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UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated April 2012
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DIVISION 11 - EQUIPMENT

SECTION 11 82 21

MEDICAL WASTE INCINERATORS

08/08

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SECTION 11 82 21

MEDICAL WASTE INCINERATORS
08/08

****
NOTE: This guide specification covers the requirements for furnishing, installing, adjusting, and testing [manually] [automatically] controlled air medical waste incinerators having a capacity ranging from 63 to 252 grams/second (75 to 2000 pounds/hour).

Adhere to UFC 1-300-02 Unified Facilities Guide Specifications (UFGS) Format Standard when editing this guide specification or preparing new project specification sections. Edit this guide specification for project specific requirements by adding, deleting, or revising text. For bracketed items, choose applicable items(s) or insert appropriate information.

Remove information and requirements not required in respective project, whether or not brackets are present.

Comments, suggestions and recommended changes for this guide specification are welcome and should be submitted as a Criteria Change Request (CCR).

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PART 1 GENERAL

****
NOTE: This packaged incinerator is intended to burn waste materials of biological and pathological nature.
****

1.1 REFERENCES

****
NOTE: This paragraph is used to list the

publications cited in the text of the guide specification. The publications are referred to in the text by basic designation only and listed in this paragraph by organization, designation, date, and title.

Use the Reference Wizard's Check Reference feature when you add a RID outside of the Section's Reference Article to automatically place the reference in the Reference Article. Also use the Reference Wizard's Check Reference feature to update the issue dates.

References not used in the text will automatically be deleted from this section of the project specification when you choose to reconcile references in the publish print process.

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The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AIR MOVEMENT AND CONTROL ASSOCIATION INTERNATIONAL (AMCA)

AMCA 210	(2007) Laboratory Methods of Testing Fans for Aerodynamic Performance Rating
AMCA 99	(2010) Standards Handbook

AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE)

ASCE 25-06	(2008) Earthquake-Activated Automatic Gas Shutoff Devices
ASCE 7	(2010; Change 2010; Change 2011; Errata 2011; Change 2011) Minimum Design Loads for Buildings and Other Structures

AMERICAN WELDING SOCIETY (AWS)

AWS B2.1/B2.1M	(2009) Specification for Welding Procedure and Performance Qualification
AWS D1.1/D1.1M	(2010; Errata 2010) Structural Welding Code - Steel

ASME INTERNATIONAL (ASME)

ASME B1.20.1	(1983; R 2006) Pipe Threads, General Purpose (Inch)
ASME B1.20.2M	(2006; R 2011) Pipe Threads, 60 Deg. General Purpose (Metric)
ASME B16.1	(2010) Gray Iron Pipe Flanges and Flanged Fittings Classes 25, 125, and 250
ASME B16.11	(2011) Forged Fittings, Socket-Welding and

Threaded

ASME B16.15 (2011) Cast Bronze Alloy Threaded Fittings Classes 125 and 250

ASME B16.21 (2011) Nonmetallic Flat Gaskets for Pipe Flanges

ASME B16.3 (2011) Malleable Iron Threaded Fittings, Classes 150 and 300

ASME B16.39 (2009) Standard for Malleable Iron Threaded Pipe Unions; Classes 150, 250, and 300

ASME B16.4 (2011) Standard for Gray Iron Threaded Fittings; Classes 125 and 250

ASME B16.5 (2009) Pipe Flanges and Flanged Fittings: NPS 1/2 Through NPS 24 Metric/Inch Standard

ASME B16.9 (2007) Standard for Factory-Made Wrought Steel Buttwelding Fittings

ASME B40.100 (2005; R 2010) Pressure Gauges and Gauge Attachments

ASME BPVC SEC IX (2010) BPVC Section IX-Welding and Brazing Qualifications

ASME PTC 19.3 (1974; R 2004) Temperature Measurement

ASTM INTERNATIONAL (ASTM)

ASTM A1008/A1008M (2011) Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardened

ASTM A1011/A1011M (2010) Standard Specification for Steel, Sheet, and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability and Ultra-High Strength

ASTM A283/A283M (2003; R 2007) Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates

ASTM A319 (1971; R 2011) Standard Specification for Gray Iron Castings for Elevated Temperatures for Non-Pressure Containing Parts

ASTM A36/A36M (2008) Standard Specification for Carbon Structural Steel

ASTM A48/A48M (2003; R 2008) Standard Specification for

	Gray Iron Castings
ASTM A53/A53M	(2010) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A653/A653M	(2011) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM A733	(2003; R 2009e1) Standard Specification for Welded and Seamless Carbon Steel and Austenitic Stainless Steel Pipe Nipples
ASTM B42	(2010) Standard Specification for Seamless Copper Pipe, Standard Sizes
ASTM B88	(2009) Standard Specification for Seamless Copper Water Tube
ASTM B88M	(2005; R 2011) Standard Specification for Seamless Copper Water Tube (Metric)
ASTM C155	(1997; R 2007) Standard Specification for Insulating Firebrick
ASTM C195	(2007) Standard Specification for Mineral Fiber Thermal Insulating Cement
ASTM C196	(2000; R 2010) Standard Specification for Expanded or Exfoliated Vermiculite Thermal Insulating Cement
ASTM C27	(1998; R 2008) Fireclay and High-Alumina Refractory Brick
ASTM C270	(2012) Standard Specification for Mortar for Unit Masonry
ASTM C401	(1991; R 2005) Alumina and Alumina-Silicate Castable Refractories
ASTM C612	(2010) Mineral Fiber Block and Board Thermal Insulation
ASTM D396	(2010) Standard Specification for Fuel Oils
ASTM F1097	(1991; R 2006) Mortar, Refractory (High-Temperature, Air-Setting)

FM GLOBAL (FM)

