Waste-to-Energy Fundamentals

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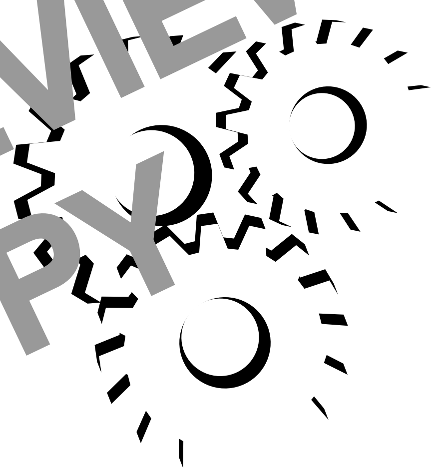
WASTE-TO-ENERGY FUNDAMENTALS

Lesson One

Introduction to Waste Combustion



TPC Training Systems

11401

Lesson

1 Introduction to Waste Combustion

TOPICS

History of Waste Management
Benefits of Converting Waste to Energy
Environmental Regulations
The Clean Air Act
Current Guidelines
Permit Program
Reporting Procedures

OBJECTIVES

After studying this Lesson, you should be able to…

- Summarize the history of waste handling.
- List some problems associated with landfills and the benefits of waste-to-energy conversion.
- Name the federal regulations that apply to MWCs.
- Explain how NSPS regulations affect the operation of MWCs.
- Explain the permitting program.

KEY TECHNICAL TERMS

Incinerator 1.06 furnace designed to burn certain materials

Municipal solid waste (MSW) 1.07 non-hazardous, non-liquid waste; examples include product packaging, grass clippings, furniture, clothing, bottles, food scraps, and newspapers

Mass-burn incinerator 1.07 incinerator in which refuse is burned with little or no preprocessing

Refuse-derived fuel (RDF) 1.07 fuel made from the processing of refuse

Combustor 1.08 incinerator that controls feed and air flow rates to regulate combustion

Routine emissions 1.19 pollutants that are normally found in industrial processes

Maximum achievable control technology (MACT) standards 1.22 based on emissions levels being achieved by lower-emitting sources in an industry

State Implementation Plan (SIP) 1.29 explains how each state will do its job under the Clean Air Act, includes a collection of regulations to be used to clean up polluted areas.

Converting waste to energy is a process born of necessity. Modern society produces more waste volume than can be handled without potential health and environmental risks to its citizens. Waste volume reduction by burning in incinerators was implemented as a method of controlling this volume of waste,. To reduce the costs of incineration, methods were introduced to use the incineration process to convert the waste heat to productive energy.

This Lesson presents a brief history of waste management, it describes the benefits of converting waste to energy, and it details the health and environmental regulations that impact the use of waste as fuel.

History of Waste Management

1.01 In ancient societies, life was a struggle for survival that required the maximum use of all resources available. Almost all parts of the animals that were killed were used in some way. Not just the fruits and grains of plants were used—the limbs, stalks, and leaves also were also put to use. In those early times, there was little waste to become a problem.

1.02 As society evolved and life became more than just a struggle for survival, some of the less desirable parts of collected resources could be disposed of. In addition, modern society developed many products to improve our lives. Many of these same products, however, produce waste material that accumulates if not disposed of in some way. Figure 1-1 shows a breakdown of the various types of waste produced in the United States in a recent year.

1.03 Not only have improved economic conditions led to more waste, but advancements in product packaging have increased the portion of a product that becomes waste. These factors have led to what some today call a "disposable society." Also, increases in population and in population density in cities have increased the volume of waste produced in a single area. Our modern society produces a vast amount of waste, as illustrated in Fig. 1-2 on the following page, which has created a disposal problem.

1.04 When populations were small, waste disposal was not a great problem because area was available for dumping. In modern cities, however, the refuse must be collected and removed from the city. Most cities developed "landfills" outside the city where the refuse could be dumped without endangering citizens. As cities grew, land for dumping refuse became scarce. In addition, citizens became concerned about the health and environmental problems associated with landfills.

1.05 Even with modern construction technology, landfills still present health and environmental problems. In an effort to decrease the need for more dumping area, attempts have been made to reduce the volume of waste and, therefore, the amount of land needed for disposal. One of these methods is burning.

