2.2 Sewage Sludge Incineration

There are approximately 170 sewage sludge incineration (SSI) plantsunits from 86 facilities in operation in the United States. Three main types of incinerators are used:– multiple hearth, fluidized bed, and electric infrared. Some sludge is co-fired with municipal solid waste in combustors based on refuse combustion technology (see Section 2.1). Refuse co-fired with sludge in combustors based on sludge incinerating technology is limited to multiple hearth incinerators only.

Over 80 percent of the identified operating sludge incinerators are of the multiple hearth design. About 15 percent are fluidized bed combustors and 3 percent are electric. The remaining combustors co-fire refuse with sludge. Most sludge incinerators are located in the Eastern United States, though there are a significant number on the West Coast. Facilities are located in 24 states and Puerto Rico. New York has the largest number of facilities with 33. Pennsylvania18. Ohio and MichiganNew Jersey have the next-largest numbers of facilities with 2111 and 1910 sites, respectively.

Sewage sludge incinerator emissions are currently regulated under 40 CFR Part 60, Subpart O and 40 CFR Part 61, Subparts C and E. Subpart O in Part 60 establishes a New Source Performance Standard for particulate matter. Subparts C and E of Part 61 National Emission Standards for Hazardous Air Pollutants (NESHAP) establish emission limits for beryllium and mercury, respectively.

In 1989, technical standards for the use and disposal of sewage sludge were proposed as 40 CFR Part 503, under authority of Section 405 of the Clean Water Act. Subpart G of this proposed Part 503 proposes to establish national emission limits for arsenic, beryllium, cadmium, chromium, lead, mercury, nickel, and total hydrocarbons from sewage sludge incinerators. The proposed limits for mercury and beryllium are based on the assumptions used in developing the NESHAPs for these pollutants, and no additional controls were proposed to be required. Carbon monoxide emissions were examined, but no limit was proposed.

In 2011, EPA established new source performance standards (NSPS) and emission guidelines (EG), and in 2016 EPA established a federal implementation plan (FIP) for sewage sludge incineration units (SSI) located at wastewater treatment facilities designed to treat domestic sewage sludge. Sewage sludge incineration units (SSI) are regulated under 40 CFR Part 60 subpart LLLL, 40 CFR Part 60 subpart MMMM and 40 CFR Part 62 subpart LLL These final rules set limits for nine pollutants under CAA section 129: cadmium, carbon monoxide, hydrogen chloride, lead, mercury, nitrogen oxides, particulate matter, polychlorinated dibenzo-p-dioxins and polychlorinated dibenzofurans, and sulfur dioxide.

2.2.1 Process Description[1,2]Description[1,2]

Types of incineration described in this section include:

- Multiple hearth,
- Fluidized bed, and
- Electric.

Style Definition: Footer

Formatted: Heading 1 Char, Font: Not Bold

Formatted: Tab stops: Not at 0"

Formatted: Heading 2, Line spacing: single, Hyphenate, Tab stops: Not at 0" + 0.5" + 1" + 1.5" + 2" + 2.5" + 3" + 3.5" + 4" + 4.5" + 5" + 5.5" + 6" + 6.5"

Single hearth cyclone, rotary kiln, and wet air oxidation are also briefly discussed.

2.2.1.1 The Source Classification Codes (SCC) for this sector are:

- 50100801 - Waste Disposal; Solid Waste Disposal – Government; Sewage Sludge Incineration; Incinerator
- 50100802 - Waste Disposal; Solid Waste Disposal – Government; Sewage Sludge Incineration; Multiple Hearth Furnaces Incinerator
- 50100803 - Waste Disposal; Solid Waste Disposal – Government; Sewage Sludge Incineration; Fluidized Bed Combustor
- 50100804 - Waste Disposal; Solid Waste Disposal – Government; Sewage Sludge Incineration; Electric Infrared Incinerator
- 50301101 - Waste Disposal; Solid Waste Disposal – Industrial; Sewage Sludge Incineration; Incinerator
- 50301102 - Waste Disposal; Solid Waste Disposal – Industrial; Sewage Sludge Incineration; Multiple Hearth Incinerator
- 50301103 - Waste Disposal; Solid Waste Disposal – Industrial; Sewage Sludge Incineration; Fluidized Bed Combustor
- 50301104 - Waste Disposal; Solid Waste Disposal – Industrial; Sewage Sludge Incineration; Electric Infrared Incinerator
- 50600701 - Waste Disposal; Solid Waste Disposal – Commercial; Sewage Sludge Incineration; Incinerator
- 50600702 - Waste Disposal; Solid Waste Disposal – Commercial; Sewage Sludge Incineration; Multiple Hearth Incinerator
- 50600703 - Waste Disposal; Solid Waste Disposal – Commercial; Sewage Sludge Incineration; Fluidized Bed Combustor
- 50600704 - Waste Disposal; Solid Waste Disposal – Commercial; Sewage Sludge Incineration; Electric Infrared Incinerator
- 50700701 - Waste Disposal; Solid Waste Disposal – Institutional; Sewage Sludge Incineration; Incinerator
- 50700702 - Waste Disposal; Solid Waste Disposal – Institutional; Sewage Sludge Incineration; Multiple Hearth Incinerator
- 50700703 - Waste Disposal; Solid Waste Disposal – Institutional; Sewage Sludge Incineration; Fluidized Bed Combustor
- 50700704 - Waste Disposal; Solid Waste Disposal – Institutional; Sewage Sludge Incineration; Electric Infrared Incinerator

2.2.1.1 Multiple Hearth Furnaces

The multiple hearth furnace was originally developed for mineral ore roasting nearly a century ago. The air-cooled variation has been used to incinerate sewage sludge since the 1930s. A cross-sectional diagram of a typical multiple hearth furnace is shown in Figure 2.2-1. The basic multiple hearth furnace (MHF) is a vertically oriented cylinder. The outer shell is constructed of steel, lined with refractory, and surrounds a series of horizontal refractory hearths. A hollow cast iron rotating shaft runs through the center of the hearths. Cooling air is introduced into the shaft which extend above the hearths. Each rabble arm is equipped with a number of teeth, approximately 6 inches in length, and spaced about 10 inches apart. The teeth are shaped to rake the sludge in a spiral motion, alternating in direction from the outside in, to the

Formatted: Font: Times New Roman

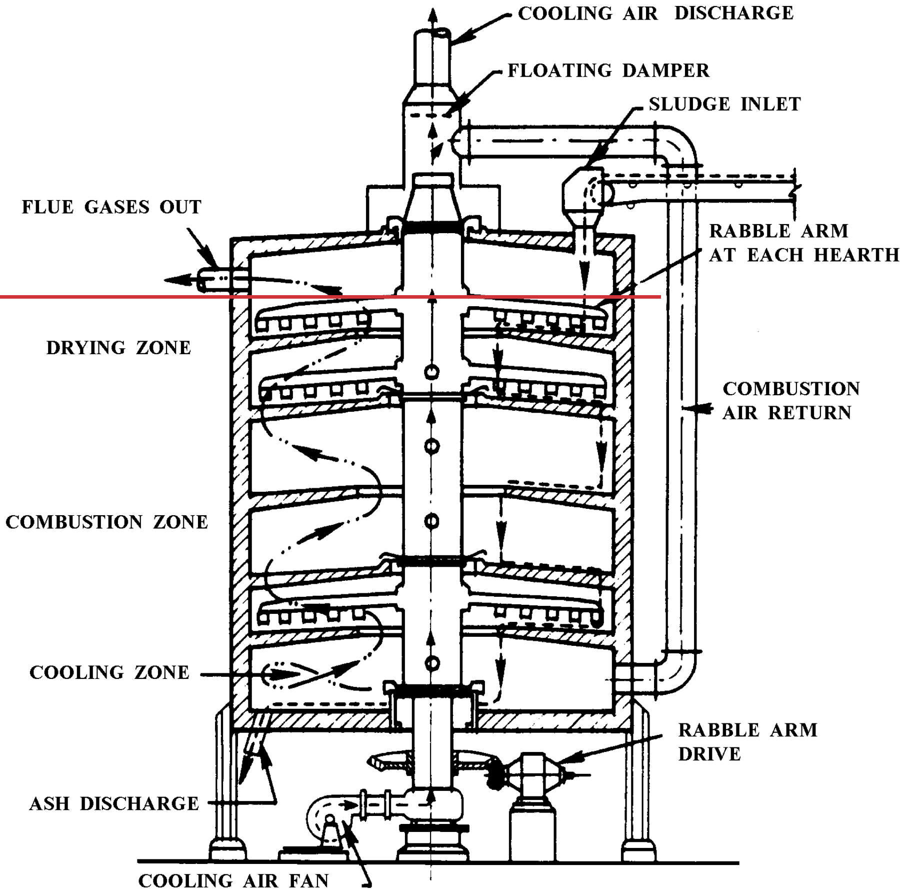


Figure 2.2-1. Cross Section of a Multiple Hearth Furnace

inside out, between hearths. Typically, the upper and lower hearths are fitted with four rabble arms, and the middle hearths are fitted with two. Burners, providing auxiliary heat, are located in the sidewalls of the hearths.

In most ~~multiple hearth furnaces~~MHFs, partially dewatered sludge is fed onto the perimeter of the top hearth. The rabble arms move the sludge through the incinerator by raking the sludge toward the center shaft where it drops through holes located at the center of the hearth. In the next hearth the sludge is raked in the opposite direction. This process is repeated in all of the subsequent hearths. The effect of the rabble motion is to break up solid material to allow better surface contact with heat and oxygen. A sludge depth of about 1 inch is maintained in each hearth at the design sludge flow rate.

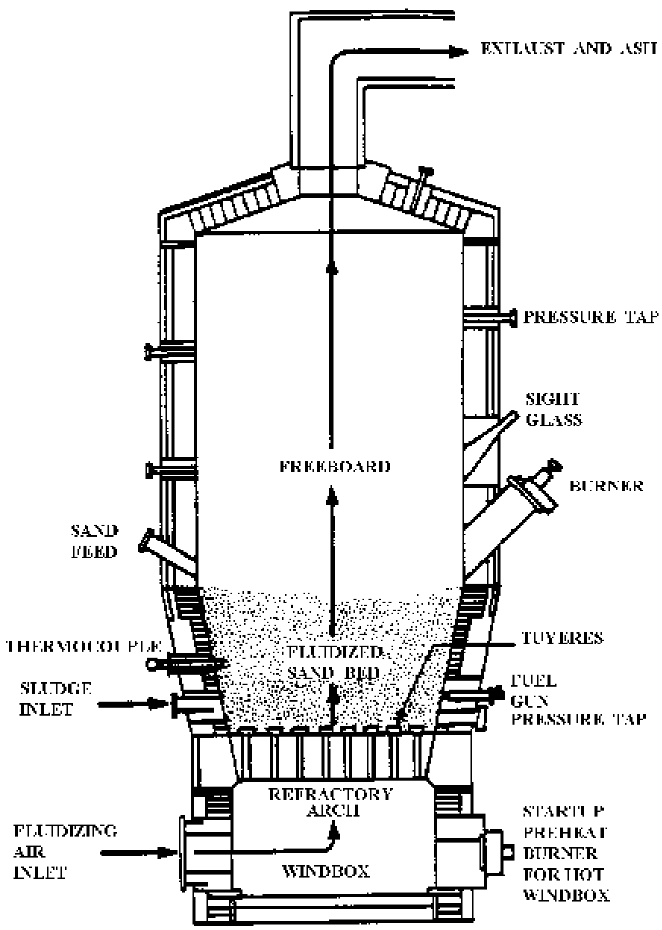
Scum may also be fed to one or more hearths of the incinerator. Scum is the material that floats on wastewater. It is generally composed of vegetable and mineral oils, grease, hair, waxes, fats, and other materials that will float. Scum may be removed from many treatment units including ~~preaeration~~pre-aeration tanks, skimming tanks, and sedimentation tanks. Quantities of scum are generally small compared to those of other wastewater solids.

Ambient air is first ducted through the central shaft and its associated rabble arms. A portion, or all, of this air is then taken from the top of the shaft and recirculated into the lowermost hearth as preheated combustion air. Shaft cooling air which is not circulated back into the furnace is ducted into the stack downstream of the air pollution control devices. The combustion air flows upward through the drop holes in the hearths, countercurrent to the flow of the sludge, before being exhausted from the top hearth. Air enters the bottom to cool the ash. Provisions are usually made to inject ambient air directly into the middle hearths as well.

From the standpoint of the overall incineration process, ~~multiple hearth furnaces~~MHFs can be divided into three zones. The upper hearths comprise the drying zone where most of the moisture in the sludge is evaporated. The temperature in the drying zone is typically between 425 and 760~~E~~°C (800 and 1400~~E~~°F). Sludge combustion occurs in the middle hearths (second zone) as the temperature is increased to about 925~~E~~°C (1700~~E~~°F). The combustion zone can be further subdivided into the upper-middle hearths where the volatile gases and solids are burned, and the lower-middle hearths where most of the fixed carbon is combusted. The third zone, made up of the lowermost hearth(s), is the cooling zone. In this zone the ash is cooled as ~~its~~its' heat is transferred to the incoming combustion air.

~~Multiple hearth furnaces~~ MHFs are sometimes operated with afterburners to further reduce odors and concentrations of unburned hydrocarbons. In afterburning, furnace exhaust gases are ducted to a chamber where they are mixed with supplemental fuel and air and completely combusted. Some incinerators have the flexibility to allow sludge to be fed to a lower hearth, thus allowing the upper hearth(s) to function essentially as an afterburner.

Under normal operating condition, 50 to 100 percent excess air must be added to an MHF ~~in order~~ to ensure complete combustion of the sludge. Besides enhancing contact between fuel and oxygen in the furnace, these relatively high rates of excess air are necessary to compensate for normal variations in both the organic characteristics of the sludge feed and the rate at which it enters the incinerator. When an inadequate amount of excess air is available, only partial oxidation of the carbon will occur, with a resultant increase in emissions of carbon monoxide, soot, and hydrocarbons.
Too much excess air, on the other hand, can cause increased entrainment of particulate and unnecessarily high auxiliary fuel consumption.



~~Multiple hearth furnace~~ MHF emissions are usually controlled by a venturi scrubber, an impingement tray scrubber, or a combination of both. Wet cyclones and dry cyclones are also used. Wet electrostatic

~~Figure 2.2-2. Cross Section of a Fluidized Bed Furnace~~

precipitators (Wet ESPs) are being installed as retrofits where tighter limits on particulate matter and metals are required by State regulations.

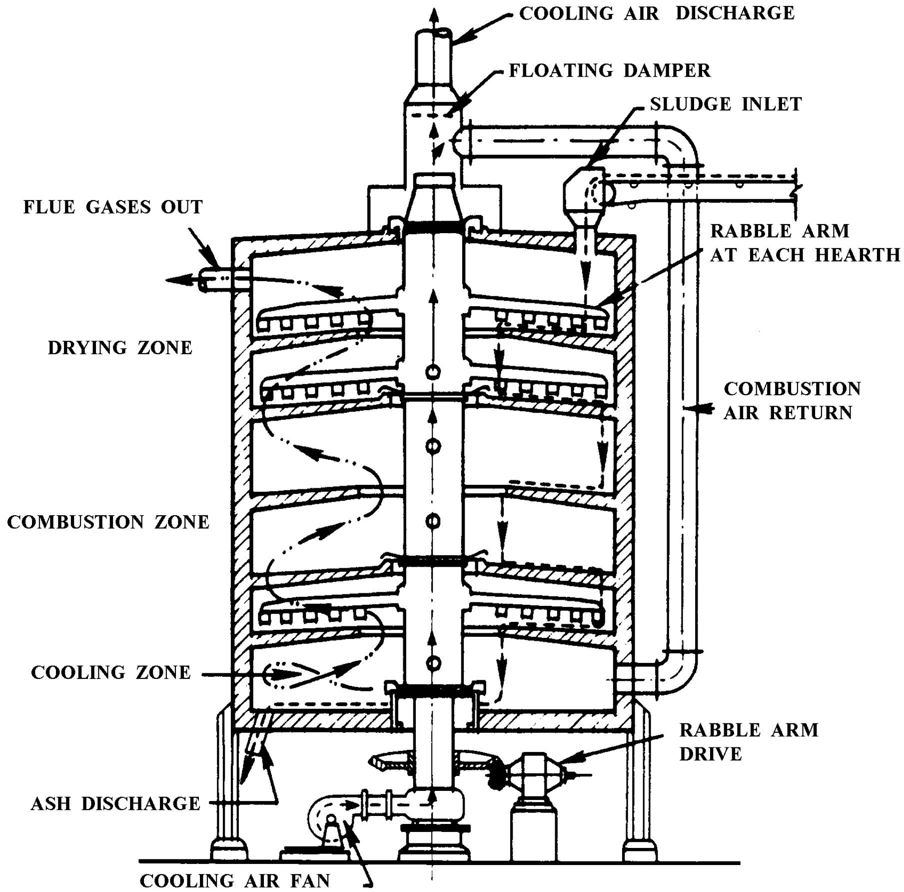


Figure 2.2-1. Cross Section of a Multiple Hearth Furnace

Formatted: Font: 11 pt, Condensed by 0.1 pt

Formatted: Font: 11 pt, Condensed by 0.1 pt

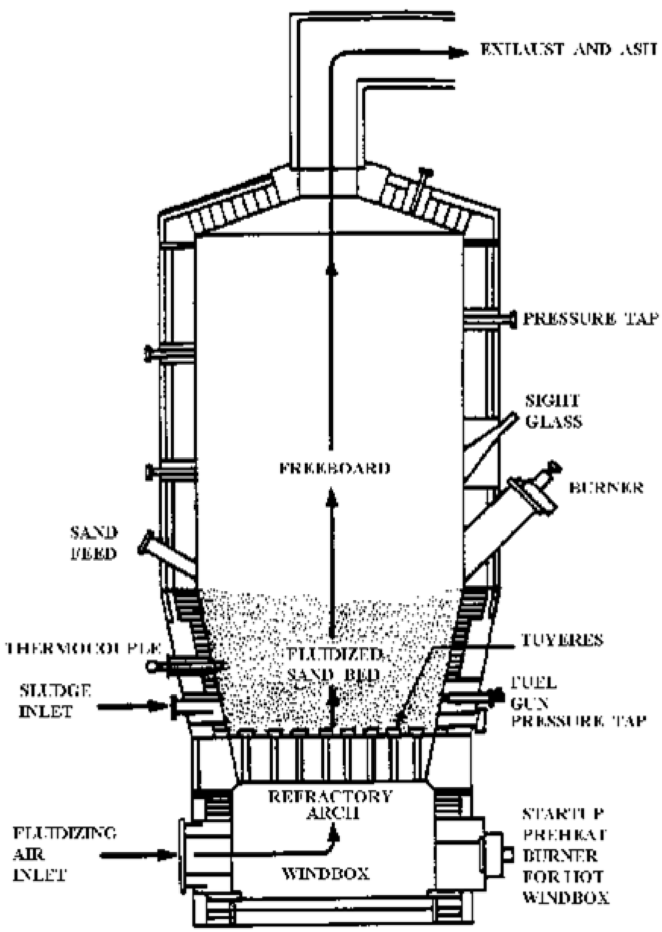


Figure 2-.2-2. Cross Section of a Fluidized Bed ~~Incinerators~~ Furnace

Formatted: Condensed by 0.1 pt

Formatted: Condensed by 0.1 pt

2.2.1.2 Fluidized Bed Incinerators

Fluidized bed technology was first developed by the petroleum industry to be used for catalyst regeneration. Figure 2.2-2 shows the cross-section diagram of a fluidized bed furnace. Fluidized bed combustors (FBCs) consist of a vertically oriented outer shell constructed of steel and lined with refractory. Tuyeres (nozzles designed to deliver blasts of air) are located at the base of the furnace within a refractory-lined grid. A bed of sand, approximately 0.75 meters (2.5 feet) thick, rests upon the grid. Two general configurations can be distinguished on the basis of how the fluidizing air is injected into the furnace. In the "hot windbox" design the combustion air is first preheated by passing through a heat exchanger where heat is recovered from the hot flue gases. Alternatively, ambient air can be injected directly into the furnace from a cold windbox.

Partially dewatered sludge is fed into the lower portion of the furnace. Air injected through the tuyeres, at pressures of from 20 to 35 kilopascals (3 to 5 pounds per square inch gauge), simultaneously fluidizes the bed of hot sand and the incoming sludge. Temperatures of 750 to 925~~E~~°C (1400 to 1700~~E~~°F) are maintained in the bed. Residence times are typically 2 to 5 seconds. As the sludge burns, fine ash particles are carried out the top of the furnace. Some sand is also removed in the air stream; sand make-up requirements are on the order of 5 percent for every 300 hours of operation.

Combustion of the sludge occurs in two zones. Within the bed itself (Zone 1), evaporation of the water and pyrolysis of the organic materials occur nearly simultaneously as the temperature of the sludge is rapidly raised. In the second zone (freeboard area), the remaining free carbon and combustible gases are burned. The second zone functions essentially as an afterburner.

Fluidization achieves nearly ideal mixing between the sludge and the combustion air and the turbulence facilitates the transfer of heat from the hot sand to the sludge. The most noticeable impact of the better burning atmosphere provided by a fluidized bed incinerator is seen in the limited amount of excess air required for complete combustion of the sludge. Typically, FBCs can achieve complete combustion with 20 to 50 percent excess air, about half the excess air required by ~~multiple hearth furnaces.~~ MHFs. As a consequence, FBC incinerators have generally lower fuel requirements compared to MHF incinerators.

Fluidized bed incinerators most often have venturi scrubbers or venturi/impingement tray scrubber combinations for emissions control.

2.2.1.3 Electric Infrared Incinerators

The first electric infrared furnace was installed in 1975, and their use is not common. Electric infrared incinerators consist of a horizontally oriented, insulated furnace. A woven wire belt conveyor extends the length of the furnace and infrared heating elements are located in the roof above the conveyor belt. Combustion air is preheated by the flue gases and is injected into the discharge end of the furnace. Electric infrared incinerators consist of a number of prefabricated modules, which can be linked together to provide the necessary furnace length. A cross section of an electric furnace is shown in Figure 2.2-3. The dewatered sludge cake is conveyed into one end of the incinerator. An internal roller mechanism levels the sludge into a continuous layer approximately one inch thick across the width of the belt. The sludge is sequentially dried and then burned as it moves beneath the infrared heating elements. Ash is discharged into a hopper at the opposite end of the furnace. The preheated combustion air enters the furnace above the ash hopper and is further heated by the outgoing ash. The direction of air flow is countercurrent to the movement of the sludge along the conveyor. –Exhaust gases leave the furnace at the feed end.– Excess air rates vary from 20 to 70 percent.