FM APP GUIDE	(updated on-line) Approval Guide http://www.approvalguide.com/

ISA - INTERNATIONAL SOCIETY OF AUTOMATION (ISA)

ISA MC96.1	(1982) Temperature Measurement

Thermocouples

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

MSS SP-70	(2011) Gray Iron Gate Valves, Flanged and Threaded Ends
MSS SP-80	(2008) Bronze Gate, Globe, Angle and Check Valves

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA MG 1	(2011) Motors and Generators

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 211	(2010) Standard for Chimneys, Fireplaces, Vents, and Solid Fuel-Burning Appliances
NFPA 31	(2011) Standard for the Installation of Oil-Burning Equipment
NFPA 54	(2012) National Fuel Gas Code
NFPA 82	(2009; Errata 10-1; TIA 11-1) Standard on Incinerators and Waste and Linen Handling Systems and Equipment

U.S. DEPARTMENT OF DEFENSE (DOD)

MIL-DTL-15024	(1997; Rev F) Plates, Tags and Bands for Identification of Equipment, General Specification for
MIL-STD-461	(2007; Rev F) Requirements for the Control of Electromagnetic Interference Characteristics of Subsystems and Equipment
UFC 3-310-04	(2007; Change 1) Seismic Design for Buildings

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

CID A-A-59222	(Basic; Notice 1) Fans, Centrifugal, Draft, Forced and Induced

UNDERWRITERS LABORATORIES (UL)

UL 50	(2007) Enclosures for Electrical Equipment, Non-environmental Considerations

1.2 DEFINITION

Biological and Pathological Waste is defined as human and animal remains, such as organs, animal carcasses, and solid organic wastes from hospitals, laboratories, slaughterhouses, animal pounds, and similar sources. This type of waste contains up to 85 percent moisture and not more than 5 percent incombustible solids, and has a heating value as low as 2330 kJ/kg

1,000 BTU per pound as fired.

1.3 SUBMITTALS

****
NOTE: Review submittal description (SD) definitions in Section 01 33 00 SUBMITTAL PROCEDURES and edit the following list to reflect only the submittals required for the project.

The Guide Specification technical editors have designated those items that require Government approval, due to their complexity or criticality, with a "G." Generally, other submittal items can be reviewed by the Contractor's Quality Control System. Only add a "G" to an item, if the submittal is sufficiently important or complex in context of the project.

For submittals requiring Government approval on Army projects, a code of up to three characters within the submittal tags may be used following the "G" designation to indicate the approving authority. Codes for Army projects using the Resident Management System (RMS) are: "AE" for Architect-Engineer; "DO" for District Office (Engineering Division or other organization in the District Office); "AO" for Area Office; "RO" for Resident Office; and "PO" for Project Office. Codes following the "G" typically are not used for Navy, Air Force, and NASA projects.

Choose the first bracketed item for Navy, Air Force and NASA projects, or choose the second bracketed item for Army projects.
****

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for [Contractor Quality Control approval.] [information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Detail Installation Drawings[; G][; G, [_____]]

SD-03 Product Data[; G][; G, [_____]]

Incinerator[; G][; G, [_____]]
Controls and instrumentation

SD-06 Test Reports

Instrument readings[; G][; G, [_____]]
Performance[; G][; G, [_____]]
Adjusting and Testing[; G][; G, [_____]]

SD-07 Certificates

Incinerator[; G][; G, [_____]]

SD-10 Operation and Maintenance Data

Operating and Maintenance Instructions[; G][; G, [_____]]
Data Package 4[; G][; G, [_____]]

1.4 QUALITY ASSURANCE

1.4.1 Asbestos Prohibition

Asbestos and asbestos-containing products are prohibited.

1.4.2 Detail Installation Drawings

Submit detail installation drawings for the incinerator, foundation, stack, waste feed system, [heat recovery boiler,] [acid gas scrubber,] [mercury and dioxin control equipment,] fuel burning equipment, ash removal system, flue gas cleaning system, and controls. Include in detail drawings all equipment settings and connections, complete electrical wiring, controls, and connection diagrams and indicate clearances required for maintenance and operation.

1.4.3 Welding

Perform all welding in accordance with ASME BPVC SEC IX and AWS D1.1/D1.1M by welders certified to have passed qualification tests using procedures covered in AWS B2.1/B2.1M.

1.4.4 Special Tools

Furnish all special tools for assembly, adjustment, setting, or maintenance of equipment specified as standard accessories.

1.5 DELIVERY, STORAGE, AND HANDLING

Protect all equipment delivered and placed in storage from the weather, humidity and temperature variations, dirt and dust, or other contaminants.

1.6 EXTRA MATERIALS

Submit spare parts data for each different item of material and equipment specified, after approval of detail drawings, and not later than [_____] months prior to date of beneficial occupancy. Include a complete list of parts and supplies, with current unit prices and source of supply, and a list of the spare parts recommended by the manufacturer to be replaced after [1] [and] [3] year[s] of service.

PART 2 PRODUCTS

2.1 SYSTEM DESCRIPTION

2.1.1 Site Work

Provide site work, structural foundations, and floor slabs as required.

2.1.2 Roof Loads

Design roof purlins and beams for dead load plus an additional 0.24 kPa 5 psf uniformly distributed load and an additional 22.4 kN 5000 lb roving concentrated load[; and snow load at [_____] kPa psf plus drift factor where applicable]. Determine wind uplift forces in accordance with ASCE 7 Section 6 using a 100-year recurrence interval and conditions.

2.1.3 Floor Loads

Provide operating floors, stairs and access platforms for operation and maintenance, designed for 4.79 kPa 100 psf live load plus dead load. Design equipment platforms for 7.18 kPa 150 psf live load plus a concentrated load of equipment weight at installed location, plus dead load.