1.06 Burning has long been a method of waste disposal in areas where burning is possible. In congested cities, individual burning is discouraged because of the dangers of fires and the other nuisances associated with burning. This disposal method is, however, possible in locations remote from the populated city centers. As *incinerators* (furnaces designed to burn certain materials) were put into use to reduce the volume of waste, other problems developed. Incinerators produced health and environmental hazards of their own. As public concern over these hazards forced government regulation of landfills and incinerators, their cost of operation increased. As operational costs increased, ways were sought to reduce these costs.

Fig. 1-1. Total waste generation

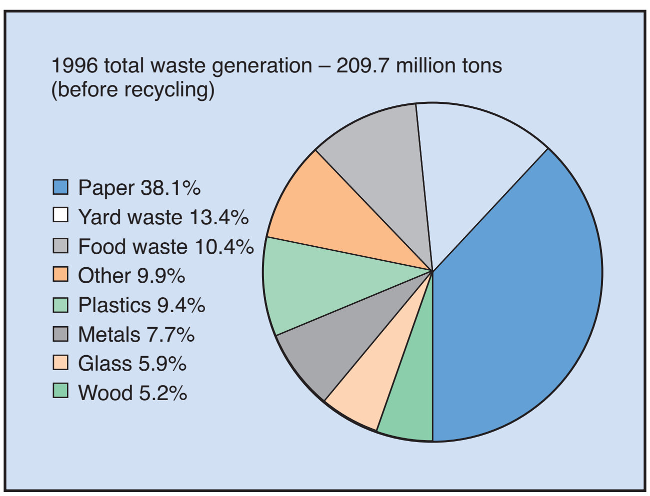
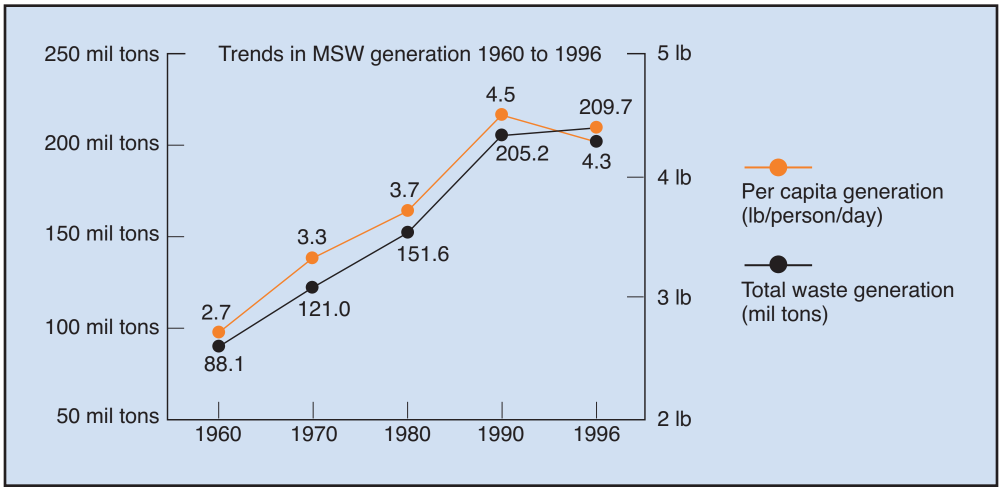


Fig. 1-2. MSW generation trends



1.07 One method developed to offset increased operating costs is to use the waste as fuel to produce energy for resale. Waste is burned to produce steam, which can be used directly for heating or to power a generator to produce electric power. The *municipal solid waste* (MSW), which consists of non-hazardous, non-liquid waste, such as product packaging, grass clippings, furniture, clothing, bottles, food scraps, and newspapers, can be handled in either of two ways. It can be

- burned directly (like coal) in a *mass-burn incinerator*, an incinerator in which the refuse is burned with little or no preprocessing, or
- processed into *refuse-derived fuel* (RDF), fuel made from the processing of refuse, which can be burned in an RDF fired unit.

1.08 In 1996, according to the United States Environmental Protection Agency (EPA), 110 combustors with energy recovery capabilities existed with the capacity to burn up to 100,000 tons of MSW per day. A *combustor* is an incinerator that controls the feed and airflow rates to regulate combustion.