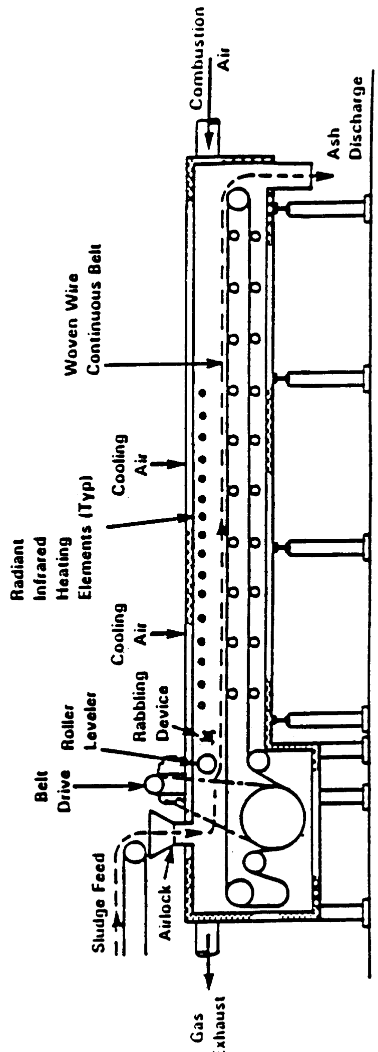


Figure 1.2-3. Cross Section of an Electric Infrared Furnace.

Formatted: Font: (Default) CG Times, 12 pt

Formatted: Font: CG Times, 1 pt

Compared to MHF and FBC technologies, the electric infrared furnace offers the advantage of lower capital cost, for especially smaller systems. However, electricity costs in some areas may make an electric furnace infeasible. One other concern is replacement of various components such as the woven wire belt and infrared heaters, which have 3- to 5-year lifetimes.

Electric infra nturi scrubber or some other wet scrubber.

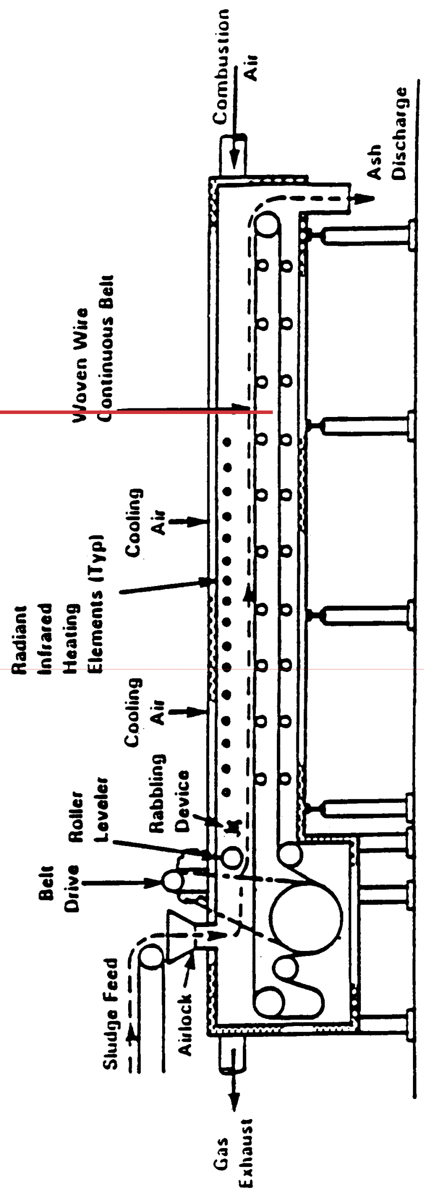


Figure 2.2-3. Cross Section of an Electric Infrared Furnace.
Figure 2.2-3. Cross Section of an Electric Infrared Furnace.

Formatted: Not Hidden

Formatted: Font: CG Times

Formatted: Font: CG Times

Formatted: Font: CG Times, 1 pt

Formatted: Font: CG Times, 1 pt

Formatted: Caption, Line spacing: single, Hyphenate, Tab stops: Not at 0" + 0.5" + 0.64" + 1.5" + 2" + 2.5" + 3" + 3.5" + 4" + 4.5" + 5" + 5.5" + 6" + 6.5", Position: Horizontal: 1.54", Relative to: Page, Vertical: 1.08", Relative to: Page, Horizontal: 0.17", Vertical: 0.17", Width: Exactly 5.04", Height: At least 8.53"

Formatted: Caption, Line spacing: single, Hyphenate, Tab stops: Not at 0" + 0.5" + 0.64" + 1.5" + 2" + 2.5" + 3" + 3.5" + 4" + 4.5" + 5" + 5.5" + 6" + 6.5", Position: Horizontal: 1.54", Relative to: Page, Vertical: 1.08", Relative to: Page, Horizontal: 0.17", Vertical: 0.17", Width: Exactly 5.04", Height: At least 8.53"

2.2.1.4 Other Technologies

A number of other technologies have been used for incineration of sewage sludge, including cyclonic reactors, rotary kilns, and wet oxidation reactors. These processes are not in widespread use in the United States and will be discussed only briefly.

The cyclonic reactor is designed for small capacity applications. It is constructed of a vertical cylindrical chamber that is lined with refractory. Preheated combustion air is introduced into the chamber tangentially at high velocities. The sludge is sprayed radially toward the hot refractory walls. Combustion is rapid: The residence time of the sludge in the chamber is on the order of 10 seconds. The ash is removed with the flue gases.

Rotary kilns are also generally used for small capacity applications. The kiln is inclined slightly from the horizontal plane, with the upper end receiving both the sludge feed and the combustion air. A burner is located at the lower end of the kiln. The circumference of the kiln rotates at a speed of about 15 centimeters (cm) per second (6 inches per second). Ash is deposited into a hopper located below the burner.

The wet oxidation process is not strictly one of incineration; it instead utilizes oxidation at elevated temperature and pressure in the presence of water (flameless combustion). Thickened sludge, at about 6 percent solids, is first ground and mixed with a stoichiometric amount of compressed air. The slurry is then pressurized. The mixture is then circulated through a series of heat exchangers before entering a pressurized reactor. The temperature of the reactor is held between 175 and 315~~F~~°C (350 and 600~~F~~°F). The pressure is normally 7,000 to 12,500 kilopascals (1,000 to 1,800 pounds per square inch grade). Steam is usually used for auxiliary heat. The water and remaining ash are circulated out the reactor and are finally separated in a tank or lagoon. The liquid phase is recycled to the treatment plant. ~~Offgases~~Off-gases must be treated to eliminate odors: wet scrubbing, afterburning, or carbon absorption may be used.

2.2.1.5 Co-incineration and Co-firing

Wastewater treatment plant sludge generally has a high-water content and in some cases, fairly high levels of inert materials. As a result, its net fuel value is often low. If sludge is combined with other combustible materials in a co-incineration scheme, a furnace feed can be created that has both a low water concentration and a heat value high enough to sustain combustion with little or no supplemental fuel.

Virtually any material that can be burned can be combined with sludge in a co-incineration process. Common materials for co-combustion are coal, municipal solid waste (MSW), wood waste and agriculture waste. Thus, a municipal or industrial waste can be disposed of while providing an autogenous (self-sustaining) sludge feed, thereby solving two disposal problems.

There are two basic approaches to combusting sludge with MSW: (1) use of MSW combustion technology by adding dewatered or dried sludge to the MSW combustion unit, and (2) use of sludge combustion technology by adding processed MSW as a supplemental fuel to the sludge furnace. With the latter, MSW is processed by removing ~~noncombustibles~~non-combustibles, shredding, air classifying, and screening. Waste that is more finely processed is less likely to cause problems such as severe erosion of the hearths, poor temperature control, and refractory failures.

Formatted: Heading 3, Line spacing: single, Hyphenate, Tab stops: Not at 0" + 0.5" + 0.64" + 1.5" + 2" + 2.5" + 3" + 3.5" + 4" + 4.5" + 5" + 5.5" + 6" + 6.5"

2.2.2 Emissions And Controls[1]and Controls[1-3]

Formatted: Heading 2, Line spacing: single, Hyphenate, Tab stops: Not at 0" + 0.5" + 0.64" + 1.5" + 2" + 2.5" + 3" + 3.5" + 4" + 4.5" + 5" + 5.5" + 6" + 6.5"

Sewage sludge incinerators potentially emit significant quantities of pollutants. The major pollutants emitted are: (1) particulate matter, (2) metals, (3) carbon monoxide (CO), (4) nitrogen oxides (NO_x), (5) sulfur dioxide (SO_2), and (6) unburned hydrocarbons. Partial combustion of sludge can result in emissions of intermediate products of incomplete combustion (PIC), including toxic organic compounds.

Uncontrolled particulate emission rates vary widely depending on the type of incinerator, the volatiles and moisture content of the sludge, and the operating practices employed. Generally, uncontrolled particulate emissions are highest from fluidized bed incinerators because suspension burning results in much of the ash being carried out of the incinerator with the flue gas. Uncontrolled emissions from multiple hearth and fluidized bed incinerators are extremely variable, however. Electric incinerators appear to have the lowest rates of uncontrolled particulate release of the three major furnace types, possibly because the sludge is not disturbed during firing. In general, higher airflow rates increase the opportunity for particulate matter to be entrained in the exhaust gases. Sludge with low volatile content or high moisture content may compound this situation by requiring more supplemental fuel to burn. As more fuel is consumed, the amount of air flowing through the incinerator is also increased. However, no direct correlation has been established between airflow and particulate emissions.

Metal emissions are affected by metal content of the sludge, fuel bed temperature, and the level of particulate matter control. Since metals which are volatilized in the combustion zone condense in the exhaust gas stream, most metals (except mercury) are associated with fine particulate and are removed as the fine particulates are removed.

Carbon monoxide is formed when available oxygen is insufficient for complete combustion or when excess air levels are too high, resulting in lower combustion temperatures.

Emissions of nitrogen and sulfur oxides are primarily the result of oxidation of nitrogen and sulfur in the sludge. Therefore, these emissions can vary greatly based on local and seasonal sewage characteristics.

Emissions of volatile organic compounds (VOC) also vary greatly with incinerator type and operation. Incinerators with countercurrent airflow such as multiple hearth designs provide the greatest opportunity for unburned hydrocarbons to be emitted. In the MHF, hot air and wet sludge feed are contacted at the top of the furnace. Any compounds distilled from the solids are immediately vented from the furnace at temperatures too low to completely destruct them.

Particulate emissions from sewage sludge incinerators have historically been controlled by wet scrubbers, since the associated sewage treatment plant provides both a convenient source and a good disposal option for the scrubber water. The types of existing sewage sludge incinerator controls range from low pressure drop spray towers and wet cyclones to higher pressure drop venturi scrubbers and venturi/impingement tray scrubber combinations. Electrostatic precipitators and baghouses are employed primarily where sludge is co-fired with municipal solid waste. The most widely used control device applied to a multiple hearth incinerator is the impingement tray scrubber. Older units use the tray scrubber alone while combination venturi/impingement tray scrubbers are widely applied to newer multiple hearth incinerators and to fluidized bed incinerators. Most electric incinerators and many fluidized bed incinerators use venturi scrubbers only.

In a typical combination venturi/impingement tray scrubber, hot gas exits the incinerator and enters the precooling or quench section of the scrubber. Spray nozzles in the quench section cool the incoming gas and the quenched gas then enters the venturi section of the control device. Venturi water is usually pumped into an inlet weir above the quencher. The venturi water enters the scrubber above the throat and floods the throat completely. This eliminates build-up of solids and reduces abrasion. Turbulence created by high gas velocity in the converging throat section deflects some of the water traveling down the throat into the gas stream. Particulate matter carried along with the gas stream impacts on these water particles and on the water wall. As the scrubber water and flue gas leave the venturi section, they pass into a flooded elbow where the stream velocity decreases, allowing the water and gas to separate. Most venturi sections come equipped with variable throats. By restricting the throat area within the venturi, the linear gas velocity is increased, and the pressure drop is subsequently increased. Up to a certain point, increasing the venturi pressure drop increases the removal efficiency. Venturi scrubbers typically maintain 60 to 99 percent removal efficiency for particulate matter, depending on pressure drop and particle size distribution.

At the base of the flooded elbow, the gas stream passes through a connecting duct to the base of the impingement tray tower. Gas velocity is further reduced upon entry to the tower as the gas stream passes upward through the perforated impingement trays. Water usually enters the trays from inlet ports on opposite sides and flows across the tray. As gas passes through each perforation in the tray, it creates a jet which bubbles up the water and further entrains solid particles. At the top of the tower is a mist eliminator to reduce the carryover of water droplets in the stack effluent gas. The impingement section can contain from one to four trays, but most systems for which data are available have two or three trays.

~~Emission factors and~~ Tables containing emission ~~factor ratings~~ factors for multiple hearth sewage sludge incinerators ~~are shown in Tables 2.2-1, 2.2-2, 2.2-3, 2.2-4, and 2.2-5. Tables 2.2-6, 2.2-7, and 2.2-8 present emission factors~~, for fluidized bed sewage sludge incinerators~~. Table 2.2-9 presents the available emission factors~~ and for electric infrared incinerators~~. Tables 2.2-10 and 2.2-11 present the cumulative particle size distribution and size-specific emission factors for sewage sludge incinerators. Figure 2.2-4, Figure 2.2-5, and Figure 2.2-6 present cumulative particle size distribution and size-specific emission factors for multiple-hearth, fluidized-bed, and electric infrared incinerators, respectively.~~ are listed below:

- Table 2.2-1 (Metric ~~And~~and English Units). CRITERIA POLLUTANT EMISSION FACTORS FOR MULTIPLE HEARTH SEWAGE SLUDGE ~~INCINERATORS[a]~~INCINERATORS
- Table 2.2-2 (Metric and English Units). ACID GAS EMISSION FACTORS FOR MULTIPLE HEARTH SEWAGE SLUDGE INCINERATORS
- Table 2.2-3 (Metric and English Units). CHLORINATED DIBENZO-P-DIOXIN (CDD) AND CHLORINATED DIBENZOFURAN (CDF) EMISSION FACTORS FOR MULTIPLE HEARTH SEWAGE SLUDGE INCINERATORS
- Table 2.2-4 (Metric and English Units). SUMMARY OF ORGANIC COMPOUND EMISSIONS FROM MULTIPLE HEARTH SEWAGE SLUDGE INCINERATORS
- Table 2.2-5 (Metric and English Units). SUMMARY OF METAL EMISSIONS FROM MULTIPLE HEARTH SEWAGE SLUDGE INCINERATORS
- Table 2.2-6 (Metric and English Units). CRITERIA POLLUTANT EMISSION FACTORS FOR FLUIDIZED BED SEWAGE SLUDGE INCINERATORS
- Table 2.2-7 (Metric and English Units). ACID GAS AND ORGANIC COMPOUND EMISSION FACTORS FOR FLUIDIZED BED SEWAGE SLUDGE INCINERATORS
- Table 2.2-8 (Metric and English Units). METAL EMISSION FACTORS FOR FLUIDIZED BED SEWAGE SLUDGE INCINERATORS

Formatted: Font: 10 pt, Not Expanded by / Condensed by

Formatted: Font: 10 pt

Formatted: Font: 10 pt

Formatted: List Paragraph, Left, Right: 0", Space After: 8 pt, Line spacing: Multiple 1.08 li, Bulleted + Level: 1 + Aligned at: 0.25" + Indent at: 0.5", Hyphenate, Tab stops: Not at 3.25"

Formatted: Font: 10 pt, Not Superscript/ Subscript, Not Expanded by / Condensed by

- Table 2.2-9 (Metric and English Units). SUMMARY OF EMISSION FACTORS FOR ELECTRIC INFRARED SEWAGE SLUDGE INCINERATORS
- Table 2.2-10 (Metric and English Units). CARBON DIOXIDE EMISSION FACTORS FOR SEWAGE SLUDGE INCINERATORS
- Table 2.2-11 (Metric and English Units). CUMULATIVE PARTICLE SIZE DISTRIBUTION FOR SEWAGE SLUDGE INCINERATORS
- Table 2.2-12 (Metric and English Units). CUMULATIVE PARTICLE SIZE-SPECIFIC EMISSION FACTORS FOR SEWAGE SLUDGE INCINERATORS

2.2.3 Updates to the Section

January 2023:

- Updated/added 66 emission factors
- Updated Source Classification Codes (SCCs): The SCCs used in the previous version of this chapter have been retired. The following SCCs have replaced the existing SCCs:
    - SCC 5-01-005-15 has been replaced with SCC 5-01-008-02
    - SCC 5-01-005-16 has been replaced with SCC 5-01-008-03
    - SCC 5-01-005-17 has been replaced with SCC 5-01-008-04
    - SCC 5-02-005-15 has been replaced with SCC 5-06-007-02
- New quality ratings have been given to factors new/revised based on approaches contained in the revised Emissions Factors Procedures Document. Factors are given quality ratings based on representativeness of factor (e.g., Highly, Moderately, Minimally).

Table 2.2-1 (Metric and English Units). CRITERIA POLLUTANT EMISSION FACTORS FOR MULTIPLE HEARTH SEWAGE SLUDGE INCINERATORS[a]

Source CategoryCategory[b]	Filterable Particulate Matter (PM) lb/MMBtu Heat Input	Sulfur Dioxide (SO_2) Nitrogen Oxides (NO_x)[e] kg/Mg	lb/ton	EMISSION FACTOR RATING	Primary Particulate Matter (PM) kg/Mg	lb/ton	EMISSION FACTOR RATING	Filterable Particulate Matter10 (PM10) kg/Mg	lb/ton	EMISSION FACTOR RATING
Uncontrolled	5.2 E+01	1.03 E+0201[z] B 1.4 E+01	2.86 E+0101[z]	BModerately				2.52 E+0000[ai]	5.04.4 E+0000[ai]	CModerately
Controlled										
Afterburner/tray-type gas absorption column/cyclone/wet ESP[b]/scrubber[ad]	-	3.6 E-01[ae]	7.2 E-01[ae]	Highly	-	-	-	-	-	-
CycloneAfterburner/wet scrubber	2.0 E+00	4.03.9 E+00-01[aa] E	27.8 E+00-01[aa]	Moderately	5.64.0 E+00-01[af]	8.0 E-01[af]	Minimally			
Afterburner/venturi/wet scrubber	2.3 E-02[ab,n]	-	-	Moderately	-	-	-	-	-	-
Afterburner/venturi/wet scrubber	3.1 E-02[ac,s]	-	-	Moderately	-	-	-	-	-	-
Cyclone	-	6.0 E-01[y]	1.2 E+00[y]	Moderately	-	-	-	-	-	-
Cyclone/impingement		4.0 E-01	8.0 E-01	E						
Cyclone/venturi	-	2.5 E-01	5.0 E-01	D						
Cyclone/venturi/impingement	-	3.1 E-01	6.2 E-01	E						
Electrostatic precipitator										
Fabric filter		2.0 E-03	4.0 E-03	E						
Impingement	-	7.0 E-01	1.4 E+00	B	3.2 E-01	6.4 E-01	D			
Venturi	-	1.60 E+0000[x]	3.2.1 E+0000[x]	BHighly	2.3 E+00	4.6 E+00	E			
Venturi/impingement/afterburner										
Venturi/impingement		1.1 E+00	2.2 E+00	A	1.0 E-01	2.0 E-01	E			
Venturi/impingement/Wetwet ESP	-	2.0 E-01	4.0 E-01	E						

~~Venturi/Wet ESP~~			

Formatted: Not Hidden

Formatted: Left, Space After: 10 pt, Line spacing: Multiple 1.15 li, Widow/Orphan control, Hyphenate, Adjust space between Latin and Asian text, Adjust space between Asian text and numbers, Tab stops: Not at 0" + 0.5" + 0.64" + 1.5" + 2" + 2.5" + 3" + 3.5" + 4" + 4.5" + 5" + 5.5" + 6" + 6.5"

Table 2.2-1 (continued).

Source Category	Carbon Monoxide (CO)[e]			Lead[d]			Methane			Total Nonmethane Organic Compounds		
	kg/Mg	lb/ton	EMISSION FACTOR RATING	kg/Mg	lb/ton	EMISSION FACTOR RATING	kg/Mg	lb/ton	EMISSION FACTOR RATING	kg/Mg	lb/ton	EMISSION FACTOR RATING
Uncontrolled	1.55 E+01	3.1 E+01	C	5.0 E-02	1.0 E-01	B				8.4 E-01	1.7 E+00	D
Controlled												
Afterburner/wet scrubber	1.6 E+00[f]	3.2 E+00[f]	Minimally	6.5 E-04[g]	1.3 E-03[g]	Moderately	-	-	-	-	-	-
Afterburner/scrubber[h]/ regenerative thermal oxidizer/ quench tower/wet ESP/dry ESP/ cyclone/tray type gas absorption column	-	-	-	7.0 E-03[i]	1.4 E-02[i]	Highly	-	-	-	-	-	-
Cyclone				3.0 E-02	6.0 E-02	E				1.5 E+00	3.0 E+00	E
Cyclone/impingement												
Cyclone/venturi				3.0 E-03	6.0 E-03	E				2.2 E-01	4.4 E-01	E
Cyclone/venturi/ impingement				1.1 E-02	2.2 E-02	E						
Electrostatic precipitator				1.0 E-03	2.0 E-03	E						
~~Fabric filter~~												
Impingement				2.0 E-02	4.0 E-02	E	3.9 E-01	7.8 E-01	E	7.8 E-01	1.6 E+00	E
Venturi				~~9.0~~4.6 E-~~04~~03[e]	~~1.8~~9.3 E-~~03~~03[e]	~~E~~Minimally	3.2 E+00	6.4 E+00	E			
Venturi/impingement/ afterburner				5.0 E-02	1.0 E-01	E						
Venturi/impingement				3.0 E-02	6.0 E-02	B						
Venturi/impingement/ Wet ESP												
Venturi/Wet ESP				9.0 E-05	1.8 E-04	E						

Table 2.2-1 (continued).