2.1.4 Lateral Loads

****
NOTE: Provide seismic requirements for stack and equipment, if a Government designer (either Corps office or A/E) is the Engineer of Record, and show on the drawings. Delete the last bracketed phrase if seismic details are not provided. Pertinent portions of UFC 3-310-04 and Sections 13 48 00 SEISMIC PROTECTION FOR MISCELLANEOUS EQUIPMENT and 13 48 00.00 10 SEISMIC PROTECTION FOR MECHANICAL EQUIPMENT must be included in the contract documents.
****

Include wind and seismic loading in the design. Base design wind pressure on a wind speed of [_____] km/h mph, exposure in accordance with ASCE 7.[Perform seismic design in accordance with UFC 3-310-04 and Sections 13 48 00 SEISMIC PROTECTION FOR MISCELLANEOUS EQUIPMENT and 13 48 00.00 10 SEISMIC PROTECTION FOR MECHANICAL EQUIPMENT [as indicated] [, and in accordance with ASCE 25-06 for gas fired equipment].]

2.1.5 Noise Limitations

Furnish equipment meeting the noise criteria specified herein through equipment design, acoustic insulation, use of inlet silencers, or other means provided under this contract. Limit sound pressure levels as follows when measured 1525 mm 5 ft from any item of equipment furnished under this contract.

Band Number	Center Band Frequency Hz	Maximum Sound Pressure Level dB, Re 0.0002 Microbars
1	63	100
2	125	91
3	250	84
4	500	78

Band Number	Center Band Frequency Hz	Maximum Sound Pressure Level dB, Re 0.0002 Microbars
5	1000	78
6	2000	78
7	4000	78
8	8000	78

2.1.6 Controls and Instrumentation

a. Include in control equipment and instruments, burners and fan controls, time clocks, relays, operating switches, indicating lights, gauges, motor starters, fuses, alarms, and circuit elements of the control system, and other controls and instruments necessary for unit operation, with system in accordance with the FM APP GUIDE.

b. Mount the controls and instruments on one or more free-standing control panels conveniently located to the incinerator, and placed to allow operating personnel effectively monitor incinerator operations. Provide control system with [on-off control] [proportioning control of the primary air supply and fuel supply to the secondary burner], and temperature indicator controllers or other indicators providing a visual indication for safe loading of the incinerator and excessive high temperature conditions which may require control by the operator. Interlock automatic control circuit systems and manual switches to prevent hazardous conditions or the discharge of excessive amounts of air pollutants.

2.1.6.1 Control Panel

Provide a sheet steel, weathertight panel, conforming to UL 50. Provide [a heater to prevent condensation] [NEMA 4 control panels for outdoor installations with electric strip heaters for condensation control.] Flush mount all controls, instruments, and other equipment at the factory and test the assembly prior to shipment. Furnish a lock and 2 keys. All controls and instruments shall be identified with nameplates.

2.1.6.2 Draft Gauges

Provide draft gauges conforming to ASME B40.100 with a diaphragm or bellows actuating system, a circular scale, a zero adjustment screw, and suitable shutoff cocks.

2.1.6.3 Pressure Gauges

Provide pressure gauges conforming to ASME B40.100, pressure detecting class, single Bourdon tube style, suitable for detecting air pressure.

2.1.6.4 Thermocouples

Provide sensors conforming to ISA MC96.1, Type K, in the combustion chamber or as otherwise directed, with a thermocouple suitable for continuous operation and control at temperatures up to 1260 degrees C 2300 degrees F

accurate to 0.75 percent, of sufficient length to be inserted 150 mm 6 inches into the furnace. Provide the thermocouple with an adjustable flange and a high-temperature metal alloy, closed-end, protecting tube suitable for insertion into the furnace without support of the projecting end. Supply thirty meters one hundred feet of 1.52 mm 16-gauge compensating lead wire with a weatherproof braid for connecting the thermocouple to the instrument, so that the installed unit indicates gas passage temperatures and controls burner operation.

2.1.7 Operating Tools

Provide and locate as indicated, operating and firing tools, such as shovel or coal scoop, hoe, rake, slice bar with metal handles, regularly used for firing and cleaning incinerators, and a firing tool rack. Provide steel rack, including hooks and other appropriate means for storing the tools in a neat manner.

2.2 MATERIALS AND EQUIPMENT

****
NOTE: Catwalk, ladder, and guardrail, if required, will be indicated on drawings.
****

Provide materials and equipment which are the standard products of a manufacturer regularly engaged in the manufacture of the product and that essentially duplicate items that have been in satisfactory use at least 2 years prior to bid opening.

a. Submit manufacturer's product data, catalog cuts, illustrations, schedules, performance charts, instructions, brochures, diagrams, sound level data, calculations for gas retention times, combustion and air emissions data, and other information to verify compliance with requirements of the contract documents.

b. Provide each major component of equipment with the manufacturer's name, address, type or style, model or serial number, and catalog number on a plate secured to the equipment.[Provide identification conforming to MIL-DTL-15024.]

c. Enclose or guard belts, pulleys, chains, gears, couplings, projecting setscrews, keys, and other rotating parts located where any person may come in close proximity thereto. Guard and cover high-temperature equipment and piping located where they could endanger personnel or create a fire hazard with insulation of type specified for service.

d. Provide items such as a [catwalk,] [stair,] [ladder,] [and guardrail] where shown and in accordance with Section [05 50 13 MISCELLANEOUS METAL FABRICATIONS] [05 50 14 STRUCTURAL METAL FABRICATIONS] [05 51 33 METAL LADDERS].

f. Provide materials and equipment conforming to the following:

2.2.1 Mortar

ASTM C270.

2.2.2 Brick

2.2.2.1 Firebrick

ASTM C27. Interpreted to include straight, radial, wedge, and skew-type brick, cupola blocks, and other similar shapes.