Benefits of Converting Waste to Energy

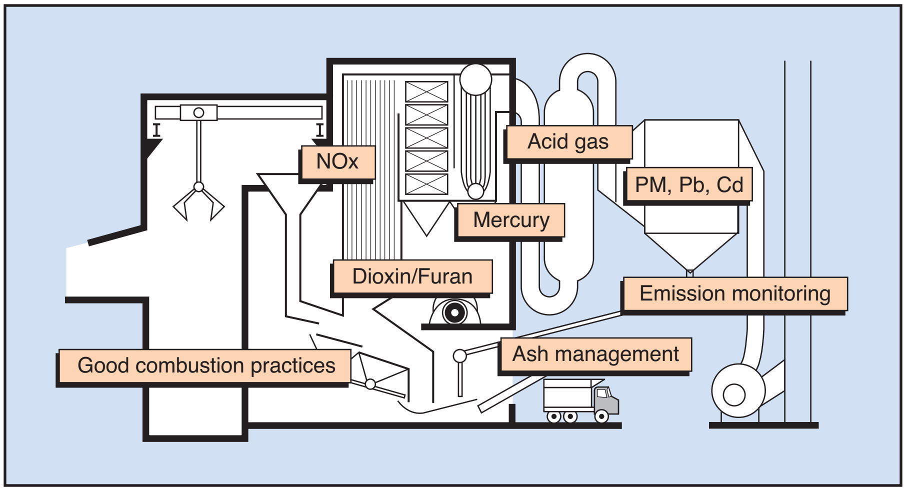
1.09 To reduce waste volume, some local governments and private operators use a controlled burning process called *combustion* or *incineration*. In addition to minimizing waste volume, combustors, when properly equipped, can convert water into steam to fuel heating systems or generate electricity. According to the EPA, burning MSW can generate energy while reducing the amount of waste by up to 90% in volume and 75% in weight. Turning waste into energy has many benefits: reducing the volume of real waste, reducing the size of landfills, reducing the cost of waste handling, recovering energy, and improving our environment. These benefits are detailed in the following paragraphs.

1.10 **Reducing the volume of real waste.** Burning the solid waste reduces the volume of waste. As the solid waste is burned, the volume is reduced to about 10% in volume and 25% by weight. After incineration, only the *bottom ash, slag,* and recovered *fly ash* are left for disposal. Currently some of this residue is being recycled into construction material.

1.11 **Reducing the number and size of landfills.** Burning the solid waste as fuel reduces the amount of waste that is deposited in landfills. This reduces the number and size of landfills needed. In the recent past, all collected waste ended up in the landfill. However, this method of disposal became a problem as most cities began finding it hard to increase their landfill area or develop new landfills. Due to health, environmental, and other concerns, the public is reluctant to have landfills in their neighborhood. This makes a reduction in the number and size of landfills an important issue.

1.12 **Reducing the cost of waste handling.** Burning the solid waste reduces the cost of waste handling in two ways: it reduces the volume of real waste and it reduces the waste to a single type. Any reduction in

Fig. 1-3. MWC regulations



the volume of waste reduces the cost of waste handling—there is less of it to process. In addition, burning the solid waste reduces the real waste to the few components that make up the ash and slag. Handling these few components is less expensive than handling everything from engine blocks to yard clippings.

1.13 **Recovering energy.** As the solid waste is burned, heat energy is recovered. This heat energy is normally used in a conventional-type boiler to produce steam. This steam may then be used directly for heating, to power steam turbines for the production of electricity, or for other municipal or industrial uses. This recovered energy reduces the costs of heating and electricity—and produces overall energy savings.

1.14 **Improving the environment.** The generation of solid waste creates certain potential health and environmental problems. Potential *toxins* (materials having the effect of a poison) and *pathogens* (organisms capable of causing disease) travel with the waste from the collection point to the landfill. If the municipal waste is deposited in landfills in the same form in which it is collected, it can attract rodents, birds, and other pests if not properly managed. In addition, some of the waste may be toxic or could generate toxins when mixed with other waste. The landfill generates unpleasant and dangerous gases as the waste decomposes. As rainwater leaches through the waste, it may carry pathogens and toxins into the groundwater system if not properly managed through a treatment system. Even though environmental regulations have imposed strict standards on the construction of landfills to lessen these problems, they still exist to some degree in every landfill. By reducing the use of landfills, the potential for environmental problems is decreased.

1.15 Though the early incinerators had problems with pollutants, the newer *municipal waste combustors* (MWCs) have many advanced technological methods available for pollutant control. A variety of pollution control technologies reduces the amount of toxic materials emitted in combustion smoke. Among these are *scrubbers*—devices that use a liquid spray to neutralize acid gases in the flue gas—and *filters*, which remove tiny ash particles from the flue gas. Burning waste at high temperatures also destroys harmful chemical compounds and disease-causing bacteria. Regular testing ensures that residual ash is non-hazardous before it is sent to a landfill.