	Nitrogen Oxides (NO_x)				Sulfur Dioxide (SO_2)				
Source Category	lb/MMbtu Heat Input	kg/Mg	lb/ton	EMISSION FACTOR RATING	lb/MMbtu Heat Input CO_2	lb/MMbtu Heat Input O_2	kg/Mg	lb/ton	EMISSION FACTOR RATING
Uncontrolled		2.5 E+00	5.0 E+00	C			1.4 E+01	2.8 E+01	B
Controlled									
Afterburner/scrubber[ad]									
Afterburner/wet scrubber		2.8 E+00[j]	5.6 E+00[j]	Moderately			1.5 E-01 [ag]	3.0 E-01[ag]	Minimally
Afterburner/ESP/regenerative thermal oxidizer/scrubber[l]/wet ESP	2.2 E-01[m,n]			Moderately					
Afterburner/ESP/scrubber[o]/ wet ESP		2.6 E+00[p]	5.2 E+00[p]	Moderately					
Afterburner/scrubber[t]/wet ESP	4.0 E-02[u,v,n]			Moderately					
Afterburner/scrubber[t]/regenerative thermal oxidizer/wet ESP	5.6 E-02[w,v,s]			Moderately	1.8 E-02[ah,v]	2.3 E-02[c,v]			Moderately
Afterburner/ESP/regenerative thermal oxidizer/scrubber[q]/wet ESP	2.1 E-01[r,s]			Moderately					
Cyclone							2.8 E+00	5.6 E+00	E
Impingement		3.5 E+00[k]	6.9 E+00[k]	Minimally			3.2 E-01	6.4 E-01	D
Venturi							2.3 E+00	4.6 E+00	E
Venturi/impingement							1.0 E-01	2.0 E-01	E

[a]Units are pollutants emitted of ~~dry~~dried sludge ~~burned.~~fed unless otherwise stated. Source Classification Code (SCC) 5-01-~~005-15~~008-02 unless otherwise stated. Blanks indicate no data.
~~[b]Wet ESP = wet~~[b]ESP = electrostatic precipitator.
~~[c]Uncontrolled emission factors for NO_x and CO apply to all air pollution control device types.~~
[c]Reference 132
[d]Hazardous air pollutants listed in the *Clean Air Act*.

[e]Reference 117
[f]Reference 86
[g]Reference 87
[h]Impingement type wet scrubber/packed bed scrubber/scrubber/wet scrubber/venturi scrubber
[i]Reference 113
[j]Reference 91
[k]Reference 92
[l]Scrubber/spray scrubber/venturi scrubber/wet scrubber
[m]Reference 120
[n]lb/MMBtu Heat Input CO_2
[o]Impingement type wet scrubber/scrubber/wet scrubber/venturi scrubber
[p]Reference 124
[q]Scrubber/spray scrubber/venturi scrubber/wet scrubber
[r]Reference 146
[s]lb/MMBtu Heat Input O_2
[t]Impingement venturi spray scrubber/wet scrubber
[u]Reference 121
[v]SCC 5-06-007-02
[w]Reference 123
[x]Reference 96
[y]Reference 94
[z]Reference 97
[aa]Reference 95
[ab]Reference 127
[ac]Reference 128
[ad]Scrubber/wet scrubber/venturi scrubber
[ae]Reference 129
[af]Reference 100
[ag]Reference 102
[ah]Reference 130
[ai]Reference 101

Table 2.2-2 (Metric ~~And~~and English Units). ACID GAS EMISSION FACTORS FOR MULTIPLE HEARTH SEWAGE SLUDGE INCINERATORS[a]

Source ~~Category~~[b]Category	Sulfuric Acid (H_2SO_4) g/Mg	lb/ton	EMISSION FACTOR RATING	Hydrogen Chloride (HCl)[c] kg/Mg	lb/ton	EMISSION FACTOR RATING
Uncontrolled	6.0 E-01	1.2 E+00	D			
Controlled						
Afterburner/regenerative thermal oxidizer/scrubber[d]/wet ESP[b]	-	-	-	5.0 E-03[e]	1.0 E-02[e]	Highly
Cyclone	3.3 E-01	6.6 E-01	E			
Cyclone/impingement				1.0 E-02	2.0 E-02	E
Cyclone/venturi				1.0 E-02	2.0 E-02	E
Cyclone/venturi/impingement						
Electrostatic precipitator						
Fabric filter						
Impingement	5.0 E-02	1.0 E-01	E	1.0 E-02	2.0 E-02	E
Venturi				1.0 E-02	2.0 E-02	E
Venturi/impingement/afterburner						
Venturi/impingement	2.0 E-01	4.0 E-01	E			
Venturi/impingement/~~Wet~~wet ESP						
Venturi/Wet ESP						

[a]Units are pollutants emitted of ~~dry~~dried sludge ~~burned~~fed. Source Classification Code (SCC) 5-01-~~005-15~~008-02. Blanks indicate no data.
[b]~~Wet ESP = wet~~ [b]ESP = electrostatic precipitator.
[c]Hazardous air pollutants listed in the *Clean Air Act*.
~~[c]Hazardous air pollutants listed in the *Clean Air Act*.~~
[d]Impingement plate scrubber/scrubber/tray scrubber/venturi scrubber/wet scrubber
[e]Reference 111

Table 2.2-3 (Metric ~~And~~and English Units). CHLORINATED DIBENZO-P-DIOXIN (CDD) AND CHLORINATED DIBENZOFURAN (CDF) EMISSION FACTORS FOR MULTIPLE HEARTH SEWAGE SLUDGE INCINERATORS[a]

EMISSION FACTOR RATING: E, unless otherwise noted

	2,3,7,8-TCDD[c]		Total TCDD		Total PCDD	
Source ~~Category[b]~~Category	~~Φg~~µg/Mg	lb/ton	~~Φg~~µg/Mg	lb/ton	~~Φg~~µg/Mg	lb/ton
Uncontrolled			6.3 E+01	1.3 E-07	2.7 E+00	5.4 E-09
Controlled						
Cyclone						
Cyclone/impingement						
Cyclone/venturi			1.4 E+00	2.8 E-09		
Cyclone/venturi/impingement	3.0 E-01	6.0 E-10				
Electrostatic precipitator						
Fabric filter						
Impingement	5.0 E-01	1.0 E-09	2.8 E+01	5.6 E-08	3.7 E+00	7.4 E-09
Venturi						
Venturi/impingement/afterburner	9.0 E-01	1.8 E-09				
Venturi/impingement	2.0 E+00	4.0 E-09				
Venturi/~~impingement/Wet ESP~~cyclone/afterburner/wet ESP[b]			1.7 E+01[m,s]	3.3 E-08[m,s]		
Venturi/~~Wet~~wet ESP						

Table 2.2-3 (cont.).

Source ~~Category~~[b]Category	Total HxCDD		Total HpCDD		Total OCDD	
	~~Φg~~μg/Mg	lb/ton	~~Φg~~μg/Mg	lb/ton	~~Φg~~μg/Mg	lb/ton
Uncontrolled	6.8 E+01	1.4 E-07	3.4 E+02	6.8 E-07	3.7 E+02	7.4 E-07
Controlled						
Cyclone						
Cyclone/impingement						
Cyclone/venturi			8.0 E-01	1.6 E-09	3.4 E+00	6.8 E-09
Cyclone/venturi/impingement	4.4 E+00	8.8 E-09	1.4 E+01	2.8 E-08	3.1 E+01	6.7 E-08
Electrostatic precipitator						
Fabric filter						
Impingement	2.4 E+01	4.8 E-08	7.3 E+01	1.5 E-07	5.3 E+01	1.1 E-07
Venturi						
Venturi/impingement/afterburner	6.0 E+01	1.2 E-07	2.3 E+01	4.6 E-08	1.2 E+01	2.4 E-08
Venturi/impingement	3.8 E+01	7.6 E-08	1.5 E+01	3.0 E-08	1.9 E+01	3.8 E-08
Venturi/impingement/Wet ESP						
Venturi/Wet ESP						

Table 2.2-3 (cont.).

Source ~~Category~~[b]Category	2,3,7,8-TCDF[c]		Total TCDF[c]		Total PCDF[c]	
	~~Φg~~µg/Mg	lb/ton	~~Φg~~µg/Mg	lb/ton	~~Φg~~µg/Mg	lb/ton
Uncontrolled	6.2 E+02	1.2 E-06	1.7 E+03	3.4 E-06	9.8 E+02	2.0 E-06
Controlled						
Afterburner/regenerative thermal oxidizer/scrubber[d]/quench tower/wet ESP	3.5 E-02 [e,f]	7.0 E-11[e,f]	-	-	-	-
Afterburner/wet scrubber	4.3 E-02[g]	8.6 E-11[g]	-	-	-	-
Cyclone			9.5 E+01[l]	1.9 E-07[l]		
Cyclone/impingement						
Cyclone/venturi	5.6 E+00	1.1 E-08	5.0 E+01	1.0 E-07	1.1 E+01	2.2 E-08
Cyclone/venturi/impingement			1.8 E+02	3.8 E-07	5.7 E+01	1.1 E-07
Electrostatic precipitator						
Fabric filter						
Impingement	1.8 E+02	3.6 E-07	7.0 E+02	1.4 E-06	3.6 E+02	7.2 E-07
Venturi						
Venturi/impingement/afterburner	5.4 E+01	1.1 E-07	3.5 E+02	7.0 E-07	1.3 E+02	2.6 E-07
Venturi/impingement	4.6 E+01	9.2 E-08	6.0 E+02	1.2 E-06	1.3 E+00	2.6 E-09
Venturi/impingement/~~Wet~~wet ESP						
Venturi/~~Wet~~wet ESP						

Table 2.2-3 (cont.).

Source ~~Category[b]~~Category	Total HxCDF[c]		Total HpCDF[c]		Total OCDF[c]	
	~~Φg~~μg/Mg	lb/ton	~~Φg~~μg/Mg	lb/ton	~~Φg~~μg/Mg	lb/ton
Uncontrolled	9.9 E+01	2.0 E-07	4.8 E+02	9.6 E-07	4.9 E+02	9.8 E-07
Controlled						
Cyclone						
Cyclone/impingement						
Cyclone/venturi	3.4 E+00	6.8 E-09	9.0 E-01	1.8 E-09	7.0 E-01	1.4 E-09
Cyclone/venturi/impingement	1.8 E+00	3.6 E-09	2.9 E+00	5.8 E-09	1.8 E+00	3.6 E-09
Electrostatic precipitator						
Fabric filter						
Impingement	1.1 E+02	2.2 E-07	2.0 E+02	4.0 E-07	1.5 E+02	3.0 E-07
Venturi						
Venturi/impingement/afterburner	7.8 E+01	1.5 E-07	4.8 E+01	9.6 E-08	7.7 E+00	1.5 E-08
Venturi/impingement	5.7 E+01	1.1 E-07	4.1 E+01	8.2 E-08	6.3 E+00	1.3 E-08
Venturi/impingement/Wet ESP						
Venturi/Wet ESP						

Table 2.2-3 (cont.).

Source ~~Category~~[b]Category	Total Tetra- through Octa- CDD		Total Tetra- through Octa- CDF		Total Pentachlorodibenzofurans	
	~~Φg~~µg/Mg	lb/ton	~~Φg~~µg/Mg	lb/ton	µg/Mg	lb/ton
Uncontrolled	8.5 E+02	1.7 E-06	3.8 E+03	7.6 E-06		
Controlled						
Cyclone					2.7 E+01[k,s]	5.4 E-08[k,s]
Cyclone/impingement						
Cyclone/venturi	5.6 E+00	1.1 E-08	6.6 E+01	1.3 E-07		
Cyclone/venturi/impingement	1.1 E+02	2.2 E-07	2.5 E+02	5.0 E-07		
Electrostatic precipitator						
Fabric filter						
Impingement	1.8 E+02	3.6 E-07	1.5 E+03	3.0 E-06		
Venturi						
Venturi/impingement/afterburner	3.1 E+02	6.2 E-07	4.6 E+02	9.2 E-07		
Venturi/impingement	2.7 E+02	5.4 E-07	9.3 E+02	1.9 E-06		
Venturi/impingement/Wet ESP						
Venturi/Wet ESP						

Table 2.2-3 (cont.).

-	1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin	-	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin	-	Other Hexachlorodibenzo-p-dioxins	-	Total TEQ	-	-
Source Category	µg/Mg	lb/ton	µg/Mg	lb/ton	µg/Mg	lb/ton	lb/MMBtu Heat Input O_2	µg/Mg	lb/ton
Uncontrolled	-	-	-	-	-	-	-	-	-
Controlled	-	-	-	-	-	-	-	-	-
Afterburner/venturi/wet scrubber	-	-	-	-	4.2 E-02[j,s]	8.4 E-11[j,s]	-	-	-
Afterburner/scrubber[n]/ regenerative thermal oxidizer/ wet ESP	-	-	-	-	-	-	-	2.9 E-02[o,f]	5.7 E-11[o,f]
Afterburner/scrubber[p]/wet ESP	-	-	-	-	-	-	1.5 E-10[q,r,f]	-	-
Afterburner/wet scrubber	9.5 E-0 [h,s]	1.9 E-10[h,s]	2.9 E-02[i,s]	5.8 E-11[i,s]	-	-	-	-	-

[a]Units are pollutant emitted of ~~dry~~dried sludge ~~burned.~~fed unless otherwise noted. Source Classification Code (SCC) 5-01-~~005-15.~~008-02 unless otherwise specified. Blanks indicate no data.
[b]~~Wet ESP = wet~~[b]ESP = electrostatic precipitator.
[c]Hazardous air pollutants listed in the *Clean Air Act*.
~~[c]Hazardous air pollutants listed in the *Clean Air Act*.~~

Formatted: Font: 12 pt
Formatted: Font: Times New Roman, 12 pt, Condensed by 0.1 pt
Formatted: Font: 12 pt
Formatted: Font: 12 pt
Formatted: Font: 12 pt
Formatted: Font: 12 pt
Formatted: Font: CG Times, 12 pt, Not Expanded by / Condensed by
Formatted: Font: CG Times, 12 pt, Not Italic, Not Expanded by / Condensed by
Formatted: Font: CG Times, 12 pt, Not Expanded by / Condensed by
Formatted: Left
Formatted: Font: Times New Roman, Condensed by 0.1 pt
Formatted: Font: Times New Roman, Italic, Condensed by 0.1 pt
Formatted: Justified

[d]Packed bed scrubber – high efficiency, venturi scrubber, impingement plate scrubber, wet scrubber
[e]Reference 143
[f]Moderately representative emission factor
[g]Reference 84
[h]Reference 82
[i]Reference 83
[j]Reference 126
[k]Reference 93
[l]Reference 103
[m]Reference 134
[n]Impingement scrubber/scrubber/spray scrubber/tray scrubber/venturi scrubber/ wet scrubber
[o]Reference 142
[p]Impingement venturi tray scrubber/wet scrubber
[q]SCC 5-06-007-02
[r]Reference 139
[s]Minimally representative emission factor

Table 2.2-4 (Metric ~~And~~and English Units). SUMMARY OF ORGANIC COMPOUND EMISSIONS FROM MULTIPLE HEARTH SEWAGE SLUDGE INCINERATORS[a]

	1,1,1-Trichloroethane[c]			1,1-Dichloroethane[c]			1,2-Dichloroethane[c]		
Source ~~Category~~[b]Category	g/Mg	lb/ton	EMISSION FACTOR RATING	g/Mg	lb/ton	EMISSION FACTOR RATING	g/Mg	lb/ton	EMISSION FACTOR RATING
Uncontrolled	6.0 E-02	1.2 E-04	D						
Controlled									
Cyclone									
Cyclone/impingement	1.9 E+00	3.8 E-03	E	2.3 E-01	4.6 E-04	E			
Cyclone/venturi	7.0 E-02	1.4 E-04	E				4.0 E-03	8.0 E-06	E
Cyclone/venturi/impingement									
Electrostatic precipitator									
Fabric filter									

Impingement									
Venturi									
Venturi/impingement/afterburner	1.4 E+00	2.8 E-03	E				3.0 E-02	6.0 E-05	E
Venturi/impingement	6.1 E-01	1.2 E-03	D				1.0 E-02	2.0 E-05	E
Venturi/impingement/Wet ~~ESP~~ESP[b]									
Venturi/Wet ESP									

Table 2.2-4 (cont.).

Formatted: Font: Times New Roman

Formatted: Centered

Table 2.2-4 (cont.).

Source Category[b]	1,2-Dichlorobenzene g/Mg	1,2-Dichlorobenzene lb/ton	1,2-Dichlorobenzene EMISSION FACTOR RATING	1,3-Dichlorobenzene g/Mg	1,3-Dichlorobenzene lb/ton	1,3-Dichlorobenzene EMISSION FACTOR RATING	1,4-Dichlorobenzene[c] g/Mg	1,4-Dichlorobenzene[c] lb/ton	1,4-Dichlorobenzene[c] EMISSION FACTOR RATING
Uncontrolled	3.7 E-01	7.4 E-04	E				4.1 E-01	8.2 E-04	E
Controlled									
Cyclone									
Cyclone/impingement									
Cyclone/venturi				5.0 E-02	1.0 E-04	E	7.0 E-03	1.4 E-05	E
Cyclone/venturi/impingement									
Electrostatic precipitator									
Fabric filter									
Impingement									
Venturi									
Venturi/impingement/ afterburner									

Source Category	1,2-Dichlorobenzene g/Mg	1,2-Dichlorobenzene lb/ton	1,2-Dichlorobenzene EMISSION FACTOR RATING	1,3-Dichlorobenzene g/Mg	1,3-Dichlorobenzene lb/ton	1,3-Dichlorobenzene EMISSION FACTOR RATING	1,4-Dichlorobenzene[c] g/Mg	1,4-Dichlorobenzene[c] lb/ton	1,4-Dichlorobenzene[c] EMISSION FACTOR RATING
Uncontrolled	3.7 E-01	7.4 E-04	E	-	-	-	4.1 E-01	8.2 E-04	E
Controlled	-	-	-	-	-	-	-	-	-
Cyclone	-	-	-	-	-	-	-	-	-
Cyclone/impingement	-	-	-	-	-	-	-	-	-
Cyclone/venturi	-	-	-	5.0 E-02	1.0 E-04	E	7.0 E-03	1.4 E-05	E
Cyclone/venturi/impingement	-	-	-	-	-	-	-	-	-
Electrostatic precipitator	-	-	-	-	-	-	-	-	-
Fabric filter	-	-	-	-	-	-	-	-	-
Impingement	-	-	-	-	-	-	-	-	-
Venturi	-	-	-	-	-	-	-	-	-
Venturi/impingement/	-	-	-	-	-	-	-	-	-

afterburner									
Venturi/impingement	1.9 E-01	3.8 E-04	E	2.0 E-02	4.0 E-05	E	2.4 E-01	4.8 E-04	E
Venturi/impingement/Wet ESP									
Venturi/Wet ESP									

Table 2.2-4 (cont.).

Source Category[b]	2-Nitrophenol			Acetaldehyde[c]			Acetone		
	g/Mg	lb/ton	EMISSION FACTOR RATING	g/Mg	lb/ton	EMISSION FACTOR RATING	g/Mg	lb/ton	EMISSION FACTOR RATING
Uncontrolled	6.0 E+00	1.2 E-02	E						
Controlled									
Cyclone									
Cyclone/impingement									
Cyclone/venturi	3.8 E-01	7.6 E-04	E						
Cyclone/venturi/impingement									
Electrostatic precipitator									
Fabric filter									
Impingement				1.6 E-01	3.2 E-04	E			
Venturi							3.2 E+00	6.4 E-03	E
Venturi/impingement/afterburner									
Venturi/impingement	1.2 E+00	2.4 E-03	E						
Venturi/impingement/Wet ESP									
Venturi/Wet ESP									

Formatted: Font: Times New Roman

Formatted: Centered

Formatted: Centered

Table 2.2-4 (cont.).

Source Category[b]Category	Acetonitrile[e]2-Nitrophenol	Acrylonitrile[e]	Benzene[e]	Acetaldehyde[c]			Acetone		
	g/Mg	lb/ton	EMISSION FACTOR RATING	g/Mg	lb/ton	EMISSION FACTOR RATING	g/Mg	lb/ton	EMISSION FACTOR RATING
Uncontrolled	2.56.0 E+0100	5.01.2 E-02	E	2.5 E+01	5.0 E-02	E	5.8 E+00	1.2 E-02	D
Controlled									
Cyclone									
Cyclone/impingement									
Cyclone/venturi	3.8 E-01	7.6 E-04	E	1.5 E-01	3.0 E-04	E	3.5 E-01	7.0 E-04	E
Cyclone/venturi/impingement									
Electrostatic precipitator									
Fabric filter									
Impingement				1.6 E-01	3.2 E-04	E			
Venturi							1.43.2 E+0100	2.86.4 E-0203	E
Venturi/impingement/afterburner	-	-	-	-	-	-	-	-	-
Venturi/impingement/afterburner	7.41.2 E-01+00	1.52.4 E-03	E	4.9 E-01	9.8 E-04	E	1.7 E-01	3.4 E-04	E
Venturi/impingement/Wet ESP	-	-	-	-	-	-	-	-	-
Venturi/Wet ESP	-	-	-	-	-	-	-	-	-

Table 2.2-4 (cont.).

Source Category	Acetonitrile[c]			Acrylonitrile[c]			Benzene[c]		
	g/Mg	lb/ton	EMISSION FACTOR RATING	g/Mg	lb/ton	EMISSION FACTOR RATING	g/Mg	lb/ton	EMISSION FACTOR RATING
Uncontrolled	2.5 E+01	5.0 E-02	E	2.5 E+01	5.0 E-02	E	5.8 E+00	1.2 E-02	D
Controlled									
Cyclone									
Cyclone/impingement									
Cyclone/venturi				1.5 E-01	3.0 E-04	E	3.5 E-01	7.0 E-04	E
Cyclone/venturi/impingement									
Electrostatic precipitator									
Fabric filter									
Impingement									
Venturi							1.4 E+01	2.8 E-02	E
Venturi/impingement/afterburner	7.4 E-01	1.5 E-03	E	4.9 E-01	9.8 E-04	E	1.7 E-01	3.4 E-04	E
Venturi/impingement	9.7 E+00	2.0 E-02	E	1.7 E+01	3.4 E-02	E	6.3 E+00	1.3 E-02	D
Venturi/impingement/Wet ESP									
Venturi/Wet ESP									

Table 2.2-4 (cont.).