2.2.2.2 Insulating Firebrick

ASTM C155.

2.2.3 Castings, Gray Iron

ASTM A48/A48M.

2.2.4 Tubing, Copper, and Fittings

ASTM B88M ASTM B88, Type K; fittings, flare type, cast brass, or wrought copper.

2.2.5 Mortar, Firebrick

ASTM F1097.

2.2.6 Pipe and Fittings

2.2.6.1 Gaskets

Provide nonasbestos compressed material gaskets in accordance with ASME B16.21, 2 mm 1/16 inch thickness, full face or self-centering flat ring type; containing aramid fibers bonded with styrene butadiene rubber (SBR) or nitrile butadiene rubber (NBR). Use NBR for hydrocarbon service.

2.2.6.2 Cast-Iron Flanges and Flanged Fittings

ASME B16.1, Class 125 or 250 as required to match adjacent piping.

2.2.6.3 Nipples

ASTM A733, standard weight.

2.2.6.4 Pipe

ASTM A53/A53M, Type S, Grade A, standard weight; or copper pipe, ASTM B42.

2.2.6.5 Pipe Fittings

a. Steel: Provide buttwelding fittings conforming to ASME B16.9; socket welding fittings conforming to ASME B16.11; and flanged fittings conforming to ASME B16.5.

b. Brass or Bronze: ASME B16.15, Class A, 862 kPa 125 psi.

c. Cast-Iron: ASME B16.4, 862 kPa 125 psi, type to match adjacent piping.

d. Malleable-Iron: ASME B16.3, type to match adjacent piping.

2.2.6.6 Unions

ASME B16.39, Malleable Iron threaded pipe unions, Class 150, 250, or 300 as indicated or required for service.

2.2.7 Pipe Threads

ASME B1.20.2MASME B1.20.1.

2.2.8 Galvanized Steel Sheets

ASTM A653/A653M for incinerator casings, housing, and components. Gauges specified are United States Standard Sheet and Plate Gauge.

2.2.9 Steel Sheets and Strips

ASTM A1008/A1008M or ASTM A1011/A1011M, for incinerator casings, housings, and components.

2.2.10 Thermometers

ASME PTC 19.3, with wells and temperature range suitable for the use encountered.

2.2.11 Valves

2.2.11.1 Angle

MSS SP-80, Type 1, 2, or 3, Class 125 as required. Provide iron-body valves in sizes above 75 mm 3 inches with brass or bronze standard trim and glands or followers in the stuffing boxes. Provide valves with nonmetallic renewable composition discs and raised flat seats designed for 862 kPa 125 psi steam. Secure iron wheels with hexagonal nuts.

2.2.11.2 Check

MSS SP-80, Type 1, 2, 3, or 4, Class 125, as required. Provide iron-body check valves in sizes above 75 mm 3 inches of the swing type designed for 862 kPa 125 psi steam, and check valves with renewable composition discs or metallic discs of the regrinding type to permit regrinding without removing valve from the line.

2.2.11.3 Gate

Sizes of 40 mm 1-1/2 inches or less, MSS SP-80, Class 125, Type 1 and 2; 50 mm 2 inch size and over, MSS SP-70, Class 125 or 250, design OT or OF, as required.

2.2.11.4 Globe

MSS SP-80, Type 1, 2, or 3, Class as required. Provide iron-body globe valves in sizes above 75 mm 3 inches with brass or bronze standard trim and glands or followers in the stuffing boxes. Provide valves with nonmetallic renewable composition discs and raised flat seats designed for 862 kPa 125 psi steam. Secure iron wheels to the stems with hexagonal nuts.

2.2.12 Refractory for Castings

ASTM C401, Class R. Provide hydraulic setting refractory of a type

especially suitable for incinerators required to burn wet material.

2.2.13 Charging Ram

Provide hydraulically operated, self-contained ram mechanism with directional control, capable of injecting small loads of refuse at frequent intervals to ensure relatively uniform burning rates in addition to limiting the amount of air entering the primary chamber with each charge; [continuously] [intermittently] moving the burning waste toward the cleanout area.

2.2.14 Pyrometer

Provide indicating recording pyrometer for measuring incinerator temperature, with a temperature range from minus 18 to plus 1315 degrees C 0 to 2400 degrees F accurate to within plus or minus 1 percent of the range.

2.2.15 Thermocouple

Provide thermocouples indicating gas passage temperatures and control of burner operation, suitable for operation up to 1260 degrees C2300 degrees F and accurate within 0.5 percent of the operating and indicating temperature range.

2.3 ELECTRICAL WORK

****
NOTE: Indicate the type and class of motor enclosure depending on the environment in which the motor is to be used.
****

Provide electrical motor-driven equipment as specified, complete with motors conforming to NEMA MG 1, motor starters, and controls[conforming to MIL-STD-461], with enclosures as indicated. Provide electrical equipment, including motors and wiring, in accordance with Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM, with electrical characteristics as indicated or specified. Provide motor starters complete with thermal overload protection and other appurtenances necessary for the motor control specified, and of sufficient size to drive the equipment at the specified capacity without exceeding the nameplate rating of the motor. Provide manual or automatic control, protective or signal devices required for the operation specified, and any control wiring required for controls and devices specified but not shown.

2.4 INCINERATOR

****
NOTE: The incinerators are capable of burning medical waste. The composition of Type 4 waste is indicated in the following table:

WASTE VS. CONTENT			
Type	**Noncombusti Solids (Max % by**	**Moisture Content (Max %)**	**Heating Value J/kg (BTU Per Pound)**

WASTE VS. CONTENT			
(Highly Combustible)	5	10	19,771,000 (8,500)
(Pathological)	5	85	2,326,000 (1,000)

The medical waste to be disposed of in the incinerator is a mixture of paper, plastics, Type 4 waste, etc., and is of a widely varying nature with a Btu content which may well exceed the usually reported value of 2,326,000 J/kg (1000 Btu per pound). Prior to developing final design of the incinerator, detailed waste classification should be made in consultation with U.S. Army Center For Health Promotion & Preventive Medicine, Aberdeen Proving Ground, Maryland. Include the ranges of amounts of glass, metal, paper, plastics, organic, rubber, cloth, wood, moisture, etc., in the waste and the variable joule (Btu) content. The waste stream at each installation must be analyzed and the information should be utilized for the final design.