Environmental Regulations

1.16 Because of the health and environmental problems associated with the collection and disposal of municipal solid waste, federal, state, and local governments have imposed many environmental regulations in recent years to reduce the environmental impact of these operations. The processes involved in operating MWCs is regulated at almost every step, as shown in Fig. 1-3. Federal regulations provide the basis for managing the health and environmental problems associated with municipal waste disposal. The regulations imposed on MWCs are especially strict since the revision of the Clean Air Act in 1990.

1.17 The federal regulation covering the handling of MSW is Title 40 Code of Federal Regulations. Title 40 of the Code of Federal Regulations (40 CFR) is titled "Protection of the Environment" and includes 1599 parts. The parts of 40 CFR that are related to municipal waste combustors include the following:

- Parts 50-99: Clean Air Act (CAA)
- Parts 100-149: Clean Water Act (CWA)
- Parts 240-259: Solid Waste
- Parts 260-299: Resource Conservation Recovery Act (RCRA)
- Parts 300-349: Comprehensive Environmental Response, Compensation and Liability Act (CERCLA)
- Parts 400-499: Effluent Guidelines

1.18 The EPA's Office of Air and Radiation is primarily responsible for regulating combustors, because air emissions from combustion pose the greatest environmental concern. The following federal regulations impact the operators of landfills and municipal waste combustors:

- Clean Air Act Amendments (CAAA)
- Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)
- Clean Water Act (CWA)
- Effluent Guidelines (EG)
- New Source Performance Standards (NSPS)
- Occupational Safety and Health Act (OSHA)
- Resource Conservation and Recovery Act (RCRA)
- Superfund Amendments and Reauthorization Act (SARA)

The Programmed Exercises on the next page will tell you how well you understand the material you have just read. Before starting the exercises, remove the REVEAL KEY from the back of the book. Read the instructions printed on the Reveal Key. Follow these instructions as you work through the Programmed Exercises.

1-1. The major component of waste produced in the United States in 1996 was ________.	1-1. PAPER Ref: Fig. 1-1
1-2. Have improvements in product packaging increased or decreased the portion of a product that becomes waste?	1-2. INCREASED Ref: 1.03
1-3. Modern cities have developed ________ outside the city where refuse can be dumped.	1-3. LANDFILLS Ref: 1.04
1-4. To reduce the need for landfill space, the volume of waste can be reduced by ________.	1-4. BURNING Ref: 1.05
1-5. An incinerator that controls the feed and airflow rates to regulate combustion is called a(n) ________.	1-5. COMBUSTOR Ref: 1.08
1-6. When properly equipped, combustors can produce steam that can be used to generate ________.	1-6. ELECTRICITY Ref: 1.09
1-7. MWCs use _________ and _________ to reduce the amount of toxic materials emitted in smoke.	1-7. SCRUBBERS; FILTERS Ref: 1.15
1-8. The regulations imposed on MWCs are especially strict since the 1990 revision of the ________.	1-8. CLEAN AIR ACT Ref: 1.16

The Clean Air Act

1.19 Since 1970, the Clean Air Act has provided the primary framework for protecting people and the environment from the harmful effects of air pollution. A key component of the Clean Air Act is a requirement that the EPA significantly reduce daily, so-called “routine” emissions of the most potent air pollutants—those that are known or suspected to cause serious health problems such as cancer or birth defects. The Clean Air Act refers to these pollutants as *hazardous air pollutants*, but they are also commonly known as *toxic air pollutants* or, simply, *air toxics*.

1.20 Prior to 1990, the Clean Air Act required the EPA to set standards for each toxic air pollutant individually, based on its particular health risks. Early regulations imposed on incinerators included New Source Performance Standards (NSPS). These regulations were adopted by the EPA in 1971 and applied to incinerators with capacities of more than 50 tons per day (tpd). The NSPS regulations set specific quantitative limits on emissions of certain pollutants. This approach proved difficult to administer and was not very effective at reducing emissions. As a result, when amending the Clean Air Act in 1990, Congress directed the EPA to use a *technology-based* and *performance-based* approach to significantly reduce emissions of air toxins from major sources of air pollution, followed by a *risk-based* approach to address any remaining (residual) risks.