Source Category[b] Category	Bis(2-ethylhexyl)phthalate[c] g/Mg	Bis(2-ethylhexyl)phthalate[c] lb/ton	Bis(2-ethylhexyl)phthalate[c] EMISSION FACTOR RATING	Bromodichloromethane g/Mg	Bromodichloromethane lb/ton	Bromodichloromethane EMISSION FACTOR RATING	Carbon Tetrachloride[c] g/Mg	Carbon Tetrachloride[c] lb/ton	Carbon Tetrachloride[c] EMISSION FACTOR RATING
Uncontrolled	9.3 E-01	1.9 E-03	E	4.0 E-03	8.0 E-06	E	1.0 E-02	2.0 E-05	E
Controlled									
Cyclone									
Cyclone/impingement									
Cyclone/venturi	4.0 E-02	8.0 E-05	E				7.0 E-03	1.4 E-05	E
Cyclone/venturi/impingement									
Electrostatic precipitator									
Fabric filter									
Impingement									
Venturi				1.5 E+00	3.0 E-03	E			
Venturi/impingement/ afterburner							1.0 E-03	2.0 E-06	E
Venturi/impingement	3.2 E-01	6.4 E-04	E				3.0 E-02	6.0 E-05	D
Venturi/impingement/Wet ESP									
Venturi/Wet ESP									

Table 2.2-4 (cont.).

Source ~~Category~~[b]Category	Chlorobenzene[c]			Chloroform[c]		
	g/Mg	lb/ton	EMISSION FACTOR RATING	g/Mg	lb/ton	EMISSION FACTOR RATING
Uncontrolled	7.5 E-01	1.5 E-03	E	3.0 E-02	6.0 E-05	E
Controlled						
Cyclone						
Cyclone/impingement						
Cyclone/venturi	6.0 E-03	1.2 E-05	E	2.0 E-02	4.0 E-05	E
Cyclone/venturi/impingement						
Electrostatic precipitator						
Fabric filter						
Impingement						
Venturi	4.2 E+00	8.4 E-03	E	3.3 E+00	6.6 E-03	E
Venturi/impingement/afterburner	2.6 E-01	5.2 E-04	E	4.9 E-01	9.8 E-04	E
Venturi/impingement	6.0 E-01	1.2 E-03	E	1.3 E+00	2.6 E-03	D
Venturi/impingement/Wet ESP						
Venturi/Wet ESP						

Table 2.2-4 (cont.).

Source ~~Category[b]~~Category	Ethylbenzene[c]			Formaldehyde[c]			Methyl Ethyl Ketone[c]		
	g/Mg	lb/ton	EMISSION FACTOR RATING	g/Mg	lb/ton	EMISSION FACTOR RATING	g/Mg	lb/ton	EMISSION FACTOR RATING
Uncontrolled	8.0 E-01	1.6 E-03	E				6.1 E+00	1.2 E-02	E
Controlled									
Cyclone									
Cyclone/impingement									
Cyclone/venturi	3.0 E-03	6.0 E-06	E	1.3 E+00	2.6 E-03	E			
Cyclone/venturi/impingement									
Electrostatic precipitator									
Fabric filter									
Impingement									
Venturi	6.0 E+00	1.2 E-02	E	4.0 E-01	8.0 E-04	E	6.1 E+00	1.2 E-02	E
Venturi/impingement/ ~~afterburner~~ afterburner	2.0 E-02	4.0 E-05	E				5.0 E-02	1.0 E-04	E
Venturi/impingement	1.0 E+00	2.0 E-03	D				8.9 E+00	1.8 E-02	E
Venturi/impingement/Wet ESP									
Venturi/Wet ESP									

Table 2.2-4 (cont.).

Source ~~Category[b]~~ Category	Methyl Isobutyl Ketone[c]			Methylene Chloride[c]			Naphthalene[c]		
	g/Mg	lb/ton	EMISSION FACTOR RATING	g/Mg	lb/ton	EMISSION FACTOR RATING	g/Mg	lb/ton	EMISSION FACTOR RATING
Uncontrolled				4.0 E-01	8.0 E-04	D	9.2 E+00	1.8 E-02	E
Controlled									
Cyclone							1.0 E+00[d]	2.0 E-03[d]	Minimally
Cyclone/impingement	1.0 E-02	2.0 E-05	E						
Cyclone/venturi				3.0 E-01	6.0 E-04	E	9.7 E-01	1.9 E-03	D
Cyclone/venturi/impingement									
Electrostatic precipitator									
Fabric filter									
Impingement									
Venturi									
Venturi/impingement/ ~~afterburner~~ afterburner				4.0 E-01	8.0 E-04	E			
Venturi/impingement				9.0 E-01	1.8 E-03	D			
Venturi/impingement/Wet ESP									
Venturi/Wet ESP									

Table 2.2-4 (cont.).

Formatted: Not Expanded by / Condensed by

Source Category[b]	Perchloroethylene[e]			Phenol[e]			Tetrachloroethane[e]		
	g/Mg	lb/ton	EMISSION FACTOR RATING	g/Mg	lb/ton	EMISSION FACTOR RATING	g/Mg	lb/ton	EMISSION FACTOR RATING
Uncontrolled	4.0 E-01	8.0 E-04	E	2.2 E+01	4.4 E-02	E			
Controlled									
Cyclone									
Cyclone/impingement									
Cyclone/venturi	3.0 E-01	6.0 E-04	E						
Cyclone/venturi/impingement									
Electrostatic precipitator									
Fabric filter									
Impingement									
Venturi	2.0 E-01	4.0 E-04	E				1.2 E+01	2.4 E-02	E
Venturi/impingement/ afterburner									
Venturi/impingement				1.8 E+00	3.6 E-03	E			
Venturi/impingement/Wet ESP									
Venturi/Wet ESP									

Table 2.2-4 (cont.).

Source Category[b]Category	Perchloroethylene[c]Toluene[c]	Trans-1,2-Dichloroethene[c]	Trichloroethene[c]	Phenol[c]			Tetrachloroethane[c]		
	g/Mg	lb/ton	EMISSION FACTOR RATING	g/Mg	lb/ton	EMISSION FACTOR RATING	g/Mg	lb/ton	EMISSION FACTOR RATING
Uncontrolled	7.84.0 E+00-01	1.58.0 E-0204	DE	9.02.2 E-02+01	1.84.4 E-0402	E	4.0 E-01	8.0 E-04	E
Controlled									
Cyclone									
Cyclone/impingement									
Cyclone/venturi	3.30 E+00-01	6.60 E-0304	E						
Cyclone/venturi/impingement									
Electrostatic precipitator									
Fabric filter									
Impingement									
Venturi	1.62.0 E+-01	34.0 E-0204	E				1.2 E+01	2.4 E-02	E
Venturi/impingement/ afterburner	6.6 E-01	1.3 E-03	E	4.0 E-02	8.0 E-05	D			
Venturi/impingement afterburner	6.5 E+00	1.3 E-02	D	5.0 E-02	1.0 E-04	E	4.5 E-01	9.0 E-04	E
Venturi/impingement/Wet ESP				1.8 E+00	3.6 E-03	E			
Venturi/impingement/Wet ESP									
Venturi/Wet ESP									

Table 2.2-4. (cont.).)

	Toluene[c]Vinyl Chloride[e]	Xylene, m,p[e]	Xylene (total)[e]	Trans-1,2-Dichloroethene[c]			Trichloroethene[c]			Total Non-Methane Organic Compounds (TNMOC)		
Source CategorybCategory	g/Mg	lb/ton	EMISSION FACTOR RATING	g/Mg	lb/ton	EMISSION FACTOR RATING	g/Mg	lb/ton	EMISSION FACTOR RATING	g/Mg	lb/ton	EMISSION FACTOR RATING
Uncontrolled	6.67.8 E+00	1.35 E-02	D	9.0 E-02	1.8 E-04	E	9.54.0 E-01	8.0 E-04	E	1.91 E-03+03[e]	2.2 E+00[e]	Minimally
Controlled												
Cyclone												
Cyclone/impingement												
Cyclone/venturi	1.03.3 E+00	2.06.6 E-03	E									
Cyclone/venturi/ impingement												
Electrostatic precipitator	8.0 E-01	1.6 E-03	E									
Fabric filter												
Impingement												
Venturi	2.01.6 E+0001	43.0 E-0302	E									
Venturi/impingement/ afterburner	6.6 E-01	1.3 E-03	E	4.0 E-02	8.0 E-05	D						
Venturi/impingement	3.76.5 E+00	7.41.3 E-0302	D	5.0 E-02	1.0 E-04	E	4.5 E-01	9.0 E-04	E			
Venturi/impingement/Wet wet ESP												
Venturi/Wet ESP												

Table 2.2-4. (cont.)

Source Category	Vinyl Chloride[c] g/Mg	Vinyl Chloride[c] lb/ton	Vinyl Chloride[c] EMISSION FACTOR RATING	Xylene, m,p[c] g/Mg	Xylene, m,p[c] lb/ton	Xylene, m,p[c] EMISSION FACTOR RATING	Xylene (total)[c] g/Mg	Xylene (total)[c] lb/ton	Xylene (total)[c] EMISSION FACTOR RATING
Uncontrolled	6.6 E+00	1.3 E-02	E				9.5 E-01	1.9 E-03	E
Controlled									
Cyclone									
Cyclone/impingement									
Cyclone/venturi	1.0 E+00	2.0 E-03	E						
Cyclone/venturi/impingement									
Electrostatic precipitator	8.0 E-01	1.6 E-03	E						
Fabric filter									
Impingement									
Venturi				2.0 E+00	4.0 E-03	E			
Venturi/impingement/afterburner									
Venturi/impingement	3.7 E+00	7.4 E-03	D						
Venturi/impingement/Wet ESP									
Venturi/Wet ESP									

[a] Units are pollutants emitted of ~~dry~~dried sludge ~~burned~~fed. Source Classification Code (SCC) 5-01-~~005-15~~008-02. Blanks indicate no data.
~~[b] Wet ESP = wet~~ [b] ESP = electrostatic precipitator.
[c] Hazardous air pollutants in the *Clean Air Act*.
[d] Reference 88
[e] Reference 104

Formatted: Font: Italic

Table 2.2-5 (Metric ~~And~~and English Units). SUMMARY OF METAL EMISSIONS FROM MULTIPLE HEARTH SEWAGE SLUDGE INCINERATORS[a]

	Aluminum			Antimony[c]			Arsenic[c]		
Source ~~Category[b]~~Category	g/Mg	lb/ton	EMISSION FACTOR RATING	g/Mg	lb/ton	EMISSION FACTOR RATING	g/Mg	lb/ton	EMISSION FACTOR RATING
Uncontrolled	2.4 E+02	4.~~8E~~80E-01	D	1.5 E+00	3.0 E-03	E	4.7 E+00	9.4 E-03	B
Controlled									
Cyclone	3.0 E-01	6.~~0E~~00E-04	E	3.2 E-01	6.4 E-04	E			
Cyclone/impingement									
Cyclone/venturi							1.0 E-01	2.0 E-04	E
Cyclone/venturi/impingement							8.5 E-01	1.7 E-03	E
Electrostatic precipitator	3.8 E+02	7.6 E-02	E	4.0 E-02	8.0 E-05	E	1.2 E+00	2.4 E-03	E
Fabric filter	6.8 E-01		E	4.0 E-03	8.0 E-06	E	3.0 E-03	6.0 E-06	E
Impingement									
Venturi							5.0 E-02	1.0 E-04	E
Venturi/impingement/ afterburner							4.0 E-02	8.0 E-05	E
Venturi/impingement	9.2 E+01	1.~~8E~~80E-01	E	2.4 E-01	4.8 E-04	E	6.1 E-01	1.2 E-03	B
Venturi/impingement/ Wet ~~ESP~~ESP[b]									
Venturi/Wet ESP							6.0 E-01	1.2 E-03	E

Table 2.2-5. (cont.).

Source ~~Category~~[b]Category	Barium g/Mg	Barium lb/ton	Barium EMISSION FACTOR RATING	Beryllium[c] g/Mg	Beryllium[c] lb/ton	Beryllium[c] EMISSION FACTOR RATING	Cadmium[c] g/Mg	Cadmium[c] lb/ton	Cadmium[c] EMISSION FACTOR RATING
Uncontrolled	1.5 E+01	3.0 E-02	D	1.5 E-01	3.0 E-04	E	1.6 E+01	3.7 E-02	B
Controlled									
Afterburner/scrubber[d]	-	-	-	-	-	-	2.0 E-01[e]	4.0 E-04[e]	Moderately
Afterburner/wet scrubber	-	-	-	-	-	-	1.4 E-01[f]	2.7 E-04[f]	Moderately
Cyclone	1.0 E-01	2.0 E-04	E	9.0 E-03	1.8 E-05	D	1.7 E+01	3.4 E-02	D
Cyclone/impingement									
Cyclone/venturi							1.3 E+01	2.6 E-02	C
Cyclone/venturi/impingement							8.1 E+00	1.6 E-02	E
Electrostatic precipitator	7.4 E+00	1.5 E-02	E				1.7 E-01	3.4 E-04	E
Fabric filter	4.0 E-03	8.0 E-06	E				1.0 E-02	2.0 E-05	E
Impingement							1.2 E+00	2.4 E-03	E
Venturi							1.1 E-01	2.2 E-04	E
Venturi/impingement/ afterburner							3.0 E+00	6.0 E-03	E
Venturi/impingement	3.2 E+00	6.4 E-03	D	5.0 E-03	1.0 E-05	E	3.3 E+00	6.6 E-03	E
Venturi/impingement/ Wet ESP							1.0 E-01	2.0 E-04	E
Venturi/Wet ESP							4.0 E-02	8.0 E-05	E

Table 2.2-5 (cont.).

Source Category[b]	Calcium			Chromium[c]			Cobalt[c]		
	g/Mg	lb/ton	EMISSION FACTOR RATING	g/Mg	lb/ton	EMISSION FACTOR RATING	g/Mg	lb/ton	EMISSION FACTOR RATING
Uncontrolled	7.0 E+02	1.4 E+00	C	1.4 E+01	2.9 E-02	B	9.0 E-01	1.8 E-03	C
Controlled									
Cyclone	1.2 E+00	2.4 E-03	E	1.9 E+00	3.8 E-03	D	2.0 E-01	4.0 E-04	E
Cyclone/impingement				4.0 E-02	8.0 E-05	E			
Cyclone/venturi				5.0 E-01	1.0 E-03	E			
Cyclone/venturi/impingement				1.1 E+01	2.7 E-02	E			
Electrostatic precipitator	3.5 E+02	7.0 E-01	E	1.4 E+00	2.8 E-03	E	3.8 E-01	7.6 E-04	E
Fabric filter	8.0 E-02	1.6 E-04	E	4.0 E-02	8.0 E-05	E	6.0 E-03	1.2 E-05	E
Impingement				9.8 E+00	1.9 E-02	E			
Venturi				5.0 E-01	1.0 E-03	E			
Venturi/impingement/ afterburner				4.9 E+00	9.8 E-03	E			
Venturi/impingement	2.6 E+02	5.2 E-01	D	2.1 E+00	4.2 E-03	E	4.5 E-01	9.0 E-04	D
Venturi/impingement/Wet ESP				1.1 E-01	2.2 E-04	E			
Venturi/Wet ESP				1.0 E-02	2.0 E-05	E			

Table 2.2-5 (cont.).

Source Category[b]Category	CalciumCopper Gold Iron g/Mg	lb/ton	EMISSION FACTOR RATING	Chromium[c] g/Mg	lb/ton	EMISSION FACTOR RATING	Cobalt[c] g/Mg	lb/ton	EMISSION FACTOR RATING
Uncontrolled	47.0 E+0102	8.01.4 E-02+00	BC	3.01.4 E-02+01	6.02.9 E-0502	EB	5.69.0 E+02-01	1.18 E+00-03	C
Controlled									
Afterburner/impingement/wet scrubber	-	-	-	5.0 E+00[g]	9.9 E-03[g]	Minimally	-	-	-
Cyclone	1.2.7 E+00	52.4 E-03	E	1.9 E+00	3.8 E-03	D	1.72.0 E+00-01	3.4.0 E-0304	E
Cyclone/impingement				4.0 E-02	8.0 E-05	E			
Cyclone/venturi	1.0 E+00	2.0 E-03	E	5.0 E-01	1.0 E-03	E			
Cyclone/venturi/impingement				–1.1 E+01	2.7 E-02	E			
Electrostatic precipitator	2.03.5 E-01+02	47.0 E-0401	E	9.01.4 E-03+00	12.8 E-0503	E	2.53.8 E+-01	5.07.6 E-0204	E
Fabric filter	28.0 E-0302	4.01.6 E-0604	E	24.0 E-0302	48.0 E-0605	E	2.36.0 E-0103	4.61.2 E-0405	E
Impingement				9.8 E+00	1.9 E-02	E			
Venturi	4.0 E-01	8.0 E-04	E	5.0 E-01	1.0 E-03	E			
Venturi/impingement/afterburner	5.8 E+00	1.2 E-02	E	4.9 E+00	–9.8 E-03	E			
Venturi/impingement	5.52.6 E+0002	1.15.2 E-0201	D	2.1.0 E-02+00	4.2.0 E-0503	E	4.85 E+-01	9.60 E-0204	D
Venturi/impingement/Wet ESP				1.1 E-01	2.2 E-04	E			
Venturi/Wet ESP	1.0 E-02	2.0 E-05	E	1.0 E-02	2.0 E-05	E			

Table 2.2-5 (cont.).

Source Category[b]Category	CopperManganese[e]	Magnesium	Mercury[e]	Gold			Iron		
	g/Mg	lb/ton	EMISSION FACTOR RATING	g/Mg	lb/ton	EMISSION FACTOR RATING	g/Mg	lb/ton	EMISSION FACTOR RATING
Uncontrolled	9.4.0 E+0001	1.98.0 E-02	CB	1.43.0 E+- 02	2.86.0 E-0105	CE	5.6 E+02	1.1 E+00	C
Controlled									
Cyclone	3.32.7 E-01+00	6.65.4 E-0403	E	1.4 E+00	2.8 E-03	E	2.31.7 E+00	3.4.6E E-03	E
Cyclone/impingement									
Cyclone/venturi	1.0 E+00	2.0 E-03	E				1.6 E+00	3.2E-03	E
Cyclone/venturi/impingement									
Electrostatic precipitator	3.2.0 E-01	6.4.0 E-04	E	8.89.0 E+00-03	1.8 E-0205	E	2.5 E+01	5.0 E-02	E
Fabric filter	52.0 E-03	14.0 E-0506	E	32.0 E-0203	64.0 E-0506	E	2.3 E-01	4.6 E-04	E
Impingement							9.7 E-01	1.9E-03	E
Venturi	4.0 E-01	8.0 E-04	E						
Venturi/impingement/afterburner	5.8 E+00	1.2 E-02	E						
Venturi/impingement	85.5 E-01+00	1.71 E-0302	D	4.21.0 E+00-02	8.42.0 E-0305	DE	5.04.8 E-03+01	1.0E-059.6 E-02	ED
Venturi/impingement/Wet ESP									
Venturi/Wet ESP	1.0 E-02	2.0 E-05	E						

Table 2.2-5 (cont.).

Source CategorybCategory	Manganese[c]Nickel[e] Phosphorus[e] Potassium			Magnesium			Mercury[c]		
	g/Mg	lb/ton	EMISSION FACTOR RATING	g/Mg	lb/ton	EMISSION FACTOR RATING	g/Mg	lb/ton	EMISSION FACTOR RATING
Uncontrolled	8.09.4 E+00	1.69 E-02	BC	3.81.4 E+02	7.62.8 E-01	DC	5.3 E+01	1.1 E-01	E
Controlled									
CycloneAfterburner/ESP/scrubber[h]/Wet ESP	8.0 E-02	1.6 E-04	E	8.9 E+00	1.8 E-02	E	9.04.5 E-0101[i]	1.8.9 E-0304[i]	EModerately
Cyclone/impingement	13.3 E+00-01	26.6 E-0304	DE	1.4 E+00	2.8 E-03	E	2.3 E+00	4.60E-03	E
Cyclone/venturiimpingement	3.5 E-01	7.0 E-04	E						
Cyclone/venturi/impingement	4.5 E+00	9.0 E-03	E				1.6 E+00	3.20E-03	E
Electrostatic precipitator Cyclone/venturi/impingement	2.0 E+00	4.0 E-03	E	6.9 E+00	1.4 E-02	E			
Electrostatic precipitator Fabric filter	1.43.2 E-0201	2.86.4 E-0504	E	2.08.8 E-01+00	1.8 E-02	E			
ImpingementFabric filter	4.15.0 E+00-03	8.21.0 E-0305	E	3.0 E-02	6.0 E-05	E			
VenturiImpingement	6.0 E-02	1.2 E-04	E	9.6 E-01	1.9 E-03	E	9.7 E-01	1.90E-03	E
Venturi/impingement/afterburner	9.0 E-01	1.8 E-03	E	–					
Venturi/impingement/afterburner	9.0 E-01	1.8 E-03	A	1.2 E+01	2.4 E-02	D	7.3 E+00	1.4 E-02	E
Venturi/impingement/Wet ESP	8.5 E-01	1.7 E-03	D	4.2 E+00	8.4 E-03	D	5.0 E-03	1.00E-05	E
Venturi/impingement/Wet ESP	3.0 E-03	6.0 E-06	E						
Venturi/Wet ESP									

Table 2.2-5 (cont.).