****

Provide an incinerator with a solid hearth in the primary combustion chamber where partial burning and conversion of the combustible organic matter occurs, and a secondary combustion chamber that consumes the combustible gases and entrained combustible particles, with gas-tight shell construction. Provide an incinerator suitable for [indoor installation] [outdoor installation, including totally enclosed electric motors, and corrosion and moisture protection,] and equipped for [manual] [mechanical] [automatic] charging and operation. Incinerator shall be a complete package-type unit, factory fabricated and assembled; operating under negative air pressure and ready for attachment of all utility connections.

2.4.1 Type of Waste

Provide an incinerator capable of burning typical medical waste including paper, plastics of various kinds, and a small fraction of Type 4 (pathological) waste.

2.4.2 Capacity

Provide incinerator with a capacity of not less than [_____] kg pounds per hour, based on [operating the incinerator no more than 6 to 8 hours continuously per day.] [burning medical waste parts which have a water content as high as 85 percent by weight.] [Design for daily ash clean-out for systems designed to operate no more than 6 to 8 hours continuously.]

2.4.3 Volume

****

NOTE: Fill in the blanks to indicate minimum volumes. Consult manufacturers of medical waste incinerators for furnace and chamber volumes to satisfy the capacity specified.

****

Provide furnace with an inside volume , exclusive of the space occupied by the refractory hearths and walls, of not less than [_____] cubic meters feet; with a primary combustion chamber volume above the burning hearth of not less than [_____] cubic meters feet, and a final combustion settling chamber volume of not less than [_____] cubic meters feet.

2.4.4 System Components

****
NOTE: The component list contains items of equipment designed to reduce emissions which must be evaluated against federal, state, and local regulatory requirements. Other items of equipment must be evaluated for cost effectiveness.
****

Provide a complete waste burning system including combustion air fan, primary and secondary burners, air distribution and burner controls, ducts, breeching, stack, [bottom ash conveyor and collection,] [feed rams,] [[fire tube] [water tube] heat recovery boiler and emergency bypass stack,] [[venturi] [packed tower] wet scrubber,] [dry scrubber,] [dry powdered activated carbon injection system,] [[urea] [ammonia] injection system,] [acid gas reagent storage vessels,] [carbon storage vessels,] [combined acid gas reagent and carbon storage vessels,] [air compressors,] [slurry pumps,] [water pumps,] [baghouse,] [[vacuum type] [enclosed mechanical type] fly ash collection system,] control and emission monitoring equipment.

2.5 OPERATING AND PERFORMANCE REQUIREMENTS

2.5.1 Weight Reduction

****
NOTE: Indicate the effectiveness and burnout capability of the incinerator to be provided (15 percent ash is a reasonably accepted figure).
****

Provide an incinerator capable of reducing waste to an ash not to exceed [_____] percent of the total combustible charges when tested as specified.

2.5.2 Stack Discharge

****
NOTE: Review all applicable federal, regional and local emission regulations and utilize the most stringent requirements. Typical values are as follows (all emission limits will be corrected to 7 percent oxygen, dry basis):

Carbon Monoxide (CO): 50 ppmv, 12-hour average as measured by a Continuous Emissions Monitoring System (CEMS);

Particulate Matter: 0.013 gr/dscf (30 mg/dscm) as measured by EPA Reference Method 5;

Opacity: 5 percent, 3-minute average as measured by a CEMS;

Sulphur Dioxide (SO2): 45 ppmv, 12-hour average as measured by a CEMS;

Nitrogen Oxides (NOx): 210 ppmv, 12-hour average as measured by EPA Reference Method 7;

Hydrogen Chloride (HCL): 42 ppmv, or 97 percent reduction, 9-hour average as measured by EPA Reference Method 26;

Total Hydrocarbons: 70 ppmv, 1-hour average as measured by EPA Reference Method 25;

Mercury: 210 gr/106dscf (0.47 mg/dscm) or 85 percent reduction, 12-hour average as measured by EPA Reference Method 29;

Lead: 44 gr/106dscf (0.10 mg/dscm), 12-hour average as measured by EPA Reference Method 29;

Cadmium: 22 gr/106dscf (0.05 mg/dscm), 12-hour average as measured by EPA Reference Method 29;

Dioxin/Furans: 35 gr/109dscf (1.9 ng/dscm) toxic equivalency of 2, 3, 7, 8-TCDD, 12-hour average as measured by EPA Reference Method 23.