1.21 In the first phase, the EPA develops regulations standards requiring that sources meet specific emissions limits that are based on emissions levels already being achieved by many similar sources in the country. In the second phase, the EPA applies a risk-based approach to assess how these technology-based emissions limits are reducing health and environmental risks. Based on this assessment, EPA may implement additional standards to address any significant remaining, or residual, health or environmental risks. EPA is currently developing a strategy for addressing residual risks from air toxics.

1.22 Under the technology-based approach, the EPA develops standards for controlling the routine emissions of air toxics from each major type of facility within an industry group (source). A *source* can be the automotive industry, power industry, paint industry, etc. These standards, known as *maximum achievable control technology* (MACT) *standards* are based on emissions levels that are already being achieved by the better-controlled and lower-emitting sources in an industry. This approach assures citizens that each major source of toxic air pollution will be required to employ effective measures to limit its emissions.

1.23 In setting MACT standards, the EPA does not generally prescribe a specific control technology. Instead, whenever feasible, the Agency sets a performance level based on technology or other practices already used by the industry. Facilities are free to achieve these performance levels in whatever way is most cost-effective for them. Eight years after each MACT standard is issued, the EPA must assess the remaining health risks from the source categories. If necessary, the EPA may implement additional standards that address any significant remaining risk.

1.24 When developing a MACT standard for a particular source category, the EPA looks at the level of emissions currently being achieved by the best-performing similar sources through clean processes, control devices, work practices, or other methods. These emissions levels set a baseline (often referred to as the *MACT floor*) for the new standard. At a minimum, a MACT standard must achieve, throughout the industry, a level of emissions control that is at least equivalent to the MACT floor. The EPA can establish a more stringent standard when this makes economic, environmental, and public health sense. The MACT floor is established differently for existing sources and new sources.

1.25 For existing sources, the MACT floor must equal the average emissions limitations currently achieved by the best-performing 12% of sources in that source category if there are 30 or more existing sources. If there are fewer than 30 existing sources, then the MACT floor must equal the average emissions limitation achieved by the best-performing five sources in the category. For new sources, the MACT floor must equal the level of emissions control currently achieved by the best-controlled similar source.

1.26 Wherever feasible, the EPA writes the final MACT standard as an emissions limit (for example, as a percent reduction in emissions or a concentration limit that regulated sources must achieve). Emissions limits provide flexibility for industry to determine the most effective way to comply with the standard.

1.27 **State involvement.** Although the 1990 Clean Air Act is a federal law covering the entire country, the states do much of the work to carry out the Act. For example, a state air pollution agency holds a hearing on a permit application by a power or chemical plant or fines a company for violating air pollution limits. The law recognizes that it makes sense for states to take the lead in carrying out the Clean Air Act, because pollution control problems often require special understanding of local industries, geography, housing patterns, etc.

1.28 Under this law, the EPA sets limits on how much of a pollutant can be in the air anywhere in the United States. This ensures that all Americans have the same basic health and environmental protections. The law allows individual states to have stronger pollution controls, but states are not allowed to have weaker pollution controls than those established for the whole country.

1.29 States are required to develop *State Implementation Plans* (SIPs) that explain how each state will do its job under the Clean Air Act. A state implementation plan is a collection of the regulations a state will use to clean up polluted areas. The states must involve the public, through hearings and opportunities to comment, in the development of each state implementation plan. The EPA must approve each SIP, and if a SIP is not acceptable, the EPA can take over enforcing the Clean Air Act in that state.

1.30 **Enforcement.** The 1990 Clean Air Act gives important new enforcement powers to the EPA. In the past, it was very difficult for the EPA to penalize a company for violating the Clean Air Act. The EPA had to go to court to prosecute a polluter for even minor violations. The 1990 law empowers the EPA to fine violators, much like a police officer giving traffic tickets. Other parts of the 1990 law increase penalties for violating the Act and bring the Clean Air Act's enforcement powers in line with other environmental laws.

1.31 The 1990 Clean Air Act sets deadlines for the EPA, states, local governments, and businesses to reduce air pollution. The deadlines in the 1990 Clean Air Act were designed to be more realistic than deadlines in previous versions of the law, so it is more likely that these deadlines will be met.

1.32 Public participation is a very important part of the 1990 Clean Air Act. Throughout the Act, the public is given opportunities to take part in determining how the law will be carried out. For instance, ordinary citizens can take part in hearings on the state and local plans for cleaning up air pollution. They can sue the government or a pollution source's owner or operator to get action when EPA or the state has not enforced the Act. Citizens can request action by the state or EPA against violators.