Source CategorybCategory	Nickel[c]Selenium[c] Silicon Silver				Phosphorus[c]			Potassium		
	lb/MMBtu Heat Input CO_2	g/Mg	lb/ton	EMISSION FACTOR RATING	g/Mg	lb/ton	EMISSION FACTOR RATING	g/Mg	lb/ton	EMISSION FACTOR RATING
Uncontrolled	-	1.58.0 E-01+00	3.01.6 E-0402	DB	3.48 E+02	7.6.8 E-01	ED	6.5.3 E-+01	1.31 E-0301	E
Controlled										
Afterburner/regenerative thermal oxidizer/scrubber[j]/wet ESP	6.9 E-06[k]	-	-	Moderately	-	-	-	-	-	-
Afterburner/fabric filter/regenerative thermal oxidizer/scrubber[j]/wet ESP	-	1.2 E-01[l]	2.3 E-04[l]	Moderately	-	-	-	-	-	-
Cyclone		8.0 E-02	1.6 E-04	E	4.68.9 E+00	1.8 E-02	E	9.20 E-0301	1.8 E-03	E
Cyclone/impingement		1.3 E+00	2.6 E-03	D						
Cyclone/venturi		3.5 E-01	7.0 E-04	E						
Cyclone/venturi/impingement		4.5 E+00	9.0 E-03	E						
Electrostatic precipitator		2.0 E+00	64.0 E-03	E	6.9 E+00	1.24 E-0502	E			
Fabric filter	1.2 E-01	21.4 E-0402	2.8 E-05	E 1.0 E-04	2.0 E-0701	E	E			
Impingement		4.1 E+00	8.2 E-03	E						
Venturi		6.0 E-02	1.2 E-04	E	4.09.6 E-01	8.01.9 E-0403	E			
Venturi/impingement/afterburner		9.0 E-01	1.8 E-03	E						

Venturi/impingement		9.0 E-01	1.8 E-03	A	4.41.2 E+01	8.82.4 E-02	ED	7.3 E+00	9.01.4 E-02	1.8 E-04	E
Venturi/impingement/Wet ESP											
Venturi/Wet ESP		3.0 E-03	6.0 E-06	E							

Table 2.2-5 (cont.).

Source Category[b]Category	Selenium[c]Sodium g/Mg	Sulfur lb/ton	Tin EMISSION FACTOR RATING	Silicon g/Mg	lb/ton	EMISSION FACTOR RATING	Silver g/Mg	lb/ton	EMISSION FACTOR RATING
Uncontrolled	4.71.5 E+-01	9.43.0 E-0204	CD	3.64 E+0302	7.26.8 E-0001	DE	1.36.5 E+-01	2.61.3 E-0203	CE
Controlled									
Cyclone	1.8 E+00	3.6 E-03	E	1.94.6 E+0100	3.9.2 E-0203	E	5.9 E+00	1.2 E-02	E
Cyclone/impingement									
Cyclone/venturi									
Cyclone/venturi/impingement									
Electrostatic precipitator	-	-	-	-	-	-	6.0 E-03	1.2 E-05	E
Fabric filter Electrostatic precipitator	5.51.2 E-01	1.12.4 E-0304	E				21.0 E-0104	42.0 E-0407	E
Impingement	-	-	-	-	-	-	-	-	-
Venturi	6.0 E-02	1.2 E-04	E	-	-	-	4.0 E-01	8.0 E-04	E
Venturi/impingement/afterburner	-	-	-	-	-	-	-	-	-
Venturi/impingement	-	-	-	4.4 E+01	8.8 E-02	E	9.0 E-02	1.8 E-04	E
Venturi/impingement/Wet ESP	-	-	-	-	-	-	-	-	-
Venturi/Wet ESP	-	-	-	-	-	-	-	-	-

Table 2.2-5 (cont.).

Source Category	Sodium g/Mg	Sodium lb/ton	Sodium EMISSION FACTOR RATING	Sulfur g/Mg	Sulfur lb/ton	Sulfur EMISSION FACTOR RATING	Tin g/Mg	Tin lb/ton	Tin EMISSION FACTOR RATING
Uncontrolled	4.7 E+01	9.4 E-02	C	3.6 E+03	7.2 E-00	D	1.3 E+01	2.6 E-02	C
Controlled									
Cyclone	1.8 E+00	3.6 E-03	E	1.9 E+01	3.9 E-02	E	5.9 E+00	1.2 E-02	E
Cyclone/impingement									
Cyclone/venturi									
Cyclone/venturi/impingement									
Electrostatic precipitator	5.5 E-01	1.1 E-03	E				2.0 E-01	4.0 E-04	E
Fabric filter	1.0 E-02	2.0 E-05	E	6.0 E+01	1.2 E-01	E	2.0 E-02	4.0 E-05	E
Impingement									
Venturi									
Venturi/impingement/afterburner									
Venturi/impingement	1.4 E+01	2.8 E-02	D	1.1 E+02	2.2 E-01	E	7.9 E+00	1.6 E-02	D
Venturi/impingement/Wet ESP									
Venturi/Wet ESP									

Table 2.2-5 (cont.).

Source Category[b]	Titanium			Vanadium			Zinc		
	g/Mg	lb/ton	EMISSION FACTOR RATING	g/Mg	lb/ton	EMISSION FACTOR RATING	g/Mg	lb/ton	EMISSION FACTOR RATING

Table 2.2-5 (cont.).

Source Category	Titanium g/Mg	Titanium lb/ton	EMISSION FACTOR RATING	Vanadium g/Mg	Vanadium lb/ton	EMISSION FACTOR RATING	Zinc g/Mg	Zinc lb/ton	EMISSION FACTOR RATING
Uncontrolled	5.1 E+01	1.0 E-01	C	3.3 E+00	6.6 E-03	C	6.6 E+01	1.3 E-01	C
~~Controlled~~							~~1.1 E+01~~	~~2.2 E-02~~	~~E~~
~~Cyclone~~	~~1.0 E-01~~	~~2.0 E-04~~	~~E~~	~~3.0 E-01~~	~~6.0 E-04~~	~~E~~			
~~Cyclone/impingement~~									
~~Cyclone/venturi~~							~~3.8 E+01~~	~~7.6 E-02~~	~~E~~
~~Cyclone/venturi/impingement~~									
Controlled							1.1 E+01	2.2 E-02	E
Cyclone	1.0 E-01	2.0 E-04	E	3.0 E-01	6.0 E-04	E			
Cyclone/impingement									
Cyclone/venturi							3.8 E+01	7.6 E-02	E
Cyclone/venturi/impingement									
Electrostatic precipitator	9.0 E-01	1.8 E-03	E	9.9 E-01	2.0 E-03	E	3.9 E-01	7.8 E-04	E
Fabric filter	6.0 E-03	1.2 E-05	E	2.0 E-03	4.0 E-06	E	4.0 E-02	8.0 E-05	E
Impingement									
Venturi							4.4 E+00	8.8 E-03	E
Venturi/impingement/ afterburner							3.3 E+01	6.6 E-02	E
Venturi/impingement	3.1 E+00	6.2 E-03	D	8.0 E-01	1.6 E-03	E	2.4 E+01	4.8 E-02	C
Venturi/impingement/Wet ESP									
Venturi/Wet ESP							2.0 E-01	4.0 E-04	E

[a]Units are pollutants emitted of ~~dry~~dried sludge ~~burned.~~fed unless otherwise specified. Source Classification Code (SCC) 5-01-~~005-15~~008-02. Blanks indicate no data.
[b]~~Wet ESP = wet~~ [b]ESP = electrostatic precipitator.

[c]Hazardous air pollutants listed in the *Clean Air Act*.

DRAFT – DO NOT CITE OR QUOTE

[d]Tray scrubber/scrubber/ventrui scrubber
[e]Reference 144
[f]Reference 85
[g]Reference 109
[h]Impingement scrubber/scrubber/tray scrubber/venturi scrubber
[i]Reference 114
[j]Spray scrubber/venturi scrubber/wet scrubber
[k]Reference 118
[l]Reference 119

Table 2.2-6 (Metric Andand English Units). CRITERIA POLLUTANT EMISSION FACTORS FOR FLUIDIZED BED SEWAGE SLUDGE INCINERATORS[a]

EMISSION FACTOR RATING: E, unless otherwise specified

Source Category[b]Category	Filterable Particulate Matter		Sulfur Dioxide			Nitrogen Oxides[c]Oxides		
	kg/Mg	lb/ton	lb/MMBtu heat input	kg/Mg	lb/ton	lb/MMBtu heat input	kg/Mg	lb/ton
Uncontrolled	2.3 E+02	4.6 E+02		1.5 E-01	3.0 E-01		8.8 E-01	1.7 E+00
Controlled								
CycloneACI[c]/average bed temperature/cyclone/ESP[b]/fabric filter/incinerator/tray-type gas absorption column/scrubber[y]/wet ESP	7.5 E-02[z,l]	1.5 E-01[z,l]						
Cyclone/impingementAverage bed temperature/ESP/incinerator/tray-type gas absorption column/scrubber[ac]/wet ESP				1.6 E-01[ab,g]	3.2 E-01[ab,g]			
Average bed temperature/cyclones/ ESP/scrubber[e]/wet ESP= Cyclone/venturi/impingement			5.08.2 E-0103[aa,g,j]	1.0 E+00				
Electrostatic precipitatorAverage bed temperature/scrubber[r]/wet ESP						1.5 E-01[s,g,j]		
Fabric filterAdsorption/scrubber[v]/selective non-catalytic reduction/wet ESP							4.5 E-01[t,g]	9.0 E-01[t,g]

Cyclone/venturi/impingement ~~Impingement~~	~~1.3 E-01~~ ~~2.6 E-01~~	~~3~~5.0 E-01	~~6~~1.0 E-~~01~~+00							
~~Venturi~~Impingement	~~5.7~~1.3 E-01		~~9.~~2.6 E+~~00~~-01		~~1.8~~3.0 E+-01	6.0 E-01				
Venturi~~/impingement/afterburner~~	1.6 E-01[w,q]		3.2 E-01[w,q]		9.2 E+00	1.8 E+01				
Venturi/impingement	2.7 E-01		1.1 E+00		4.0 E-01	8.0 E-01				
Venturi/impingement/Wet ESP	1.0 E-01		2.0 E-01							
~~Venturi/~~Wet ~~ESP~~scrubber	5.0 E-02[x,q]		1.1 E-01[x,q]							

Table 2.2-6 (cont.).

Source ~~Category~~[b]Category	Carbon ~~Monoxide~~[e]Monoxide (CO) lb/MMbtu heat input	Carbon Monoxide (CO) kg/Mg	Carbon Monoxide (CO) lb/ton	Lead[d] kg/Mg	Lead[d] lb/ton	Methane VOC kg/Mg	Methane VOC lb/ton
Uncontrolled	-	1.1 E+00	2.1 E+00	2.0 E-02	4.0 E-02		
Controlled							
ACI/ average bed temperature/ fabric filter/ESP/ tray type gas absorption column/scrubber[n]/wet ESP	-	-	-	7.5 E-06[o,l]	1.5 E-05[o,l]	-	-
ACI/average bed temperature/cyclone/incinerator/selective non-catalytic reduction/scrubber[n]/ tray type gas absorption column/ wet ESP	-	4.9 E-02[f,l]	9.9 E-02[f,l]	-	-	-	-
Average bed temperature/mercury air pollution control system/scrubber[h]/tray type gas absorption column/wet ESP	8.2 E-03[i,g,j]	-	-	-	-	-	-
Cyclone							
Cyclone/impingement							
Cyclone/venturi							
Cyclone/venturi/impingement							
Electrostatic precipitator							
Fabric filter				5.0 E-06	1.0 E-05		
Impingement				3.0 E-03	6.0 E-03		
Venturi				2.0 E-03[m,q]	4.0 E-03[m,q]	1.6 E+00	3.2 E+00
Venturi/impingement/afterburner							
Venturi/impingement				8.0 E-02	1.6 E-01	4.0 E-01	8.0 E-01
Venturi/impingement/~~Wet~~wet ESP				1.0 E-06	2.0 E-06		
Venturi/~~Wet~~wet ESP							

[a]Units are pollutants emitted of ~~dry~~dried sludge ~~burned.~~fed unless otherwise noted. Source Classification Code (SCC) 5-01-~~005-16~~008-03. Blanks indicate no data.

[b]Wet ESP = wet[b]ESP = electrostatic precipitator.
[c]Uncontrolled Emission Factors for NO_x and CO apply to all Air Pollution Control Device Types.
[c]ACI = activated carbon injection
[d]Hazardous air pollutants listed in the *Clean Air Act*.
[e]Scrubber pressure drop/scrubber water pH/tray tower scrubber/venturi scrubber/wet scrubber
[f]Reference 145
[g]Moderately representative emission factor
[h]Scrubber pressure drop/scrubber water pH/spray scrubber/tray scrubber/venturi scrubber
[i]Reference 147
[j]lb/MMbtu heat input O_2
[k]Impingement scrubber/venturi scrubber
[l]Highly representative emission factor
[m]Reference 89
[n]Impingement scrubber/scrubber/venturi scrubber
[o]Reference 115
[p]Impingement scrubber/tray scrubber/venturi scrubber/wet scrubber
[q]Minimally representative emission factor
[r]Scrubber water pH/wet scrubber
[s]Reference 122
[t]Reference 125
[u]Impingement scrubber/scrubber/venturi scrubber/wet scrubber
[v]Scrubber/impingement type wet scrubber/venturi scrubber/wet scrubber
[w]Reference 98
[x]Reference 99
[y]Impingement scrubber/scrubber pressure drop/tray scrubber/venturi scrubber
[z]Reference 137
[aa]Reference 130
[ab]lb/MMBtu heat input CO_2
[aae]Reference 131
[abd]Reference 133
[ae]Scrubber/impingement type wet scrubber/venturi scrubber

Table 2.2-7 (Metric ~~And~~and English Units). ACID GAS AND ORGANIC COMPOUND EMISSION FACTORS FOR FLUIDIZED BED SEWAGE SLUDGE INCINERATORS[a]

EMISSION FACTOR RATING: E, unless otherwise stated

	Uncontrolled		Impingement		Venturi/Impingement		Cyclone/Impingement	
Pollutant	g/Mg	lb/ton	g/Mg	lb/ton	g/Mg	lb/ton	g/Mg	lb/ton
Sulfuric Acid (H_2SO_4)			3.0 E+01	6.0 E-02	6.0 E+01	1.2 E-01		
Hydrogen Chloride (HCl)[b]					5.0 E+01	1.0 E-01		
2,3,7,8-TCDD[b]					3.0 E-07	6.0 E-10		
Total TCDD					2.2 E-06	4.4 E-09		
Total PCDD	1.1 E-06	2.2 E-09						
Total HxCDD					9.0 E-07	1.8 E-09		
Total HpCDD					9.0 E-07	1.8 E-09		
Total OCDD					4.3 E-06	8.6 E-09		
2,3,7,8-TCDF[b]					2.0 E-07	4.0 E-10		
Total TCDF[b]					6.2 E-06	1.2 E-08		
Total PCDF[b]					5.2 E-06	1.0 E-08		
Total HxCDF[b]					4.1 E-06	8.2 E-09		
Total HpCDF[b]					1.6 E-06	3.2 E-09		
Total OCDF[b]					1.3 E-06	2.6 E-09		
1,1,1-Trichloroethane[b]					2.6 E-01	5.2 E-04		
1,2-Dichlorobenzene					6.4 E+01	1.3 E-01		
1,4-Dichlorobenzene[b]					2.4 E+02	4.8 E-01		
Benzene[b]					2.0 E-01	4.0 E-04		
Bis(2-ethylhexyl)phthalate[b]					4.1 E+01	8.2 E-02		

Carbon Tetrachloride[b]					1.2 E-02	2.4 E-05		
Chlorobenzene[b]					5.0 E-03	1.0 E-05		

Table 2.2-7 (cont.).

Pollutant	~~Uncontrolled~~Average bed temperature/ tray-type gas absorption column/incinerator/ scrubber[k]/wet ESP[c]	~~Impingement~~	Venturi/Impingement		Cyclone/Impingement			
	g/Mg	lb/ton	g/Mg	lb/ton	g/Mg	lb/ton	~~g/Mg~~	~~lb/ton~~
Chloroform[b]			2.0 E+00	4.0 E-03				
Ethylbenzene[b]			2.5 E-02	5.0 E-05				
Methylene Chloride[b]			7.0 E-01	1.4 E-03				
Naphthalene[b]			9.7 E+01	1.9 E-01				
Perchloroethylene[b]			1.2 E-01	2.4 E-04				
Toluene[b]					3.5 E-01	7.0 E-04		
Trichloroethene[b]			3.0 E-02	6.0 E-05				
Total TCDF[b]	7.5 E-08[j,i]	1.5 E-10[j,i]						

Table 2.2-7 (cont.).

Pollutant	ACI[c]/Average Bed Temperature/Baghouse/ Incinerator/Scrubber[d]/Wet ESP		Average bed temperature/ESP/tray type gas absorption column/scrubber[g]		Adsorption – activated carbon or other/average bed temperature/ESP/selective non-catalytic reduction/cyclones/incinerator/tray-type gas absorption column/wet ESP/scrubber[l]	
	g/Mg	lb/ton	g/Mg	lb/ton	g/Mg	lb/ton
Hydrogen Chloride (HCl)[b]	4.0 E+00[e,f]	7.9 E-03[e,f]	-	-	-	-
Total TCDD	-	-	9.5 E-06[h,i]	1.9 E-08[h,i]	-	-
Total TEQ	-	-	-	-	3.3 E-07[m,f]	6.6 E-10[m,f]

[a]Units are pollutants emitted of ~~dry~~dried sludge ~~burned~~fed. Source Classification Code (SCC) 5-01-~~005-16~~008-03. Blanks indicate no data.
[b]Hazardous air pollutants listed in the *Clean Air Act*.
[c]ACI = activated carbon injection; ESP = electrostatic precipitator
[d] Scrubber water pH/ tray scrubber/venturi scrubber/wet scrubber
[e]Reference 112
[f]Highly representative emission factor
[g]Scrubber pressure drop/scrubber water pH/tray scrubber/venturi scrubber/wet scrubber
[h]Reference 138
[i]Moderately representative emission factor
[j]Reference 135
[k]Scrubber, venturi scrubber/wet scrubber
[l]Scrubber/impingement type wet scrubber/venturi scrubber/wet scrubber
[m]Reference 140
[n]Impingement scrubber/tray scrubber/venturi scrubber

Formatted: Font: Times New Roman

Formatted: Superscript

Table 2.2-8 (Metric ~~And~~and English Units). METAL EMISSION FACTORS FOR FLUIDIZED BED SEWAGE SLUDGE INCINERATORS[a]

EMISSION FACTOR RATING: E, unless otherwise noted

Pollutant	Uncontrolled		Impingement		Venturi/Impingement		Venturi/Impingment/ ~~Wet~~ WET ESP[b]	
	g/Mg	lb/ton	g/Mg	lb/ton	g/Mg	lb/ton	g/Mg	lb/ton
Aluminum					1.9 E+00	3.8 E-03		
Arsenic[c]	2.2 E+00	4.4 E-03			1.5 E-02	3.0 E-05	5.0 E-03	1.0 E-05
Barium					2.4 E-01	4.8 E-04		
Beryllium[c]					2.0 E-04	4.0 E-07	2.0 E-04	4.0 E-07
Cadmium[c]	2.2 E+00	4.4 E-03	4.0 E-01	8.0 E-04	5.7 E-01	1.1 E-03	1.0 E-03	2.0 E-06
Calcium[c]					5.2 E+00	1.0 E-02		
Chromium[c]			3.2 E-01	6.4 E-04	2.5 E-01	5.0 E-04	3.0 E-02	6.0 E-05
Copper					3.0 E-01	6.0 E-04		
Manganese[c]					3.0 E-01	6.0 E-04		
Magnesium					6.0 E-01	1.2 E-03		
Mercury[c]					3.0 E-02	6.0 E-05		
Nickel[c]	1.78 E+01	3.5 E-02			1.7 E+00	3.4 E-03	5.~~0~~E00E-03	1.~~0~~E00E-05
Potassium					6.0 E-01	1.2 E-03		
Selenium[c]					2.0 E-01	4.0 E-04		
Silicon					3.2 E+00	6.4 E-03		
Sulfur					8.6 E+00	1.7 E-02		
Tin					3.5 E-01	7.0 E-04		
Titanium					4.0 E-01	8.0 E-04		
Zinc					1.0 E+00	2.0 E-03		

Table 2.2-8 (cont.).

Pollutant	ACI[i]/ Average Bed Temperature/Baghouse/Cyclones/Wet ESP/ ESP/SNCR[g]/ Incinerator/ Tray-Type Gas Absorption/ Scrubber[j]		Average Bed Temperature/Scubber[l]/ Wet ESP	
	g/Mg	lb/ton	g/Mg	lb/ton
Aluminum				
Arsenic[c]				
Barium				
Beryllium[c]				
Cadmium[c]	1.7 E-03[k,p]	3.3 E-06[k,p]		
Calcium[c]				
Chromium[c]			1.8 E-02[m,h]	3.6 E-05[m,h]
Copper				
Manganese[c]				
Magnesium				
Mercury[c]				
Nickel[c]				
Potassium				
Selenium[c]				
Silicon				
Sulfur				
Tin				
Titanium				
Zinc				

Table 2.2-8 (cont.).

Pollutant	Incinerator/Venturi		ACI/ Average Bed Temperature/Baghouse/Cyclone/ Incinerator/ESP/Wet ESP/Scrubber/ Tray-Type Gas Absorption Column	
	g/Mg	lb/ton	g/Mg	lb/ton
Aluminum				
Arsenic[c]				
Barium				
Beryllium[c]				
Cadmium[c]				
Calcium[c]				
Chromium[c]				
Copper				
Manganese[c]				
Magnesium				
Mercury[c]	2.4 E-01[n,h]	4.8 E-04[n,h]	1.2 E-01[f,p]	2.3 E-04[f,p]
Nickel[c]				
Potassium				
Selenium[c]				
Silicon				
Sulfur				
Tin				
Titanium				
Zinc				

[a]Units are pollutants emitted of drydried sludge burnedfed. Source Classification Code (SCC) 5-01-005-16008-03. Blanks indicate no data.

[b]Wet ESP = wet[b]ESP = electrostatic precipitator.

[c]Hazardous air pollutants listed in the *Clean Air Act*.