****

Provide pollution control equipment meeting or providing lower emission values than those specified for the following:

a. Carbon Monoxide (CO): [_____] ppmv, 12-hour average as measured by a Continuous Emissions Monitoring System (CEMS);

b. Particulate Matter: [_____] gr/dscf ([_____] mg/dscm) as measured by EPA Reference Method 5;

c. Opacity: [_____] percent, 3-minute average as measured by a CEMS;

d. Sulphur Dioxide (SO2): [_____] ppmv, 12-hour average as measured by [a CEMS] [EPA Reference Method [_____]];

e. Nitrogen Oxides (NOx): [_____] ppmv, 12-hour average as measured by EPA Reference Method 7;

f. Hydrogen Chloride (HCL): [_____] ppmv, or [_____] percent reduction, 9-hour average as measured by EPA Reference Method 26;

g. Total Hydrocarbons: [_____] ppmv, 1-hour average as measured by EPA Reference Method 25;

h. Mercury: [_____] gr/106dscf ([_____] mg/dscm) or [_____] percent reduction, 12-hour average as measured by EPA Reference Method 29;

i. Lead: [_____] gr/106dscf ([_____] mg/dscm), 12-hour average as measured by EPA Reference Method 29;

j. Cadmium: [_____] gr/106dscf ([_____] mg/dscm), 12-hour average as

measured by EPA Reference Method 29;

k. Dioxin/Furans: [_____] gr/109dscf ([_____] ng/dscm) toxic equivalency of 2, 3, 7, 8-TCDD, 12-hour average as measured by EPA Reference Method 23;

Correct all emission limits to 7 percent oxygen, dry basis. The following definitions were used above: parts per million by volume (ppmv); dry standard cubic feet (dscf); dry standard cubic meters (dscm); grams (gr); milligrams (mg); and nanograms (ng).

2.5.3 Noise

Noise level at 305 mm 1 foot from any incinerator component shall not exceed 85 dBA. Provide sound dampening devices on equipment as required.

2.6 FURNACE CONSTRUCTION

2.6.1 Primary Chamber

Construct the primary chamber with a steel casing supported by a steel frame, and provide with insulation and refractory. Make the casing with 2.66 mm 12-gauge sheet steel minimum, conforming to ASTM A1011/A1011M and reinforced to withstand internal pressures without deflection or damage to refractory or other components of the incinerator. Construct the frame and all reinforcing members of steel conforming to ASTM A36/A36M. Provide a free-standing frame capable of supporting the weight of all components of the incinerator, including doors, burners, breeching, stack connections, and appurtenant assemblies without binding or warping. Make the frame and casing of all welded construction, completed and erected prior to installation of the refractory and insulation. Perform all welding in accordance with ASME BPVC SEC IX and AWS D1.1/D1.1M. Provide all access doors and parts with seals to prevent emission of smoke or admission of significant amounts of air during incinerator operation, and a primary chamber with no openings which would permit leakage of waste fluids.

2.6.2 Secondary Chamber

Provide a secondary chamber with an exterior casing not less than 2.66 mm 12-gauge sheet steel conforming to ASTM A1011/A1011M, with insulation and refractory lining of the same class, type, and thickness required for walls in the primary chamber. Allow for a minimum dwell time of [0.5] [0.8] [1.0] seconds for any condition within normal operating limits.

2.6.3 Insulation

Provide insulation conforming to ASTM C612, Class 5 and designed to be used with masonry or reinforced concrete or noncombustible material, with a fire resistant rating of not less than 3 hours, to prevent damage to the foundation from excessive heat. As a minimum, provide insulation thickness to limit the temperature of the outer casing to 66 degrees C 150 degrees F maximum in an ambient temperature of 21 degrees C 70 degrees F when the unit is operating at full-rated capacity. Use insulating cement conforming to ASTM C195 or ASTM C196.

2.6.4 Refractory

Provide heat-resistant plastic super-duty fireclay refractory conforming to ASTM C27. The minimum thickness of plastic or castable refractory is 110

mm 4-1/4 inches for walls and [110] [64] mm [4-1/4] [2-1/2] inches for hearths. Attach refractory walls to the casing with alloy steel or refractory anchors to form a monolithic structure which will resist heat and support the walls with a safety factor of 4. Prevent bulging and destruction of refractory due to heat stress by reinforcing, expansion joints, ties, and anchors.

2.6.5 Exterior Walls

Provide 2.66 mm 12-gauge sheet steel walls reinforced with steel framing [and] [,] provided with door frames [, and mounted on structural steel skids].

2.6.6 Hearth

Provide an abrasion resistant refractory hearth constructed of heat-resistant, thermal-insulating clay conforming to ASTM C401, Class R plastic or castable type, high-duty class, capable of supporting not less than twice the hourly burning rate and preventing leakage of waste fluids.

2.6.7 Doors

****
NOTE: Select door material to be employed (many manufacturers recommend steel).
****

a. Provide doors for stoking, cleanout, and charging areas, with securely attached door frames. Construct doors and frames of [cast iron conforming to ASTM A319] [steel conforming to ASTM A1011/A1011M or ASTM A36/A36M]. Line doors, exposed to flame or direct heat of combustion gases, with the same type and thickness of refractory and insulation used in the combustion chamber.

b. Secure refractory to the doors so as to prevent sagging. Taper refractory edges to clear door frames during movement of swinging doors. Weld alloy steel hooked bars to door cover to anchor the refractory, to enable safe operation by one person, and maintaining temperature of door handles to permit operation of doors without gloves or other protective devices.

c. Interlock charging doors with primary burners and air supply so that burner ignition shuts off and underfire air dampers close when doors open. Gasket door closure with nonasbestos packing.

d. [Provide counter-weights for vertically operated doors requiring a maximum manual operating force of 133 N 30 pounds maximum.] [Provide guillotine-type doors which lift completely off the seals to effect opening.] [Provide full-swing-type doors with an integral smaller feed door having a minimum rectangular clear opening of 610 by 610 mm 24 by 24 inches or a minimum circular clear opening of 762 mm 30 inches diameter.] Include hasps or brackets for doors to permit locking.

2.6.7.1 Stoking and Cleanout Doors

Provide tight fitting cleanout doors which allow access for total cleanout, visual inspection of the entire interior of the incinerator, and prevent leakage of waste fluids.

2.6.7.2 Mechanical-Charging Doors

Provide inner and outer [guillotine] [swing] [automatic sliding] mechanical-charging doors type, with the inner or charging door opening with operation of the charger. Interlock the inner and outer doors to prevent simultaneous opening during incinerator operation. Insulate and line the combustion chamber door with refractory material. Construct the outer door of the same materials as the exterior casing of the incinerator. Doors shall be provided with means for manual operation.