Current Guidelines

1.33 In 1995, revisions to the 1991 NSPS and Emission Guidelines for units larger than 250 tpd were put into effect. These revisions had several results:

- set numerical emission limits for lead, mercury, and cadmium, and extend NO_x limits to existing facilities
- extended the regulations downward to include all facilities larger than 39 tpd (tons per day)
- required notification of design capacity and start-up date for new and existing facilities between 28 and 39 tpd
- imposed "good combustion practices" on MWCs as an environmental control measure.

1.34 **Good combustion practices (new and existing facilities).** In the NSPS, the specified "good combustion practices" include the following:

- The load must not exceed 110% of the maximum load level demonstrated during dioxin/furan performance tests.
- The temperature at the inlet to a particulate material control device cannot exceed by more than 17°C (celsius), the demonstrated temperature during dioxin/furan performance tests.
- CO must not exceed 50 to 150 ppmv depending on type of unit for new units, and 50 to 250 ppmv for existing units (average value based on boiler technology).

Table 1-1. Particulate emission limits

New facilities	24 mg/dscm* (0.010 gr/dscf)**
Existing facilities>250 tpd	27 mg/dscm (0.012 gr/dscf)
Existing facilities>250 tpd	70 mg/dscm (0.003 gr/dscf)

*dry standard cubic meter **dry standard cubic foot

Table 1-2. Cadmium emission limits

New facilities	0.02 mg/dscm (8.7 gr/mil dscf)
Existing facilities>250 TPD	0.04 mg/dscm (18 gr/mil dscf)
Existing facilities>250 TPD	0.10 mg/dscm (44 gr/mil dscf)

Table 1-3. Lead emission limits

New facilities	0.20 mg/dscm (87 gr/mil dscf)
Existing facilities>250 TPD	0.49 mg/dscm (200 gr/mil dscf)
Existing facilities>250 TPD	1.6 mg/dscm (700 gr/mil dscf)

Table 1-4. Organic emission limits

New facilities	[illegible]mg/d[illegible]m [illegible] mg [illegible]th [illegible]es[illegible] [illegible]que[illegible] testing)
Existing facilities>250 TPD	60 [illegible]g/dscm wi[illegible] ESP/30 mg w[illegible] FF
Existing facilities>250 TPD	125 [illegible]g/dscm

Table 1-5. Acid gas controls

Sulfur dioxide:	**The higher of:**
New facilities	80% reduction or 30 ppmv
Existing facilities>250 TPD	75% reduction or 31 ppmv
Existing facilities>250 TPD	50% reduction or 80 ppmv
Hydrochloric Acid :	**The higher of:**
New facilities	95% reduction or 25 ppmv
Existing facilities>250 TPD	95% reduction or 31 ppmv
Existing facilities>250 TPD	50% reduction or 250 ppmv

Table 1-6. Nitrous oxide emission limits

New facilities	150 ppmv
Existing facilities>250 TPD	200–250 ppmv

(Does not apply to existing mass burn/refractory MWCs)

- Certification of chief facility operators and shift supervisors, and training for plant operators must be done.
- Continuous emissions monitoring of sulfur dioxide, NO_x, opacity, CO, load, and temperature must be performed.
- Annual stack testing must be performed for particulates, lead, cadmium, dioxins/furans, and HCl.
- Opacity must be less than 10% (6-minute average).

1.35 **Emissions limits.** Emissions limits imposed by the NSPS for particulates, cadmium, and lead are listed in Tables 1-1 through 1-3. The mercury emissions limits imposed by the NSPS for new and existing facilities are 0.08 mg/dscm (35 gr/mil dscf) or an 85% reduction. Dioxins and furans are measured as total tetra-through-octa-chlorinated dibenzo-p-dioxins and dibenzofurans. The limits for organic compounds are listed in Table 1-4. Operators seeking less frequent testing may elect to meet lower limits. The acid gas controls imposed by the NSPS are listed in Table 1-5. The nitrous oxide (NO_x) emission limits imposed by the NSPS are listed in Table 1-6. The fly ash and bottom ash emissions limits imposed by the NSPS for new and existing facilities are "visible emissions less than 5% of operating time."