[f] Reference 116

[g]SNCR = selective non-catalytic reduction

[h]Moderately representative emission factor

[i]ACI = Activated Carbon Injection

[j]Scrubber/scrubber water pH/tray scrubber/venturi scrubber

Formatted: Font: Times New Roman

[k]Reference 141
[l]Impingement type wet scrubber/scrubber pressure drop/scrubber water pH/tray scrubber/venturi scrubber/wet scrubber
[m]Reference 110
[n]Reference 90
[o]Venturi scrubber/scrubber/tray scrubber/
[p]Highly representative emission factor

Table 2.2-9 (Metric ~~And~~and English Units). SUMMARY OF EMISSION FACTORS FOR ELECTRIC INFRARED SEWAGE SLUDGE INCINERATORS[a]

EMISSION FACTOR RATING: E

Source ~~Category~~[b]Category	Particulate Matter		Sulfur Dioxide		Nitrogen Oxides	
	kg/Mg	lb/ton	kg/Mg	lb/ton	kg/Mg	lb/ton
Uncontrolled	3.7 E+00	7.4 E+00	9.2 E+00	1.8 E+01	4.3 E+00	8.6 E+00
Controlled						
Cyclone						
Cyclone/impingement						
Cyclone/venturi	1.9 E+00	3.8 E+00				
Cyclone/venturi/impingement						
Electrostatic precipitator						
Fabric filter						
Impingement	8.2 E-01	1.6 E+00				
Venturi						
Venturi/impingement/ afterburner						
Venturi/impingement	9.5 E-01	1.9 E+00	2.3 E+00	4.6 E+00	2.9 E+00	5.8 E+00
Venturi/impingement/ Wet ~~ESP~~ESP[b]						
Venturi/Wet ESP						

[a]Units are pollutants emitted of ~~dry~~dried sludge ~~burned~~fed. Source Classification Code (SCC) 5-01-~~005-17~~008-04.
~~[b]Wet ESP = wet~~ [b]ESP = electrostatic precipitator.

Table 2.2-10 (Metric Andand English Units). CARBON DIOXIDE EMISSION FACTORS FOR SEWAGE SLUDGE INCINERATORS.

Formatted: Condensed by 0.1 pt

Formatted: Condensed by 0.1 pt

Source Category	Carbon Dioxide		
	lb/MMbtu Heat Input	kg/Mg[a]	lb/ton[a]
Uncontrolled			
Controlled (SCC 5-01-008-02)			
Afterburner/ESP[a]/Scrubber[b]/Wet ESP[p]/ Regenerative Thermal Oxidizer		1.8 E+03[e,i]	3.5 E+03[e,i]
Afterburner/ESP/Scrubber[c]/Wet ESP	1.6 E+02[d,i,g]		
Controlled (SCC 5-01-008-03)			
Average Bed Temperature/ Incinerator/Scrubber[h]/Wet ESP		1.5 E+03[j,i]	2.9 E+03[j,i]
Average Bed Temperature/ESP/Tray-Type Gas Absorption Column/ Scrubber[k]/Wet ESP	1.9 E+02[l,m,i]		
Controlled (SCC 5-06-007-02)			
Afterburner/Scrubber[n]/Wet ESP	1.6 E+02[o,i,g]		

[a] Units are in dried sludge fed,
[b] Venturi scrubber/wet scrubber/tray scrubber/impingement plate scrubber
[c] Venturi scrubber/wet scrubber
[d] Reference 106
[e] Reference 107
[f] Minimally representative emission factor
[g] lb/MMbtu heat input O_2
[h] Scrubber water pH/venturi scrubber/wet scrubber
[i] Moderately representative emission factor
[j] Reference 108
[k] Scrubber/scrubber pressure drop/scrubber water pH, tray scrubber, venturi scrubber
[l] Reference 105
[m] lb/MMbtu heat input CO_2
[n] Impingement venturi tray scrubber/wet scrubber
[o] Reference 136
[p] ESP = electrostatic precipitator

Table 2.2-11 (Metric and English Units). CUMULATIVE PARTICLE SIZE DISTRIBUTION FOR SEWAGE SLUDGE INCINERATORS[a]

EMISSION FACTOR RATING: E

Particle Size ~~(µm)~~ (µm)	Cumulative Mass % Stated Size				
	Uncontrolled		Controlled (Scrubber)		
	MH[b]	EI[c]	MH	FB[d]	EI
15	15	43	30	7.7	60
10	10	30	27	7.3	50
5~~.0~~	5.3	17	25	6.7	35
2.5	2.8	10	22	6~~.0~~	25
1~~.0~~	1.2	6~~.0~~	20	5~~.0~~	18
0.625	0.75	5~~.0~~	17	2.7	15

[a]Reference 5.
[b]MH = multiple hearth incinerator. Source Classification Code (SCC) 5-01-~~005-15~~008-02.
[c]EI = electric infrared incinerator. SCC~~-~~ 5-01-~~005-17~~008-04.
[d]FB = fluidized bed incinerator. SCC 5-01-~~005-16~~008-03.

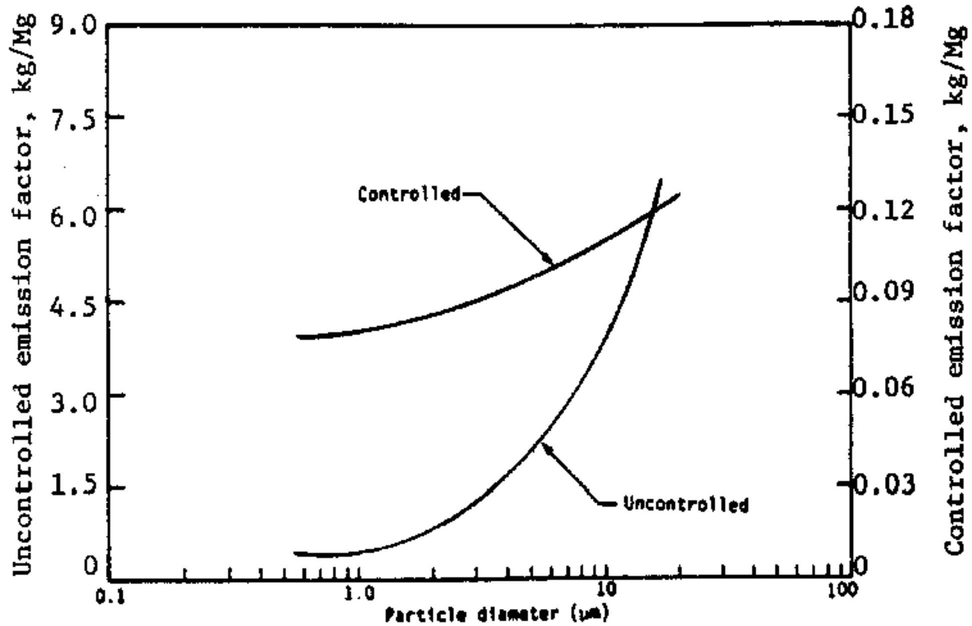
Formatted: Tab stops: 3.25", Centered + Not at 0" + 0.5" + 0.64" + 1.5" + 2" + 2.5" + 3" + 3.5" + 4" + 4.5" + 5" + 5.5" + 6" + 6.5"
Inserted Cells
Inserted Cells
Inserted Cells
Inserted Cells
Formatted: Font: Times New Roman, Font color: Black
Split Cells
Formatted: Font: Times New Roman, Font color: Black
Formatted: Font: Times New Roman, Font color: Black
Formatted: Left, Space Before: 0 pt, After: 0 pt, Line spacing: single, Widow/Orphan control, Hyphenate, Adjust space between Latin and Asian text, Adjust space between Asian text and numbers, Tab stops: Not at -1.64" + -1.14" + -1" + -0.14" + 0.36" + 0.86" + 1.36" + 1.86" + 2.36" + 2.86" + 3.36" + 3.86" + 4.36"
Formatted: Font: Times New Roman, Font color: Black
Formatted: Space Before: 0 pt, After: 0 pt, Line spacing: single, Widow/Orphan control, Hyphenate, Adjust space between Latin and Asian text, Adjust space between Asian text and numbers, Tab stops: Not at -0.07" + 0.43" + 0.57" + 1.43" + 1.93" + 2.43"
Formatted: Font: Times New Roman, Font color: Black
Formatted: Space Before: 0 pt, After: 0 pt, Line spacing: single, Widow/Orphan control, Hyphenate, Adjust space between Latin and Asian text, Adjust space between Asian text and numbers, Tab stops: Not at -0.07" + 0.43" + 0.57" + 1.43" + 1.93" + 2.43"
Formatted: Font: Times New Roman, Font color: Black
Formatted ...
Formatted: Font: Times New Roman, Font color: Black
Formatted ...
Formatted: Font: Times New Roman, Font color: Black
Formatted: Font: Times New Roman, Font color: Black
Formatted ...
Formatted: Font: Times New Roman, Font color: Black
Formatted: Font: Times New Roman, Font color: Black
Formatted ...
Formatted: Font: Times New Roman, Font color: Black
Formatted: Font: Times New Roman, Font color: Black
Formatted: Font: Times New Roman, Font color: Black
Formatted: Font: Times New Roman, Font color: Black
Formatted ...
Formatted: Font: Times New Roman, Font color: Black
Formatted: Font: Times New Roman, Font color: Black
Formatted ...

Table 2.2-~~11~~12 (Metric ~~And~~and English Units). CUMULATIVE PARTICLE SIZE-SPECIFIC EMISSION FACTORS FOR SEWAGE SLUDGE INCINERATORS[a]

EMISSION FACTOR RATING: E, unless otherwise noted

Particle Size ~~(µm)~~	Cumulative Emission Factor									
	Uncontrolled				Controlled (Scrubber)					
	MH[b]		EI[c]		MH		FB[d]		EI	
(µm)	kg/Mg	lb/ton	kg/Mg	lb/ton	kg/Mg	lb/ton	kg/Mg	lb/ton	kg/Mg	lb/t
15	6.0 E+00	1.2 E+01	4.3 E+00	8.6 E+00	1.2 E-01	2.4 E-01	2.3 E-01	4.6 E-01	1.2 E+00	2.4 E
10	4.1 E+00	8.2 E+00	3.0 E+00	6.0 E+00	1.1 E-01	2.2 E-01	2.2 E-01	4.4 E-01	1.0 E+00	2.0 E
5.~~0~~	2.1 E+00	4.2 E+00	1.7 E+00	3.4 E+00	1.0 E-01	2.0 E-01	2.0 E-01	4.0 E-01	7.0 E-01	1.4 E
2.5	1.1 E+00	2.2 E+00	1.0 E+00	2.0 E+00	9.0 E-02	1.8 E-01	1.8 E-01	3.6 E-01	5.0 E-01	1.0 E
1.~~0~~	4.7 E-01	9.4 E-01	6.0 E-01	1.2 E+00	8.0 E-02	1.6 E-01	1.5 E-01	3.0 E-01	3.5 E-01	7.0 E
0.625	3.0 E-01	6.0 E-01	5.0 E-01	1.0 E+00	7.0 E-02	1.4 E-01	8.0 E-02	1.6 E-01	3.0 E-01	6.0 E

[a] Reference 5.
[b] MH = multiple hearth incinerator. Source Classification Code (SCC) 5-01-~~005-15~~008-02.
[c] EI = electric infrared incinerator. SCC 5-01-~~005-17~~008-04.
[d] FB = fluidized bed incinerator. SCC 5-01-~~005-16~~008-03.



Uncontrolled emission factor, kg/Mg
9.0
7.5
6.0
4.5
3.0
1.5
0
Controlled emission factor, kg/Mg
0.18
0.15
0.12
0.09
0.06
0.03
0
Controlled
Uncontrolled
0.1
1.0
10
100
Particle diameter (µm)

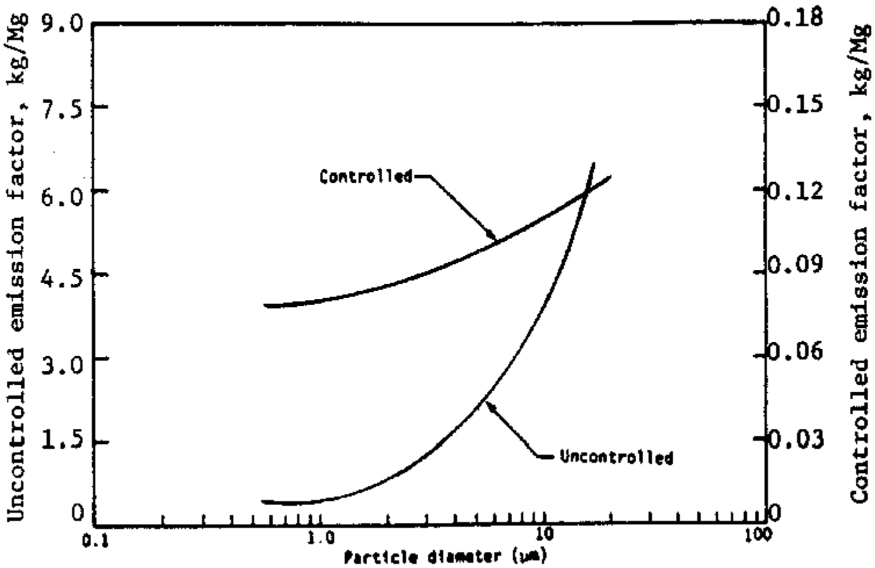
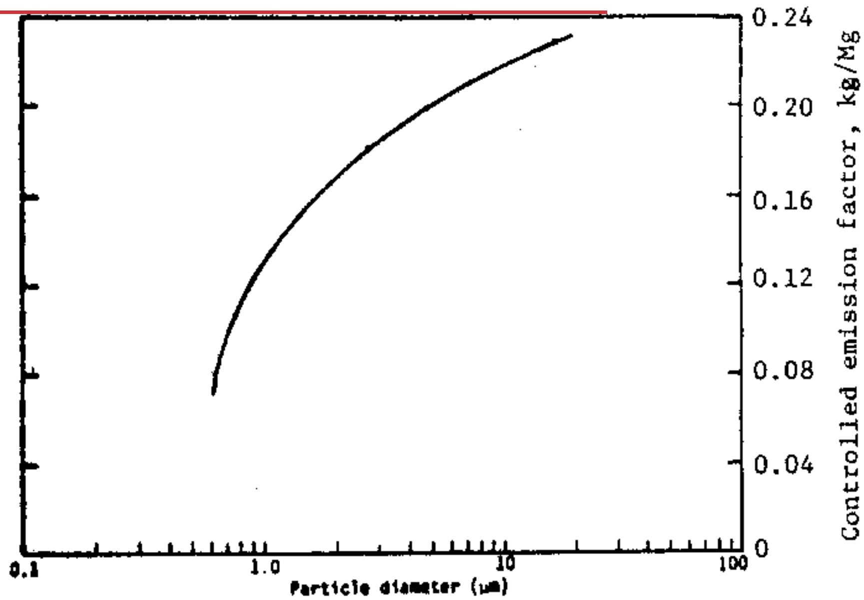


Figure 2.2-4. Cumulative Particle Size Distribution and Size-Specific Emission Factors for Multiple-Health Incinerators



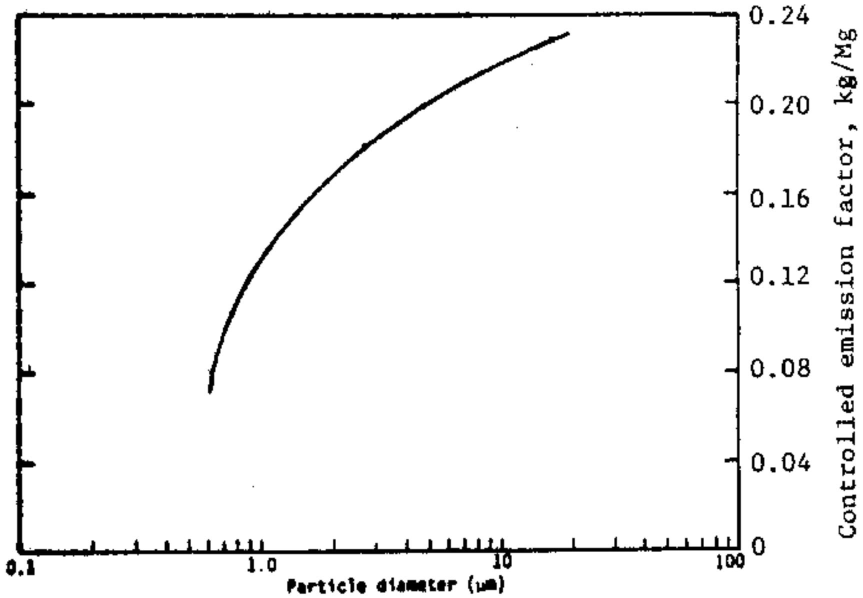
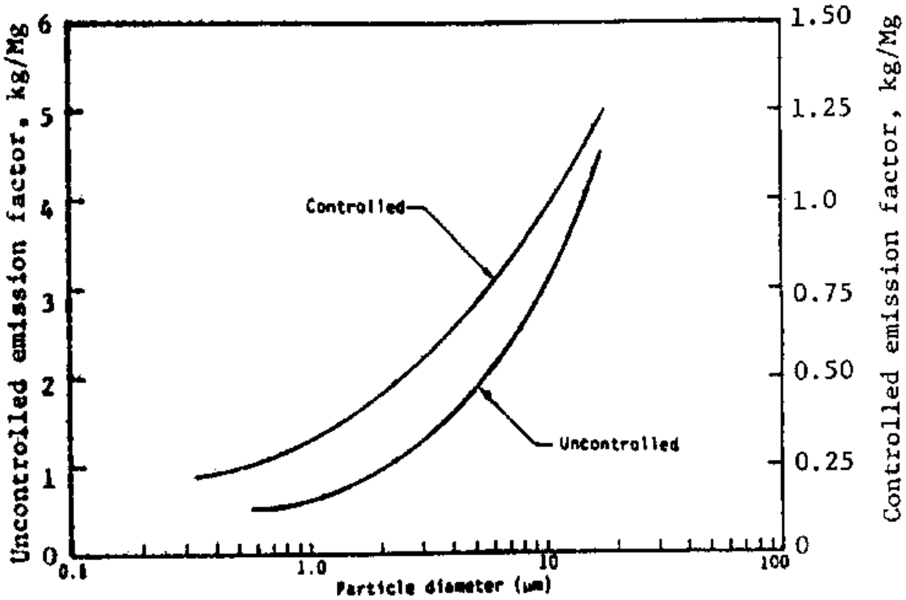


Figure 2.2-5. Cumulative Particle Size Distribution and Size-Specific Emission Factors for Fluidized-Bed Incinerators



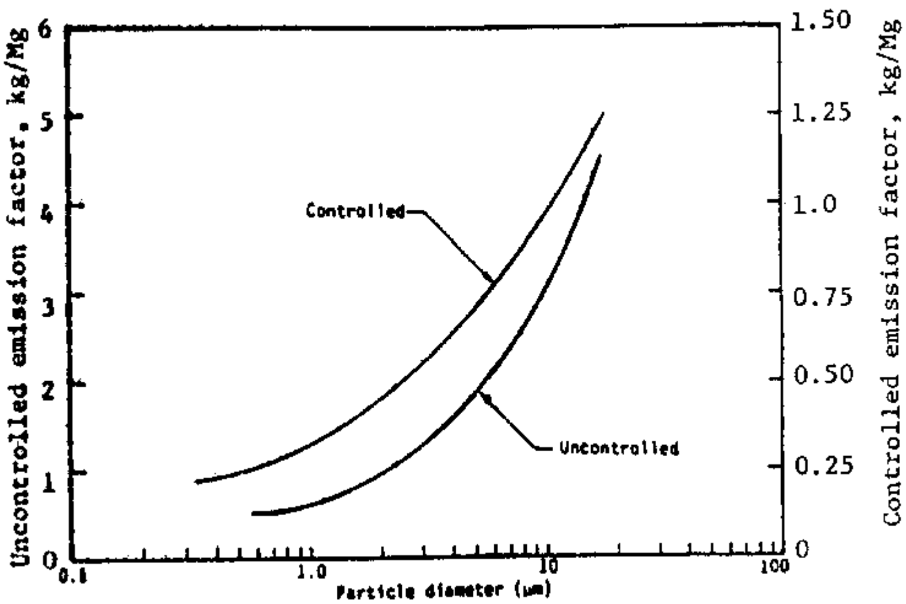


Figure 2.2-6. Cumulative Particle Size Distribution and

References For Section 2.2

References For Section 2.2

1. *Second Review Of Standards Of Performance For Sewage Sludge Incinerators*, EPA-450/3-84-010, U. S. Environmental Protection Agency, Research Triangle Park, North Carolina, March 1984.

1. *Second Review Of Standards Of Performance For Sewage Sludge Incinerators*, EPA-450/3-84-010, U. S. Environmental Protection Agency, Research Triangle Park, North Carolina, March 1984.

2. *Process Design Manual For Sludge Treatment And Disposal*, EPA-625/1-79-011, U. S. Environmental Protection Agency, Cincinnati, Ohio, September 1979.

3. *Control Techniques For Particulate Emissions From Stationary Sources - Volume 1*, EPA-450/3-81-005a, U. S. Environmental Protection Agency, Research Triangle Park, North Carolina, September 1982.

4. *Final Draft Test Report - Site 01 Sewage Sludge Incinerator SSI-A*, National Dioxin Study. Tier 4: Combustion Sources. EPA Contract No. 68-03-3148, U. S. Environmental Protection Agency, Research Triangle Park, North Carolina, July 1986.

5. *Final Draft Test Report - Site 03 Sewage Sludge Incinerator SSI-B*, National Dioxin Study. Tier 4: Combustion Sources. EPA Contract No. 68-03-3148, U. S. Environmental Protection Agency, Research Triangle Park, North Carolina, July 1986.

Formatted: Heading 2, Line spacing: single, Hyphenate, Tab stops: Not at 0" + 0.5" + 1" + 1.5" + 2" + 2.5" + 3" + 3.5" + 4" + 4.5" + 5" + 5.5" + 6" + 6.5"

4. *Final Draft Test Report--Site 01 Sewage Sludge Incinerator SSI-A*, National Dioxin Study. Tier 4: Combustion Sources. EPA Contract No. 68-03-3148, U. S. Environmental Protection Agency, Research Triangle Park, North Carolina, July 1986.