2.6.8 Observation Ports

Provide two observation ports, 75 mm 3 inches in diameter, on the charging door for viewing the primary combustion chamber during operation. Construct observation ports of black steel or cast-iron tube or duct having a minimum thickness of 3.42 mm 10 gaugeand provided with heat-resistant glass cover, or an angular steel frame and closure plate with handle, for operation without gloves or other protective devices. Extend the tube or duct from the exterior of the casing to not less than one-half the thickness of the refractory lining, and weld the frame to the casing, to provide a gas-tight refractory opening.

2.6.9 Damper

Provide a controller actuated refractory lined damper which regulates secondary, underfire, and overfire air, constructed of steel conforming to ASTM A1011/A1011M, not less than 1.52 mm 16-gauge thick, operating without noise or flutter, and [pneumatically operated] [electric motor operated at [_____] volt ac] actuators.

2.6.10 Bypass Dampers

****
NOTE: Use a maximum leakage rate of 1.0 percent. Review all applicable emission requirements and percent reductions to determine an acceptable leakage rate.
****

Construct bypass dampers to provide a leakage rate of less than [_____] percent at 1.5 times the maximum operating pressure.

2.6.11 Test Holes and Test Groups

****
NOTE: Indicate and clearly identify an instrument test group near every thermocouple well to connect portable equipment to verify installed equipment.
****

Provide test holes, near the test group shown on the contract drawings, and fit with standard weight, 50 mm 2 inch diameter, black steel pipe welded to the casing. Extend the sleeve from the exterior of the casing to not less than one-half the thickness of the refractory lining. Form the refractory opening from the end of the pipe sleeve to the interior wall surface to shield the end of the sleeve from reflected heat, and fit with a brass screw cap. Submit a copy of the Instrument Readings to the Contracting Officer.

2.7 FLUE GAS CLEANING SYSTEM

****
NOTE: Where particulate control is required at the levels specified in paragraph: STACK DISCHARGE, specify dry type adsorber.
****

Provide a complete flue gas cleaning system (FGC)consisting of a [[dry] [semi-dry/semi-wet] [wet] powdered activated carbon injection system, and a [dry] [semi-dry/semi-wet] [wet] acid gas scrubber system] [combination [dry] [semi-dry/semi-wet] [wet] powdered activated carbon and acid gas scrubbing system] [and [baghouse] [precipitator] for particulate control]; capable of [continuous operation] [operation compatible with the incineration capacity and schedule specified].

2.7.1 System Components

Provide each scrubber system with bulk storage silos, unloading facilities for trucks, dust control filters, mixing equipment, slurry tanks, pumps, compressors, induced draft fans, and all piping and valves necessary to provide a complete and operating system.

2.7.2 Product Storage Capacity

Provide bulk storage capacity for all required products to sustain a minimum operating period of [two] [_____] weeks between deliveries.

2.7.3 Adsorbers

2.7.3.1 Access

Provide access openings at strategic locations for inspection, cleaning, and maintenance, all being a gas tight quick-opening type. Elevate the adsorbers to permit 2130 mm 7 feet access under the lowest point which would collect particulates. Locate an access door at this lowest point to permit removal of accumulated particulate; designed to open with an accumulation of material above it.

2.7.3.2 Construction

Construct adsorber with at least 4.76 mm 3/16 inch thick steel plate, ASTM A36/A36M or ASTM A283/A283M, grades B, C, or D. Space external stiffeners as required to provide support for the vessel skin. Seal weld all structurally welded seams. Design joints to be assembled air and water tight. Design adsorber for a gas pressure of plus or minus 635 mm 25 inch water gage, or as required by the system operation, whichever is greater, and with any panel deflection not exceeding L/240.

2.7.3.3 Gas Flow

Provide the gas inlet to each module with internal deflector plates designed to provide uniform gas distribution and velocities through the unit.

2.7.4 Product Handling and Preparation System

Provide a complete system to receive, store, and supply [product] [lime] to the spray-dry adsorbers, with the capability of supplying sufficient

[product] [lime] for the incinerator operating at 120 percent of full load. Include in the system, but do not limit to, [product] [lime] storage silo complete with vibrating bin discharger, flexible connections, gravimetric feeders, attrition slaker, [product] [lime] slurry and water pumps, slaked [product] [lime] storage tank, and agitators.

2.7.5 Powdered Activated Carbon

Provide powdered activated carbons (PAC) specifically made for the removal of mercury, dioxins, and furans with a high percentage of pore sizes in the 20 to 50 angstrom range, with PAC completely devolatilized.

2.7.6 Pebble Quick Lime Analysis

Provide flue gas cleaning equipment capable of meeting emission requirements specified using lime with the following composition:

SiO2	2.6 percent
Al203	0.5 percent
Fe2O3	0.4 percent
MgO	5.7 percent
S	0.03 percent
CaO	90.8 percent
Available CaO	85.0 percent
Fineness	19 mm 3/4 inch x 0 Weight
Density	7853 N/cubic meter 50 lb/cubic foot
Mass Density	800 kg/cubic meter 1.55 slugs/cubic foot

2.7.7 Service and Process Water Analysis

The service and process water analysis will vary; however, consider the following characteristics to be typical:

Calcium	[_____] ppm
Magnesium	[_____] ppm
Sodium	[_____] ppm
Bicarbonate	[_____] ppm
Sulfate	[_____] ppm
Chloride	[_____] ppm

Silicon	[_____] ppm
Iron (as Fe3)	[_____] ppm
Manganese (as Mn)	[_____] ppm
Hardness (CaCO3)	[_____] ppm
pH	[ranges between [_____] and [_____]] [is [_____]]

2.8 HEAT RECOVERY BOILER

Provide heat recovery boilers in accordance with Section 23 52 43.00 10 HEAT RECOVERY BOILERS 23 52 43.00 20 LOW PRESSURE WATER HEATING BOILERS (UNDER 800,000 BTU/HR OUTPUT).