1.36 **Siting requirements for new facilities.** An analysis of the impact of newly proposed waste-handling facilities on ambient air quality, visibility, soils, and vegetation must be conducted and made available for public comment. The facility owner must develop and submit for public review and comment a draft materials separation plan summarizing what materials will be separated, how they will be separated and what service areas will be included. The owner must also prepare written responses to comments received and prepare a final draft materials separation plan as a part of the permit application. In addition, they must hold a public meeting to discuss the plan and provide notification of the meeting in the areas where the waste will be collected and where the plant will be sited.

1.37 **Ash management.** In accordance with Resource Conservation and Recovery Act (RCRA) Regulations for new and existing facilities, the following regulations apply:

- If ash tests hazardous (using the RCRA Toxic Characteristics Leaching Procedure), it must be managed as a hazardous waste.

- If it does not test hazardous, it may be disposed in a municipal waste (non-hazardous) landfill.

- Fly ash and bottom ash may be combined prior to testing. Combined ash does not generally test hazardous.

Permit Program

1.38 One of the major breakthroughs in the 1990 Clean Air Act is a permit program for larger sources that release pollutants into the air. Requiring polluters to apply for a permit is not a new idea. Approximately 35 states have had statewide permit programs for air pollution. The Clean Water Act also requires permits to release pollutants into lakes, rivers, or other waterways. Now air pollution is also managed by a national permit system. Under the new program, permits are issued by states or, when a state fails to carry out the Clean Air Act satisfactorily, by the EPA.

1.39 Before any waste handling operation can begin, an *operating permit* must be obtained from the federal, state, and local authorities. The permit includes information on specific operating conditions, including which pollutants are being released, how much may be released, what steps the owner or operator is taking to reduce pollution, and plans to monitor the pollution. The permit system is especially useful for facilities covered by more than one part of the law, since information about all of a source's pollution will now be in one place. The permit system simplifies and clarifies a facility's obligations for cleaning up air pollution and, over time, can reduce paperwork. For instance, an electric power plant may be covered by the acid rain, hazardous air pollutant and non-attainment (smog) parts of the Clean Air Act. The detailed information required by all these separate sections will be in one place—on the permit.

1.40 The limits on the types and quantities of pollutants allowed to be released may be technology based, water-quality based, or air-quality based. Currently regulated air pollutants from municipal waste combustors include the following:

- opacity

- particulate matter

- carbon monoxide

- nitrogen oxides

- acid gases, hydrogen chloride, sulfur dioxide

- organics (dioxin and furan)

- metals, such as lead, cadmium, and mercury.

1.41 A facility's operating permit restrictions may also include provisions that prevent specified materials from being processed in MWC units. Examples include hazardous wastes, radioactive wastes, and "red bag" medical waste. Other materials may include construction debris and industrial wastes.

Reporting Procedures

1.42 In addition to the operating permits, the environmental regulations at the federal, state, and local level require a number of reports from municipal waste combustor operators. These reports include the following:

- daily operating reports

- releases to the environment

- movement of waste off site

- hazardous material on site

- movement of hazardous material.

1.43 The reports required by the Act are public documents. A great deal of information has been collected on just how much pollution is being released. This information is available to the public. The 1990 Clean Air Act ordered the EPA to set up clearinghouses to collect and give out technical information. Typically, these clearinghouses serve the public as well as state and other air pollution control agencies.

1-9. Amendments to the Clean Air Act directed the EPA to use a(n) ________ - and ________ -approach to reducing emissions, followed by a(n) ________ -based approach to addressing remaining risks.	1-9. TECHNOLOGY; PERFORMANCE; RISK Ref: 1.20
1-10. In setting MACT standards, the EPA sets a performance level based on ________.	1-10. PRACTICES IN USE IN THE INDUSTRY Ref: 1.23
1-11. Whenever possible, the EPA writes the final MACT standard as a(n) ________.	1-11. EMISSIONS LIMIT Ref: 1.26
1-12. In most cases, who is responsible for carrying out the provisions of the Clean Air Act?	1-12. THE STATES Ref: 1.27-1.29
1-13. If the EPA and state do not adequately enforce the Clean Air Act, ________ can request action against violators.	1-13. CITIZENS Ref: 1.32
1-14. The 1995 revision of the NSPS and Emission Guidelines imposed ________ on MWCs.	1-14. GOOD COMBUSTION PRACTICES Ref: 1.33
1-15. A major breakthrough of the 1990 Clean Air Act is a(n) ________ program for larger sources that release pollutants.	1-15. PERMIT Ref: 1.38
1-16. The reports required by the Clean Air Act are ________ documents.	1-16. PUBLIC Ref: 1.43

Answer the following questions by marking an "X" in the box next to the best answer.

