIONS (§265.347)
Combustion temperature Waste feed rate Combustion gas velocity Carbon monoxide (CO) Daily inspections Weekly operations test	Monitor emission control system every 15 minutes Daily inspection Daily operations test

CLOSURE (§264.351)	CLOSURE (§265.351)
Remove all hazardous waste and residues	Remove all hazardous waste and residues

In addition, the trial burn process for interim status incinerators is different than that discussed previously in this module. As interim status units were already in operation on the effective date of the regulations the facility would submit their trial burn plan for approval without ceasing operation. Once this plan is approved, the facility would conduct the trial burn test (or submit data in lieu of the trial burn) and continue operating under interim status until the final permit is issued.

3. REGULATORY DEVELOPMENTS

On April 19, 1996, EPA published a proposed rule, called the "MACT" rule (maximum achievable control technology), under the joint authority of RCRA and the Clean Air Act (CAA), to upgrade the emission standards for hazardous waste combustors (61 FR 17358). Specifically, this rule will affect incinerators, cement kilns, and lightweight aggregate kilns. It proposes emissions standards for dioxins, furans, mercury, cadmium, lead, particulate matter, hydrochloric acid, chlorine, hydrocarbons, carbon monoxide, and several low-volatile metals. EPA plans to address boilers and other industrial furnaces in a future rulemaking. This rule fulfills EPA's commitment to upgrade emissions standards as stated in its 1994 Strategy for Hazardous Waste Minimization and Combustion.

On June 19, 1998, EPA finalized the first phase of the MACT rule (63 FR 33782). This final rule includes the comparable fuels exclusion and amendments to the permit modification procedures for combustion facilities. EPA expects to finalize the remainder of the April 19, 1996, proposal in early 1999.

EPA expects that many combustion facilities currently operating under RCRA permits will need to modify their permits in order to comply with the upcoming MACT emissions standards. The current permit modification procedures are time consuming and may hinder facilities from meeting the three-year compliance deadline established by the CAA. To facilitate meeting the deadline, EPA revised the RCRA permit modification procedures to explicitly address changes to a facility's design or operations that are necessary to comply with the MACT standards (63 FR 33782, 33801; June 19, 1998). EPA designated such changes as Class 1 modifications that require prior Agency approval (see Permits and Interim Status module for further discussion of permit modifications). EPA also incorporated a time default of 90 days, with a possible one-time 30-day extension, for the permitting agency to make a decision about the requested modification. If the agency fails to make a decision within the default time frame, the permittee may consider the request approved. In authorized states, owners and operators of facilities subject to the MACT standards will only be able to take advantage of the revised permit modification procedures if the state has become authorized for the revised modification provisions (see State Programs module for further discussion of state authorization).

Interim status combustion facilities subject to the MACT standards will also have to meet the three-year deadline. Interim status facilities are allowed to implement certain facility changes if the changes do not amount to reconstruction (see Permits and Interim Status module for further discussion of reconstruction). To ensure that the reconstruction clause does not present an obstacle for interim status facilities trying to implement changes to meet the new MACT emissions levels, EPA exempted changes necessary to comply with the MACT standards from the reconstruction limit.

NOTICE OF INTENT TO COMPLY

EPA carefully considered public participation when promulgating the streamlined permit modification procedures. In order to provide for public involvement early in a source's compliance planning process, EPA requires owners and operators of combustion facilities subject to the MACT standards to submit a Notification of Intent to Comply (NIC) within one year of promulgation of the final standards indicating whether the source intends to come into compliance with the new standards (63 FR 33782, 33806; June 19, 1998). In addition to submitting the NIC, EPA requires covered facilities to provide notice of and host an informal meeting with the community to discuss plans for complying with the MACT standards and to submit a progress report within two years of promulgation of the final standards which demonstrates progress made toward meeting the emissions standards.

WASTE MINIMIZATION AND POLLUTION PREVENTION

The CAA compliance deadline may cause companies to install simple end-of-pipe emissions controls, instead of pollution prevention process changes. In order to limit this practice and encourage waste minimization, EPA allows owners and operators of combustion facilities to request a one-year extension to the MACT compliance period in cases where additional time is needed to install pollution prevention and waste minimization measures that reduce the amount of hazardous waste entering combustion feedstreams (63 FR 33782, 33816; June 19, 1998). Requests for a one-year extension must reasonably document that the waste minimization measures could not be installed in time to meet the three-year compliance period. Decisions to grant the extensions will be made by EPA or authorized state programs.

The rule proposes emissions standards for dioxins, furans, mercury, cadmium, lead, particulate matter, hydrochloric acid, chlorine, carbon monoxide, hydrocarbons, and several low volatile metals. It also proposes a new comparable fuels exclusion, and makes significant changes to the existing combustion regulations.

EPA intends to finalize this proposal in two parts. The first part, expected in late 1997 or early 1998, is likely to include the comparable fuels exemption and the permit modification amendments. The second part, expected later in 1998, will finalize the remaining issues from the April 19, 1996 proposal.

4. SPECIAL ISSUES

As EPA continues to revise the regulatory program for incinerators in order to adequately protect human health and the environment, omnibus permitting authority, site-specific risk assessments, and public participation issues have received greater attention. The following discusses both issues in greater detail.

4.1 OMNIBUS PERMITTING AUTHORITY

The omnibus provision, added by Congress in the 1984 Hazardous and Solid Waste Amendments, allows the Regional Administrator or state to incorporate into a permit any provision deemed necessary to protect human health and the environment. EPA codified this authority in §270.32(b)(2). Even if a facility submits a permit application that is complete and technically adequate, if site-specific factors at the facility suggest that typical permit conditions or performance standards will not assure protection of human health and the environment, the Agency can impose additional conditions to ensure such protection. Regulators can invoke the omnibus authority whenever a facility owner/operator is seeking a new permit, reissue of an expiring permit, or when existing permits are reopened for modification (in appropriate circumstances).

EPA has recommended that permit writers invoke the omnibus provision to more stringently control emissions for toxic metals, HCl, and products of incomplete combustion (PICs), and to enhance public participation in the combustion permitting process. Also, under the Strategy for Hazardous Waste Minimization and Combustion, EPA has directed states and regions to conduct site-specific risk assessments (incorporating direct and indirect exposures) using the omnibus authority. These risk assessments can be conducted by either the implementing agency or the facility (with agency oversight) during the permitting process.

4.2 PUBLIC PARTICIPATION

On December 11, 1995, EPA published a final rule expanding the role of public participation in the RCRA permitting process. This rule affects incinerators by increasing the extent of public participation during the trial burn process (60 FR 63417). Specifically, the permitting agency is required to issue a public notice prior to approving a facility's trial burn plan, and must announce the commencement and completion dates for all trial burns. The proposed public participation rule (59 FR 28680; June 2, 1994) also included some changes to the procedural requirements for permitting interim status facilities. These changes, however, were not finalized because of pending technical revisions to the hazardous waste combustor standards. See the Regulatory Development section of this module for a discussion of this proposed rule.