5. *Final Draft Test Report--Site 03 Sewage Sludge Incinerator SSI-B*, National Dioxin Study. Tier 4: Combustion Sources. EPA Contract No. 68-03-3148, U. S. Environmental Protection Agency, Research Triangle Park, North Carolina, July 1986.

6. *Draft Test Report--Site 12 Sewage Sludge Incinerator SSI-C*, EPA Contract No. 68-03-3138, U. S. Environmental Protection Agency, Research Triangle Park, North Carolina, April 1986.

7. M. Trichon and R. T. Dewling, *The Fate Of Trace Metals In A Fluidized-Bed Sewage Sludge Incinerator*, (Port Washington). (GCA).

8. Engineering-Science, Inc., *Particulate And Gaseous Emission Tests At Municipal Sludge Incinerator Plants "O", "P", "Q", And "R" (4 tests)*, EPA Contract No. 68-02-2815, U. S. Environmental Protection Agency, McLean, Virginia, February 1980.

9. *Organics Screening Study Test Report. Sewage Sludge Incinerator No. 13, Detroit Water And Sewer Department, Detroit, Michigan*, EPA Contract No. 68-02-3849, PEI Associates, Inc., Cincinnati, Ohio, August 1986.

10. *Chromium Screening Study Test Report. Sewage Sludge Incinerator No. 13, Detroit Water And Sewer Department, Detroit Michigan*, EPA Contract No. 68-02-3849, PEI Associates, Inc., Cincinnati, Ohio, August 1986.

11. *Results Of The October 24, 1980, Particulate Compliance Test On The No. 1 Sludge Incinerator Wet Scrubber Stack, MWCC St. Paul Wastewater Treatment Plant in St. Paul, Minnesota*, [STAPPA/ALAPCO/05/27/86-No. 02], Interpoll Inc., Circle Pines, Minnesota, November 1980.

12. *Results Of The June 6, 1983, Emission Compliance Test On The No. 10 Incinerator System In The F&I 2 Building, MWCC Metro Plant, St. Paul, Minnesota*, [STAPPA/ALAPCO/05/27/86-No. 02], Interpoll Inc., Circle Pines, Minnesota, June 1983.

13. *Results Of The May 23, 1983, Emission Compliance Test On The No. 9 Incinerator System In The F&I 2 Building, MWCC Metro Plant, St. Paul, Minnesota*, [STAPPA/ALAPCO/05/27/86-No. 02], Interpoll Inc., Circle Pines, Minnesota, May 1983.

14. *Results Of The November 25, 1980, Particulate Emission Compliance Test On The No. 4 Sludge Incinerator Wet Scrubber Stack, MWCC St. Paul Wastewater Treatment Plant, St. Paul, Minnesota*, [STAPPA/ALAPCO/05/27/86-No. 02], Interpoll Inc., Circle Pines, Minnesota, December, 1980.

15. *Results Of The March 28, 1983, Particulate Emission Compliance Test On The No. 8 Incinerator, MWCC Metro Plant, St. Paul, Minnesota*, [STAPPA/ALAPCO/05/28/86-No. 06], Interpoll Inc., Circle Pines, Minnesota, April 1983.

16. *Particulate Emission Test Report For A Sewage Sludge Incinerator, City Of Shelby Wastewater Treatment Plant*, [STAPPA/ALAPCO/07/28/86-No. 06], North Carolina Department of Natural Resources, February 1979.

17. *Source Sampling Evaluation For Rocky River Wastewater Treatment Plant, Concord, North Carolina*, [STAPPA/ALAPCO/05/28/86-No. 06], Mogul Corp., Charlotte, North Carolina, July 1982.

18. *Performance Test Report: Rocky Mount Wastewater Treatment Facility*, [STAPPA/ALAPCO/07/28/86-No. 06], Envirotech, Belmont, California, July 1983.

19. *Performance Test Report For The Incineration System At The Honolulu Wastewater Treatment Plant, Honolulu, Oahu, Hawaii*, [STAPPA/ALAPCO/05/22/86-No. 11], Zimpro, Rothschild, Wisconsin, January 1984.

20. *(Test Results) Honolulu Wastewater Treatment Plant, Ewa, Hawaii*, [STAPPA/ALAPCO/05/22/86-No. 11], Zimpro, Rothschild, Wisconsin, November 1983.

21. *Air Pollution Source Test. Sampling And Analysis Of Air Pollutant Effluent From Wastewater Treatment Facility-Sand Island Wastewater Treatment Plant in Honolulu, Hawaii*, [STAPPA/ALAPCO/05/22/86-No. 11], Ultrachem, Walnut Creek, California, December 1978.

22. *Air Pollution Source Test. Sampling And Analysis Of Air Pollutant Effluent From Wastewater Treatment Facility-Sand Island Wastewater Treatment Plant In Honolulu, Hawaii-Phase II*, [STAPPA/ALAPCO/05/22/86-No. 11], Ultrachem, Walnut Creek, California, December 1979.

23. *Stationary Source Sampling Report, EEI Reference No. 2988, At The Osborne Wastewater Treatment Plant, Greensboro, North Carolina*, [STAPPA/ALAPCO/07/28/86-No. 06], Particulate Emissions and Particle Size Distribution Testing. Sludge Incinerator Scrubber Inlet and Scrubber Stack, Entropy, Research Triangle Park, North Carolina, October 1985.

24. *Metropolitan Sewer District-Little Miami Treatment Plant (three tests: August 9, 1985, September 16, 1980, And September 30, 1980) And Mill Creek Treatment Plant (one test: January 9, 1986)*, [STAPPA/ALAPCO/05/28/86-No. 14], Southwestern Ohio Air Pollution Control Agency.

25. *Particulate Emissions Compliance Testing, At The City Of Milwaukee South Shore Treatment Plant, Milwaukee, Wisconsin*, [STAPPA/ALAPCO/06/12/86-No. 19], Entropy, Research Triangle Park, North Carolina, December 1980.

26. *Particulate Emissions Compliance Testing, At The City of Milwaukee South Shore Treatment Plant, Milwaukee, Wisconsin*, [STAPPA/ALAPCO/06/12/86-No. 19], Entropy, Research Triangle Park, North Carolina, November 1980.

27. *Stack Test Report-Bayshore Regional Sewage Authority, In Union Beach, New Jersey*, [STAPPA/ALAPCO/05/22/86-No. 12], New Jersey State Department of Environmental Protection, Trenton, New Jersey, March 1982.

28. *Stack Test Report-Jersey City Sewage Authority, In Jersey City, New Jersey*, [STAPPA/ALAPCO/05/22/86-No. 12], New Jersey State Department of Environmental Protection, Trenton, New Jersey, December 1980.

29. *Stack Test Report-Northwest Bergen County Sewer Authority, In Waldwick, New Jersey*, [STAPPA/ALAPCO/05/22/86-No. 12], New Jersey State Department of Environmental

Protection, Trenton, New Jersey, March 1982.

30. *Stack Test Report - Pequannock, Lincoln Park, And Fairfield Sewerage Authority, In Lincoln Park, New Jersey*, [STAPPA/ALAPCO/05/22/86-No. 12], New Jersey State Department of Environmental Protection, Trenton, New Jersey, December 1975.

31. *Atmospheric Emission Evaluation, Of The Anchorage Water And Wastewater Utility Sewage Sludge Incinerator*, ASA, Bellevue, Washington, April 1984.

32. *Stack Sampling Report For Municipal Sewage Sludge Incinerator No. 1, Scrubber Outlet (Stack), Providence, Rhode Island*, Recon Systems, Inc., Three Bridges, New Jersey, November 1980.

33. *Stack Sampling Report, Compliance Test No. 3, At The Attleboro Advanced Wastewater Treatment Facility, In Attleboro, Massachusetts*, David Gordon Associates, Inc., Newton Upper Falls, Massachusetts, May 1983.

34. *Source Emission Survey, At The Rowlett Creek Plant*, North Texas Municipal Water District, Plano, Texas, Shirco, Inc., Dallas, Texas, November 1978.

35. *Emissions Data For Infrared Municipal Sewage Sludge Incinerators (Five tests)*, Shirco, Inc., Dallas, Texas, January 1980.

37. *Electrostatic Precipitator Efficiency On A Multiple Hearth Incinerator Burning Sewage Sludge*, Contract No. 68-03-3148, U. S. Environmental Protection Agency, Research Triangle Park, North Carolina, August 1986.

38. *Baghouse Efficiency On A Multiple Hearth Incinerator Burning Sewage Sludge*, Contract No. 68-03-3148, U. S. Environmental Protection Agency, Research Triangle Park, North Carolina, August 1986.

39. J. B. Farrell and H. Wall, *Air Pollution Discharges From Ten Sewage Sludge Incinerators*, U. S. Environmental Protection Agency, Cincinnati, Ohio, August 1985.

40. *Emission Test Report. - Sewage Sludge Incinerator, At The Davenport Wastewater Treatment Plant, Davenport, Iowa*, [STAPPA/ALAPCO/11/04/86-No. 119], PEDCo Environmental, Cincinnati, Ohio, October 1977.

41. *Sludge Incinerator Emission Testing. - Unit No. 1 For City Of Omaha, Papillion Creek Water Pollution Control Plant*, [STAPPA/ALAPCO/10/28/86-No. 100], Particle Data Labs, Ltd., Elmhurst, Illinois, September 1978.

42. *Sludge Incinerator Emission Testing. - Unit No. 2 For City Of Omaha, Papillion Creek Water Pollution Control Plant*, [STAPPA/ALAPCO/10/28/86-No. 100], Particle Data Labs, Ltd., Elmhurst, Illinois, May 1980.

43. *Particulate And Sulfur Dioxide Emissions Test Report For Zimpro On The Sewage Sludge Incinerator Stack at the Cedar Rapids Water Pollution Control Facility*, [STAPPA/ALAPCO/11/04/86-No. 119], Serco, Cedar Falls, Iowa, September 1980.

44. *Newport Wastewater Treatment Plant*, Newport, Tennessee. (Nichols; December 1979). [STAPPA/ALAPCO/10/27/86-No. 21].

45. *Maryville Wastewater Treatment Plant Sewage Sludge Incinerator Emission Test Report*, [STAPPA/ALAPCO/10/27/86-No. 21], Enviro-measure, Inc., Knoxville, Tennessee, August 1984.

46. *Maryville Wastewater Treatment Plant Sewage Sludge Incinerator Emission Test Report*, [STAPPA/ALAPCO/10/27/86-No. 21], Enviro-measure, Inc., Knoxville, Tennessee, October 1982.

47. *Southerly Wastewater Treatment Plant, Cleveland, Ohio, Incinerator No. 3*, [STAPPA/ALAPCO/11/12/86-No. 124], Envisage Environmental, Inc., Richfield, Ohio, May 1985.

48. *Southerly Wastewater Treatment Plant, Cleveland, Ohio. Incinerator No. 1*, [STAPPA/ALAPCO/11/12/86-No. 124], Envisage Environmental, Inc., Richfield, Ohio, August 1985.

49. *Final Report For An Emission Compliance Test Program (July 1, 1982), At The City Of Waterbury Wastewater Treatment Plant Sludge Incinerator, Waterbury, Connecticut*, [STAPPA/ALAPCO/12/17/86-No. 136], York Services Corp, July 1982.

50. *Incinerator Compliance Test, At The City Of Stratford Sewage Treatment Plant, Stratford, Connecticut*, [STAPPA/ALAPCO/12/17/86-No. 136], Emission Testing Labs, September 1974.

51. *Emission Compliance Tests At The Norwalk Wastewater Treatment Plant In South Smith Street, Norwalk, Connecticut*, [STAPPA/ALAPCO/12/17/86-No. 136], York Research Corp, Stamford, Connecticut, February 1975.

52. *Final Report- Emission Compliance Test Program At The East Shore Wastewater Treatment Plant In New Haven, Connecticut*, [STAPPA/ALAPCO/12/17/86-No. 136], York Services Corp., Stamford, Connecticut, September 1982.

53. *Incinerator Compliance Test At The Enfield Sewage Treatment Plant In Enfield, Connecticut*, [STAPPA/ALAPCO/12/17/86-No. 136], York Research Corp., Stamford, Connecticut, July 1973.

54. *Incinerator Compliance Test At The Glastonbury Sewage Treatment Plant In Glastonbury, Connecticut*, [STAPPA/ALAPCO/12/17/86-No. 136], York Research Corp., Stamford, Connecticut, August 1973.

55. *Results of the May 5, 1981, Particulate Emission Measurements of the Sludge Incinerator, at the Metropolitan District Commission Incinerator Plant*, [STAPPA/ALAPCO/12/17/86- No. 136], Henry Southern Laboratories, Hartford, Connecticut.

56. *Official Air Pollution Tests Conducted on the Nichols Engineering and Research Corporation Sludge Incinerator at the Wastewater Treatment Plant in Middletown, Connecticut*, [STAPPA/ALAPCO/12/17/86-No. 136], Rossnagel and Associates, Cherry Hill, New Jersey, November 1976.

57. *Measured Emissions From The West Nichols-Neptune Multiple Hearth Sludge Incinerator At The Naugatuck Treatment Company In Naugatuck, Connecticut*, [STAPPA/ALAPCO/

12/17/86-No. 136], The Research Corp., East Hartford, Connecticut, April 1985.

58. *Compliance Test Report - (August 27, 1986), At The Mattabasset District Pollution Control Plant Main Incinerator In Cromwell, Connecticut*, [STAPPA/ALAPCO/12/17/86-No. 136], ROJAC Environmental Services, Inc., West Hartford, Connecticut, September 1986.

59. *Stack Sampling Report (May 21, 1986) City of New London No. 2 Sludge Incinerator Outlet Stack Compliance Test*, [STAPPA/ALAPCO/12/17/86-No. 136], Recon Systems, Inc., Three Bridges, New Jersey, June 1986.

60. *Particulate Emission Tests, At The Town of Vernon Municipal Sludge Incinerator in Vernon, Connecticut*, [STAPPA/ALAPCO/12/17/86-No. 136], The Research Corp., Wethersfield, Connecticut, March 1981.

61. *Non-Criteria Emissions Monitoring Program For The Envirotech Nine-Hearth Sewage Sludge Incinerator, At The Metropolitan Wastewater Treatment Facility In St. Paul, Minnesota*, ERT Document No. P-E081-500, October 1986.

7. M. Trichon and R. T. Dewling, *The Fate Of Trace Metals In A Fluidized-Bed Sewage Sludge Incinerator*, (Port Washington). (GCA).

8. Engineering-Science, Inc., *Particulate And Gaseous Emission Tests At Municipal Sludge Incinerator Plants "O", "P", "Q", And "R" (4 tests)*, EPA Contract No. 68-02-2815, U. S. Environmental Protection Agency, McLean, Virginia, February 1980.

9. *Organics Screening Study Test Report. Sewage Sludge Incinerator No. 13, Detroit Water And Sewer Department, Detroit, Michigan*, EPA Contract No. 68-02-3849, PEI Associates, Inc., Cincinnati, Ohio, August 1986.

10. *Chromium Screening Study Test Report. Sewage Sludge Incinerator No. 13, Detroit Water And Sewer Department, Detroit Michigan*, EPA Contract No. 68-02-3849, PEI Associates, Inc., Cincinnati, Ohio, August 1986.

11. *Results Of The October 24, 1980, Particulate Compliance Test On The No. 1 Sludge Incinerator Wet Scrubber Stack, MWCC St. Paul Wastewater Treatment Plant in St. Paul, Minnesota*, [STAPPA/ALAPCO/05/27/86-No. 02], Interpoll Inc., Circle Pines, Minnesota, November 1980.

12. *Results Of The June 6, 1983, Emission Compliance Test On The No. 10 Incinerator System In The F&I 2 Building, MWCC Metro Plant, St. Paul, Minnesota*, [STAPPA/ALAPCO/05/27/86-No. 02], Interpoll Inc., Circle Pines, Minnesota, June 1983.

13. *Results Of The May 23, 1983, Emission Compliance Test On The No. 9 Incinerator System In The F&I 2 Building, MWCC Metro Plant, St. Paul, Minnesota*, [STAPPA/ALAPCO/05/27/86-No. 02], Interpoll Inc., Circle Pines, Minnesota, May 1983.

14. *Results Of The November 25, 1980, Particulate Emission Compliance Test On The No. 4 Sludge Incinerator Wet Scrubber Stack, MWCC St. Paul Wastewater Treatment Plant, St. Paul, Minnesota*, [STAPPA/ALAPCO/05/27/86-No. 02], Interpoll Inc., Circle Pines, Minnesota, December, 1980.

15. *Results Of The March 28, 1983, Particulate Emission Compliance Test On The No. 8 Incinerator, MWCC Metro Plant, St. Paul, Minnesota*, [STAPPA/ALAPCO/05/28/86-No. 06], Interpoll Inc.,

Circle Pines, Minnesota, April 1983.

16. *Particulate Emission Test Report For A Sewage Sludge Incinerator, City Of Shelby Wastewater Treatment Plant*, [STAPPA/ALAPCO/07/28/86-No. 06], North Carolina Department of Natural Resources, February 1979.

17. *Source Sampling Evaluation For Rocky River Wastewater Treatment Plant, Concord, North Carolina*, [STAPPA/ALAPCO/05/28/86-No. 06], Mogul Corp., Charlotte, North Carolina, July 1982.

18. *Performance Test Report: Rocky Mount Wastewater Treatment Facility*, [STAPPA/ALAPCO/07/28/86-No. 06], Envirotech, Belmont, California, July 1983.

19. *Performance Test Report For The Incineration System At The Honolulu Wastewater Treatment Plant, Honolulu, Oahu, Hawaii*, [STAPPA/ALAPCO/05/22/86-No. 11], Zimpro, Rothschild, Wisconsin, January 1984.

20. *(Test Results) Honolulu Wastewater Treatment Plant, Ewa, Hawaii*, [STAPPA/ALAPCO/05/22/86-No. 11], Zimpro, Rothschild, Wisconsin, November 1983.

21. *Air Pollution Source Test. Sampling And Analysis Of Air Pollutant Effluent From Wastewater Treatment Facility--Sand Island Wastewater Treatment Plant in Honolulu, Hawaii*, [STAPPA/ALAPCO/05/22/86-No. 11], Ultrachem, Walnut Creek, California, December 1978.

22. *Air Pollution Source Test. Sampling And Analysis Of Air Pollutant Effluent From Wastewater Treatment Facility--Sand Island Wastewater Treatment Plant In Honolulu, Hawaii--Phase II*, [STAPPA/ALAPCO/05/22/86-No. 11], Ultrachem, Walnut Creek, California, December 1979.

23. *Stationary Source Sampling Report, EEI Reference No. 2988, At The Osborne Wastewater Treatment Plant, Greensboro, North Carolina*, [STAPPA/ALAPCO/07/28/86-No. 06], Particulate Emissions and Particle Size Distribution Testing. Sludge Incinerator Scrubber Inlet and Scrubber Stack, Entropy, Research Triangle Park, North Carolina, October 1985.

24. *Metropolitan Sewer District--Little Miami Treatment Plant (three tests: August 9, 1985, September 16, 1980, And September 30, 1980) And Mill Creek Treatment Plant (one test: January 9, 1986)*, [STAPPA/ALAPCO/05/28/86-No. 14], Southwestern Ohio Air Pollution Control Agency.

25. *Particulate Emissions Compliance Testing, At The City Of Milwaukee South Shore Treatment Plant, Milwaukee, Wisconsin*, [STAPPA/ALAPCO/06/12/86-No. 19], Entropy, Research Triangle Park, North Carolina, December 1980.

26. *Particulate Emissions Compliance Testing, At The City of Milwaukee South Shore Treatment Plant, Milwaukee, Wisconsin*, [STAPPA/ALAPCO/06/12/86-No. 19], Entropy, Research Triangle Park, North Carolina, November 1980.

27. *Stack Test Report--Bayshore Regional Sewage Authority, In Union Beach, New Jersey*, [STAPPA/ALAPCO/05/22/86-No. 12], New Jersey State Department of Environmental Protection, Trenton, New Jersey, March 1982.

28. *Stack Test Report--Jersey City Sewage Authority, In Jersey City, New Jersey*, [STAPPA/ALAPCO/05/22/86-No. 12], New Jersey State Department of Environmental Protection, Trenton, New Jersey, December 1980.

29. *Stack Test Report--Northwest Bergen County Sewer Authority, In Waldwick, New Jersey*, [STAPPA/ALAPCO/05/22/86-No. 12], New Jersey State Department of Environmental Protection, Trenton, New Jersey, March 1982.

30. *Stack Test Report--Pequannock, Lincoln Park, And Fairfield Sewerage Authority, In Lincoln Park, New Jersey*, [STAPPA/ALAPCO/05/22/86-No. 12], New Jersey State Department of Environmental Protection, Trenton, New Jersey, December 1975.

31. *Atmospheric Emission Evaluation, Of The Anchorage Water And Wastewater Utility Sewage Sludge Incinerator*, ASA, Bellevue, Washington, April 1984.

32. *Stack Sampling Report For Municipal Sewage Sludge Incinerator No. 1, Scrubber Outlet (Stack), Providence, Rhode Island*, Recon Systems, Inc., Three Bridges, New Jersey, November 1980.

33. *Stack Sampling Report, Compliance Test No. 3, At The Attleboro Advanced Wastewater Treatment Facility, In Attleboro, Massachusetts*, David Gordon Associates, Inc., Newton Upper Falls, Massachusetts, May 1983.

34. *Source Emission Survey, At The Rowlett Creek Plant*, North Texas Municipal Water District, Plano, Texas, Shirco, Inc., Dallas, Texas, November 1978.

35. *Emissions Data For Infrared Municipal Sewage Sludge Incinerators (Five tests)*, Shirco, Inc., Dallas, Texas, January 1980.

37. *Electrostatic Precipitator Efficiency On A Multiple Hearth Incinerator Burning Sewage Sludge*, Contract No. 68-03-3148, U. S. Environmental Protection Agency, Research Triangle Park, North Carolina, August 1986.

38. *Baghouse Efficiency On A Multiple Hearth Incinerator Burning Sewage Sludge*, Contract No. 68-03-3148, U. S. Environmental Protection Agency, Research Triangle Park, North Carolina, August 1986.