1-1. A mass burn incinerator is one in which

- ☐ a. feed and airflow rates are regulated
- ☐ b. fuel consists of processed refuse
- ☐ c. refuse is burned with no preprocessing
- ☐ d. waste is converted into steam

1-2. According to the EPA, burning MSW can reduce the volume of waste by ________ %.

- ☐ a. 30
- ☐ b. 50
- ☐ c. 70
- ☐ d. 90

1-3. Municipal waste combustors use scrubbers to

- ☐ a. clean the interior of a combustion chamber
- ☐ b. neutralize acid gases in smoke
- ☐ c. remove ash particles from smoke
- ☐ d. remove toxins from waste before burning

1-4. Prior to 1990, the Clean Air Act required the EPA to set standards for each toxic air pollutant individually, based on

- ☐ a. available technology
- ☐ b. ease of processing
- ☐ c. funds available
- ☐ d. its particular health risks

1-5. MACT standards are based on emissions levels that are already being achieved by the ________ sources in an industry.

- ☐ a. computer-controlled
- ☐ b. economically challenged
- ☐ c. lower-emitting
- ☐ d. newer-technology

1-6. In 1995, revisions were made to the 1991 NSPS and Emissions Guidelines for units larger than 250 tons per day (tpd). These revisions set numerical emission limits for

- ☐ a. carbon monoxide
- ☐ b. lead
- ☐ c. nitrous oxide
- ☐ d. sulfur dioxide

1-7. In the NSPS, the specified "good combustion practices" include which of the following?

- ☐ a. Chief facility operators and shift supervisors must be certified
- ☐ b. CO must not exceed 25 ppmv for existing units
- ☐ c. Load must not exceed 150% of the maximum load level demonstrated during dioxin/furan performance tests.
- ☐ d. Opacity must be less than 5% (6-minute average).

1-8. The fly ash and bottom ash emissions limits imposed by the NSPS for new and existing facilities are "visible emissions less than ________ % of the time."

- ☐ a. 5
- ☐ b. 10
- ☐ c. 15
- ☐ d. 20

1-9. An analysis of the impact of newly proposed waste handling facilities on which of the following must be conducted and made available for public comment?

- ☐ a. Ambient air quality
- ☐ b. Landfill availability
- ☐ c. Proximity to water
- ☐ d. Work force availability

1-10. In which situation(s) can fly ash and bottom ash be combined prior to testing?

- ☐ a In both existing and new facilities
- ☐ b. In existing facilities only
- ☐ c. In new facilities only
- ☐ d. Never

SUMMARY

Waste management has progressed from throwing garbage out the window to carrying it to landfills to using it as fuel to produce energy. Using waste to produce energy is beneficial in that it reduces the health and environmental hazards of landfills, reduces the volume of waste, reduces the number and size of landfills, and recaptures some of the expense of disposing of the waste.

Because of the health and environmental hazards associated with waste collection and burning, the public has demanded strict controls on the emissions from MWCs. These regulations are imposed by the federal, state, and local authorities. The regulations are normally managed by the states but enforced by the EPA. The Clean Air Act provides the primary framework for protecting people and the environment from the effects of air pollution. Current NSPS and Emission Guidelines went into effect in 1995.

An important part of the Clean Air Act is a permit program for larger sources that release pollutants into the air. These permits state which pollutants may be released and the allowable quantities. Regulations also require MWC operators to complete several kinds of reports covering operations, releases, and handling of wastes.

Answers to Self-Check Quiz

1-1. c. Refuse is burned with no preprocessing. Ref: 1.07

1-2. d. 90. Ref: 1.09

1-3. b. Neutralize acid gases in smoke. Ref: 1.15

1-4. d. Its particular health risks. Ref: 1.20

1-5. c. Lower-emitting. Ref: 1.22

1-6. b. Lead. Ref: 1.33

1-7. a. Chief facility operators and shift supervisors must be certified. Ref: 1.34

1-8. a. 5. Ref: 1.35

1-9. a. Ambient air quality. Ref: 1.36

1-10. a. In both existing and new facilities. Ref: 1.37

Contributions from the following sources are appreciated:

Figure 1-1. U.S. Environmental Protection Agency, Washington DC
Figure 1-2. U.S. Environmental Protection Agency, Washington DC
Figure 1-3. U.S. Environmental Protection Agency, Washington DC