39. J. B. Farrell and H. Wall, *Air Pollution Discharges From Ten Sewage Sludge Incinerators*, U. S. Environmental Protection Agency, Cincinnati, Ohio, August 1985.

40. *Emission Test Report. Sewage Sludge Incinerator, At The Davenport Wastewater Treatment Plant, Davenport, Iowa*, [STAPPA/ALAPCO/11/04/86-No. 119], PEDCo Environmental, Cincinnati, Ohio, October 1977.

41. *Sludge Incinerator Emission Testing. Unit No. 1 For City Of Omaha, Papillion Creek Water Pollution Control Plant*, [STAPPA/ALAPCO/10/28/86-No. 100], Particle Data Labs, Ltd., Elmhurst, Illinois, September 1978.

42. *Sludge Incinerator Emission Testing. Unit No. 2 For City Of Omaha, Papillion Creek Water Pollution Control Plant*, [STAPPA/ALAPCO/10/28/86-No. 100], Particle Data Labs, Ltd., Elmhurst, Illinois, May 1980.

43. *Particulate And Sulfur Dioxide Emissions Test Report For Zimpro On The Sewage Sludge Incinerator Stack at the Cedar Rapids Water Pollution Control Facility*, [STAPPA/ALAPCO/11/04/86-No. 119], Serco, Cedar Falls, Iowa, September 1980.

44. *Newport Wastewater Treatment Plant*, Newport, Tennessee. (Nichols; December 1979). [STAPPA/ALAPCO/10/27/86-No. 21].

45. *Maryville Wastewater Treatment Plant Sewage Sludge Incinerator Emission Test Report*, [STAPPA/ALAPCO/10/27/86-No. 21], Enviro-measure, Inc., Knoxville, Tennessee, August 1984.

46. *Maryville Wastewater Treatment Plant Sewage Sludge Incinerator Emission Test Report*, [STAPPA/ALAPCO/10/27/86-No. 21], Enviro-measure, Inc., Knoxville, Tennessee, October 1982.

47. *Southerly Wastewater Treatment Plant, Cleveland, Ohio, Incinerator No. 3*, [STAPPA/ALAPCO/11/12/86-No. 124], Envisage Environmental, Inc., Richfield, Ohio, May 1985.

48. *Southerly Wastewater Treatment Plant, Cleveland, Ohio. Incinerator No. 1*, [STAPPA/ALAPCO/11/12/86-No. 124], Envisage Environmental, Inc., Richfield, Ohio, August 1985.

49. *Final Report For An Emission Compliance Test Program (July 1, 1982), At The City Of Waterbury Wastewater Treatment Plant Sludge Incinerator, Waterbury, Connecticut*, [STAPPA/ALAPCO/12/17/86-No. 136], York Services Corp, July 1982.

50. *Incinerator Compliance Test, At The City Of Stratford Sewage Treatment Plant, Stratford, Connecticut*, [STAPPA/ALAPCO/12/17/86-No. 136], Emission Testing Labs, September 1974.

51. *Emission Compliance Tests At The Norwalk Wastewater Treatment Plant In South Smith Street, Norwalk, Connecticut*, [STAPPA/ALAPCO/12/17/86-No. 136], York Research Corp, Stamford, Connecticut, February 1975.

52. *Final Report--Emission Compliance Test Program At The East Shore Wastewater Treatment Plant In New Haven, Connecticut*, [STAPPA/ALAPCO/12/17/86-No. 136], York Services Corp., Stamford, Connecticut, September 1982.

53. *Incinerator Compliance Test At The Enfield Sewage Treatment Plant In Enfield, Connecticut*, [STAPPA/ALAPCO/12/17/86-No. 136], York Research Corp., Stamford, Connecticut, July 1973.

54. *Incinerator Compliance Test At The Glastonbury Sewage Treatment Plant In Glastonbury, Connecticut*, [STAPPA/ALAPCO/12/17/86-No. 136], York Research Corp., Stamford, Connecticut, August 1973.

55. *Results of the May 5, 1981, Particulate Emission Measurements of the Sludge Incinerator, at the Metropolitan District Commission Incinerator Plant*, [STAPPA/ALAPCO/12/17/86- No. 136], Henry Southern Laboratories, Hartford, Connecticut.

56. *Official Air Pollution Tests Conducted on the Nichols Engineering and Research Corporation*

Sludge Incinerator at the Wastewater Treatment Plant in Middletown, Connecticut, [STAPPA/ALAPCO/12/17/86-No. 136], Rossnagel and Associates, Cherry Hill, New Jersey, November 1976.

57. *Measured Emissions From The West Nichols-Neptune Multiple Hearth Sludge Incinerator At The Naugatuck Treatment Company In Naugatuck, Connecticut*, [STAPPA/ALAPCO/12/17/86-No. 136], The Research Corp., East Hartford, Connecticut, April 1985.

58. *Compliance Test Report--(August 27, 1986), At The Mattabasset District Pollution Control Plant Main Incinerator In Cromwell, Connecticut*, [STAPPA/ALAPCO/12/17/86-No. 136], ROJAC Environmental Services, Inc., West Hartford, Connecticut, September 1986.

59. *Stack Sampling Report (May 21, 1986) City of New London No. 2 Sludge Incinerator Outlet Stack Compliance Test*, [STAPPA/ALAPCO/12/17/86-No. 136], Recon Systems, Inc., Three Bridges, New Jersey, June 1986.

60. *Particulate Emission Tests, At The Town of Vernon Municipal Sludge Incinerator in Vernon, Connecticut*, [STAPPA/ALAPCO/12/17/86-No. 136], The Research Corp., Wethersfield, Connecticut, March 1981.

61. *Non-Criteria Emissions Monitoring Program For The Envirotech Nine-Hearth Sewage Sludge Incinerator, At The Metropolitan Wastewater Treatment Facility In St. Paul, Minnesota*, ERT Document No. P-E081-500, October 1986.

62. D. R. Knisley, *et al.*, *Site 1 Revised Draft Emission Test Report, Sewage Sludge Test Program*, U. S. Environmental Protection Agency, Water Engineering Research Laboratory, Cincinnati, Ohio, February 9, 1989.

63. D. R. Knisley, *et al.*, *Site 2 Final Emission Test Report, Sewage Sludge Test Program*, U. S. Environmental Protection Agency, Water Engineering Research Laboratory, Cincinnati, Ohio, October 19, 1987.

64. D. R. Knisley, *et al.*, *Site 3 Draft Emission Test Report And Addendum, Sewage Sludge Test Program. Volume 1: Emission Test Results*, U. S. Environmental Protection Agency, Water Engineering Research Laboratory, Cincinnati, Ohio, October 1, 1987.

65. D. R. Knisley, *et al.*, *Site 4 Final Emission Test Report, Sewage Sludge Test Program*, U. S. Environmental Protection Agency, Water Engineering Research Laboratory, Cincinnati, Ohio, May 9, 1988.

66. R. C. Adams, *et al.*, *Organic Emissions from the Exhaust Stack of a Multiple Hearth Furnace Burning Sewage Sludge*, U. S. Environmental Protection Agency, Water Engineering Research Laboratory, Cincinnati, Ohio, September 30, 1985.

67. R. C. Adams, *et al.*, *Particulate Removal Evaluation Of An Electrostatic Precipitator Dust Removal System Installed On A Multiple Hearth Incinerator Burning Sewage Sludge*, U. S. Environmental Protection Agency, Water Engineering Research Laboratory, Cincinnati, Ohio, September 30, 1985.

68. R. C. Adams, *et al.*, *Particulate Removal Capability Of A Baghouse Filter On The Exhaust Of A Multiple Hearth Furnace Burning Sewage Sludge*, U. S. Environmental Protection Agency,

Water Engineering Research Laboratory, Cincinnati, Ohio, September 30, 1985.

69. R. G. McInnes, *et al.*, *Sampling And Analysis Program At The New Bedford Municipal Sewage Sludge Incinerator*, GCA Corporation/Technology Division, U. S. Environmental Protection Agency, Research Triangle Park, North Carolina, November 1984.

70. R. T. Dewling, *et al.*, "Fate And Behavior Of Selected Heavy Metals In Incinerated Sludge." *Journal Of The Water Pollution Control Federation*, Vol. 52, No. 10, October 1980.

71. R. L. Bennet, *et al.*, *Chemical And Physical Characterization Of Municipal Sludge Incinerator Emissions*, Report No. EPA 600/3-84-047, NTIS No. PB 84-169325, U. S. Environmental Protection Agency, Environmental Sciences Research Laboratory, Research Triangle Park, North Carolina, March 1984.

66. R. C. Adams, *et al.*, *Organic Emissions from the Exhaust Stack of a Multiple Hearth Furnace Burning Sewage Sludge*, U. S. Environmental Protection Agency, Water Engineering Research Laboratory, Cincinnati, Ohio, September 30, 1985.

67. R. C. Adams, *et al.*, *Particulate Removal Evaluation Of An Electrostatic Precipitator Dust Removal System Installed On A Multiple Hearth Incinerator Burning Sewage Sludge*, U. S. Environmental Protection Agency, Water Engineering Research Laboratory, Cincinnati, Ohio, September 30, 1985.

68. R. C. Adams, *et al.*, *Particulate Removal Capability Of A Baghouse Filter On The Exhaust Of A Multiple Hearth Furnace Burning Sewage Sludge*, U. S. Environmental Protection Agency, Water Engineering Research Laboratory, Cincinnati, Ohio, September 30, 1985.

69. R. G. McInnes, *et al.*, *Sampling And Analysis Program At The New Bedford Municipal Sewage Sludge Incinerator*, GCA Corporation/Technology Division, U. S. Environmental Protection Agency, Research Triangle Park, North Carolina, November 1984.

70. R. T. Dewling, *et al.*, "Fate And Behavior Of Selected Heavy Metals In Incinerated Sludge." *Journal Of The Water Pollution Control Federation*, Vol. 52, No. 10, October 1980.

71. R. L. Bennet, *et al.*, *Chemical And Physical Characterization Of Municipal Sludge Incinerator Emissions*, Report No. EPA 600/3-84-047, NTIS No. PB 84-169325, U. S. Environmental Protection Agency, Environmental Sciences Research Laboratory, Research Triangle Park, North Carolina, March 1984.

72. Acurex Corporation. *1990 Source Test Data For The Sewage Sludge Incinerator*, Project 6595, Mountain View, California, April 15, 1991.

73. *Emissions Of Metals, Chromium, And Nickel Species, And Organics From Municipal Wastewater Sludge Incinerators, Volume I: Summary Report*, U. S. Environmental Protection Agency, Cincinnati, Ohio, 1992.

74. L. T. Hentz, *et al.*, *Air Emission Studies Of Sewage Sludge, Incinerators At The Western Branch Wastewater Treatment Plan*, Water Environmental Research, Vol. 64, No. 2, March/April, 1992.

75. *Source Emissions Testing Of The Incinerator #2 Exhaust Stack At The Central Costa Sanitary District Municipal Wastewater Treatment Plan, Mortmez, California*, Galson Technical Services,

Berkeley, California, October, 1990.

73. *Emissions Of Metals, Chromium, And Nickel Species, And Organics From Municipal Wastewater Sludge Incinerators, Volume I: Summary Report*, U. S. Environmental Protection Agency, Cincinnati, Ohio, 1992.

74. L. T. Hentz, *et al.*, *Air Emission Studies Of Sewage Sludge, Incinerators At The Western Branch Wastewater Treatment Plan*, Water Environmental Research, Vol. 64, No. 2, March/April, 1992.

75. *Source Emissions Testing Of The Incinerator #2 Exhaust Stack At The Central Costa Sanitary District Municipal Wastewater Treatment Plan, Mortmez, California*, Galson Technical Services, Berkeley, California, October, 1990.

76. R. R. Segall, *et al.*, *Emissions Of Metals, Chromium And Nickel Species, And Organics From Municipal Wastewater Sludge Incinerators, Volume II: Site 5 Test Report - Hexavalent Chromium Method Evaluation*, EPA 600/R-92/003a, March 1992.

77. R. R. Segall, *et al.*, *Emissions Of Metals, Chromium And Nickel Species, And Organics From Municipal Wastewater Sludge Incinerators, Volume III: Site 6 Test Report*, EPA 600/R-92/003a, March 1992.

78. A. L. Cone *et al.*, *Emissions Of Metals, Chromium, Nickel Species, And Organics From Municipal Wastewater Sludge Incinerators. Volume 5: Site 7 Test Report CEMS*, Entropy Environmentalists, Inc., Research Triangle Park, North Carolina, March 1992.

79. R. R. Segall, *et al.*, *Emissions Of Metals, Chromium And Nickel Species, And Organics From Municipal Wastewater Sludge Incinerators, Volume VI: Site 8 Test Report*, EPA 600/R-92/003a, March 1992.

80. R. R. Segall, *et al.*, *Emissions Of Metals, Chromium And Nickel Species, And Organics From Municipal Wastewater Sludge Incinerators, Volume VII: Site 9 Test Report*, EPA 600/R-92/003a, March 1992.

81. *Stack Sampling For THC And Specific Organic Pollutants At MWCC Incinerators*. Prepared for the Metropolitan Waste Control Commission, Mears Park Centre, St. Paul, Minnesota, July 11, 1991, QC-91-217.

81. *Stack Sampling For THC And Specific Organic Pollutants At MWCC Incinerators*. Prepared for the Metropolitan Waste Control Commission, Mears Park Centre, St. Paul, Minnesota, July 11, 1991, QC-91-217.

82. 1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin stack test data submitted to CEDRI for SCC/control device combination. Each individual test report can be obtained via WebFIRE

83. 1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin stack test data submitted to CEDRI for SCC/control device combination. Each individual test report can be obtained via WebFIRE.

84. 2,3,7,8-Tetrachlorodibenzofuran stack test data submitted to CEDRI for SCC/control device combination. Each individual test report can be obtained via WebFIRE.

85. Cadmium stack test data submitted to CEDRI for SCC/control device combination. Each individual test report can be obtained via WebFIRE.

86. Carbon monoxide stack test data submitted to CEDRI for SCC/control device combination. Each individual test report can be obtained via WebFIRE.

87. Lead stack test data submitted to CEDRI for SCC/control device combination. Each individual test report can be obtained via WebFIRE.

88. Naphthalene stack test data submitted to CEDRI for SCC/control device combination. Each individual test report can be obtained via WebFIRE.

89. Lead stack test data submitted to CEDRI for SCC/control device combination. Each individual test report can be obtained via WebFIRE.

90. Mercury stack test data submitted to CEDRI for SCC/control device combination. Each individual test report can be obtained via WebFIRE.

91. NOx stack test data submitted to CEDRI for SCC/control device combination. Each individual test report can be obtained via WebFIRE.

92. NOx stack test data submitted to CEDRI for SCC/control device combination. Each individual test report can be obtained via WebFIRE.

93. Pentachlorodibenzofurans, total, stack test data submitted to CEDRI for SCC/control device combination. Each individual test report can be obtained via WebFIRE.

94. PM, Filterable stack test data submitted to CEDRI for SCC/control device combination. Each individual test report can be obtained via WebFIRE.

95. PM, Filterable stack test data submitted to CEDRI for SCC/control device combination. Each individual test report can be obtained via WebFIRE.

96. PM, Filterable stack test data submitted to CEDRI for SCC/control device combination. Each individual test report can be obtained via WebFIRE.

97. PM, Filterable stack test data submitted to CEDRI for SCC/control device combination. Each individual test report can be obtained via WebFIRE.

98. PM, Filterable stack test data submitted to CEDRI for SCC/control device combination. Each individual test report can be obtained via WebFIRE.

99. PM, Filterable stack test data submitted to CEDRI for SCC/control device combination. Each individual test report can be obtained via WebFIRE.

100. PM, Primary stack test data submitted to CEDRI for SCC/control device combination. Each individual test report can be obtained via WebFIRE.

101. PM10, Filterable stack test data submitted to CEDRI for SCC/control device combination. Each individual test report can be obtained via WebFIRE.

102. Sulfur dioxide stack test data submitted to CEDRI for SCC/control device combination. Each

individual test report can be obtained via WebFIRE.

103. Tetrachlorodibenzofurans, total stack test data submitted to CEDRI for SCC/control device combination. Each individual test report can be obtained via WebFIRE.

104. Total non-methane organic compounds stack test data submitted to CEDRI for SCC/control device combination. Each individual test report can be obtained via WebFIRE.

105. Carbon dioxide stack test data submitted to CEDRI for SCC/control device combination. Each individual test report can be obtained via WebFIRE.

106. Carbon dioxide stack test data submitted to CEDRI for SCC/control device combination. Each individual test report can be obtained via WebFIRE.

107. Carbon dioxide stack test data submitted to CEDRI for SCC/control device combination. Each individual test report can be obtained via WebFIRE.

108. Carbon dioxide stack test data submitted to CEDRI for SCC/control device combination. Each individual test report can be obtained via WebFIRE.

109. Chromium stack test data submitted to CEDRI for SCC/control device combination. Each individual test report can be obtained via WebFIRE.

110. Chromium stack test data submitted to CEDRI for SCC/control device combination. Each individual test report can be obtained via WebFIRE.

111. Hydrogen chloride stack test data submitted to CEDRI for SCC/control device combination. Each individual test report can be obtained via WebFIRE.

112. Hydrogen chloride stack test data submitted to CEDRI for SCC/control device combination. Each individual test report can be obtained via WebFIRE.

113. Lead stack test data submitted to CEDRI for SCC/control device combination. Each individual test report can be obtained via WebFIRE.

114. Mercury stack test data submitted to CEDRI for SCC/control device combination. Each individual test report can be obtained via WebFIRE.

115. Lead stack test data submitted to CEDRI for SCC/control device combination. Each individual test report can be obtained via WebFIRE.

116. Mercury stack test data submitted to CEDRI for SCC/control device combination. Each individual test report can be obtained via WebFIRE.

117. Lead stack test data submitted to CEDRI for SCC/control device combination. Each individual test report can be obtained via WebFIRE.

118. Nickel stack test data submitted to CEDRI for SCC/control device combination. Each individual test report can be obtained via WebFIRE.

119. Nickel stack test data submitted to CEDRI for SCC/control device combination. Each individual

test report can be obtained via WebFIRE.

120. NOx stack test data submitted to CEDRI for SCC/control device combination. Each individual test report can be obtained via WebFIRE.

121. NOx stack test data submitted to CEDRI for SCC/control device combination. Each individual test report can be obtained via WebFIRE.

122. NOx stack test data submitted to CEDRI for SCC/control device combination. Each individual test report can be obtained via WebFIRE.

123. NOx stack test data submitted to CEDRI for SCC/control device combination. Each individual test report can be obtained via WebFIRE.

124. NOx stack test data submitted to CEDRI for SCC/control device combination. Each individual test report can be obtained via WebFIRE.

125. NOx stack test data submitted to CEDRI for SCC/control device combination. Each individual test report can be obtained via WebFIRE.

126. Other Hexachlorodibenzo-p-dioxins stack test data submitted to CEDRI for SCC/control device combination. Each individual test report can be obtained via WebFIRE.

127. PM, Filterable stack test data submitted to CEDRI for SCC/control device combination. Each individual test report can be obtained via WebFIRE.

128. PM, Filterable stack test data submitted to CEDRI for SCC/control device combination. Each individual test report can be obtained via WebFIRE.

129. PM, Filterable stack test data submitted to CEDRI for SCC/control device combination. Each individual test report can be obtained via WebFIRE.

130. Sulfur dioxide stack test data submitted to CEDRI for SCC/control device combination. Each individual test report can be obtained via WebFIRE.

131. Sulfur dioxide stack test data submitted to CEDRI for SCC/control device combination. Each individual test report can be obtained via WebFIRE.

132. Sulfur dioxide stack test data submitted to CEDRI for SCC/control device combination. Each individual test report can be obtained via WebFIRE.

133. Sulfur dioxide stack test data submitted to CEDRI for SCC/control device combination. Each individual test report can be obtained via WebFIRE.

134. Tetrachlorodibenzo-p-dioxins, total stack test data submitted to CEDRI for SCC/control device combination. Each individual test report can be obtained via WebFIRE.

135. Tetrachlorodibenzofurans, total stack test data submitted to CEDRI for SCC/control device combination. Each individual test report can be obtained via WebFIRE.

136. Carbon dioxide stack test data submitted to CEDRI for SCC/control device combination. Each individual test report can be obtained via WebFIRE.

137. PM, Filterable stack test data submitted to CEDRI for SCC/control device combination. Each individual test report can be obtained via WebFIRE.

138. Tetrachlorodibenzo-p-dioxins, total stack test data submitted to CEDRI for SCC/control device combination. Each individual test report can be obtained via WebFIRE.

139. Total TEQ stack test data submitted to CEDRI for SCC/control device combination. Each individual test report can be obtained via WebFIRE.

140. Total TEQ stack test data submitted to CEDRI for SCC/control device combination. Each individual test report can be obtained via WebFIRE.

141. Cadmium stack test data submitted to CEDRI for SCC/control device combination. Each individual test report can be obtained via WebFIRE.

142. Total TEQ stack test data submitted to CEDRI for SCC/control device combination. Each individual test report can be obtained via WebFIRE.

143. 2,3,7,8-Tetrachlorodibenzofuran stack test data submitted to CEDRI for SCC/control device combination. Each individual test report can be obtained via WebFIRE.

144. Cadmium stack test data submitted to CEDRI for SCC/control device combination. Each individual test report can be obtained via WebFIRE.

145. Carbon monoxide stack test data submitted to CEDRI for SCC/control device combination. Each individual test report can be obtained via WebFIRE.

146. NOx stack test data submitted to CEDRI for SCC/control device combination. Each individual test report can be obtained via WebFIRE.

147. Carbon monoxide stack test data submitted to CEDRI for SCC/control device combination. Each individual test report can be obtained via WebFIRE.

Field Code Changed

Formatted: Indent: Left: 0", Hanging: 0.5", Tab stops: 0.5", Left + 1", Left + 1.5", Left + 2", Left + 2.5", Left + 3", Left + 3.5", Left + 4", Left + 4.5", Left + 5", Left + 5.5", Left + 6", Left + 6.5", Left