2.9 AUXILIARY EQUIPMENT

2.9.1 Charging Method

Charge the unit [mechanically] [manually]. [Provide a mechanical charger, including an inner door to the combustion chamber, and an outer door to discharge the contents of the loading and holding chamber into the combustion chamber. Provide the charger with a manual control, and an adjustable timer to permit semiautomatic charging at not less than 10-minute intervals. Also provide an interlock to prevent operation of the charger when a predetermined safe operating temperature is exceeded. Locate the charger on the [end] [side] [top] of the incinerator.] [Include a front loading door with minimum dimensions of 610 by 610 mm 24 by 24 inches on the manual charger, with a combustion chamber operating at negative pressure when the loading door is open to prevent injury to the operator and the escape of smoke and gases.] [Provide a hopper-type chamber for top loading chargers.] Provide charging chambers with a capacity of not less than [0.4] [0.8] [_____] cubic meters [0.5] [1.0] [_____] cubic yards.

2.9.2 Burners

****

NOTE: Select values of minimum burner input capacity as indicated in the following table and applicable data inserted within the brackets.

Size of Burners, kW (1000 Btuh)		
Capacity of Incinerator kg/hr (lb/hr)	**Type 4 Refuse**	**All Types Refuse**
11.3 (25)	**87.9 (300)**	**29.3 (100)**
22.7 (50)	**131.9 (450)**	**58.6 (200)**
34.0 (75)	**190.5 (650)**	**73.3 (250)**

Size of Burners, kW (1000 Btuh)		
45.4 (100)	249.1 (850)	87.9 (300)

****

a. Provide [gas] [oil] [combination gas and oil] [LPG] burners for the primary and secondary combustion chambers, with each burner as a complete assembly including fuel and control systems, and accessories. Provide a primary burner with an input capacity of not less than [_____] W Btuh, and a secondary burner with a minimum capacity of [_____] W Btuh, capable of maintaining a minimum continuous temperature in the secondary chamber of 871 degrees C 1600 degrees F, and a minimum continuous temperature of 760 degrees C 1400 degrees F at the roof near the exit of the primary chamber.

b. Provide electrically spark-ignited burners regulated by a variable set point indicator-controller adjustable from minus 18 to 1371 degrees C minus 27 to 2500 degrees F to operate within the temperature limits recommended by the manufacturer.

c. Provide controllers actuated by a thermocouple or shielded bimetallic sensor, with the mounting, flame shape, and characteristics of each burner suitable for the incinerator chamber in which the burner is installed. Flame impingement on the incinerator wall is not permitted.

d. Provide each burner with FM APP GUIDE listed and approved flame failure protection. Sight the flame safeguard sensor to detect only the burner flame for which it is designed, with burners which are easily moved out of firing position for inspection, cleaning, adjustment, and maintenance. Locate thermocouples in the primary and secondary chamber, suitable for a maximum temperature of 1260 degrees C 2300 degrees F. Provide a continuous secondary burner which modulates from high to low fire, based on the temperature of the secondary chamber. Provide an on/off firing burner in the primary chamber.

2.9.3 Fuel Oil Storage Tank

Provide a fuel oil storage tank, fuel oil conforming to ASTM D396, and tanks in accordance with Section 33 56 10 FACTORY-FABRICATED FUEL STORAGE TANKS.

2.9.4 Stack

****

NOTE: Depending on requirements at location and personnel involved, temperature of the casing can be 66 to 93 degrees C (150 to 200 degrees F). Limit the casing temperature to 49 degrees C (120 degrees F) maximum when personnel safety is involved.

Designer must consider the effect of stack location on adjacent occupied buildings and fresh air intakes. EPA has guidance on stack heights.

****

a. Provide a sectional, circular cross section exhaust stack of the type, size, and number of sections in accordance with the requirements of the stack and refractory manufacturer to adequately support the refractory

lining, permit expansion, and prevent cracking of the refractory; conforming to NFPA 211. Secure the refractory to the casing by steel anchors.

b. Attach a corrosion-resistant steel spark arrestor fabricated of 1.21 mm 18-gauge, 13 mm 1/2 inch mesh wire screen to the top of the stack. Provide a corrosion-resistant steel weather cap. The temperature of the casing shall not exceed [_____] degrees C degrees F in an ambient temperature of 21 degrees C 70 degrees F. Provide adequate support for any stack installed on top of the incinerator, without placing any of the load on the refractory walls of the incinerator.

2.9.5 Breeching

Provide connectors to connect the incinerator to the stack unless the stack is attached directly to the incinerator, in accordance with NFPA 211. Locate the connector at a minimum clear vertical distance of 2450 mm 8 feet above the floor.

2.9.6 Draft Equipment

Provide equipment which supplies the correct amount of air to permit complete controlled combustion. Include forced draft fans, draft gauges, dampers, damper actuators, linkage, and appurtenances necessary to maintain a negative draft in primary chamber in order to provide optimum performance at all operating rates.

2.9.6.1 Air Ducts

Introduce combustion underfire air to the primary chamber below the waste material through [perforated air pipes] [ducts] [slots located along the side of the hearth]. Control overfire air with [manually] [automatically] controlled air intake ports in the back wall, for completing combustion of combustible materials into gases, or for reducing operating temperatures. Provide dampers to set the air for the proper burning of the waste materials. Size ducts to minimize pressure drops, constructed of sheet steel conforming to ASTM A1011/A1011M, with all seams and connections air tight.

2.9.6.2 Fan

Provide a fan capable of delivering [_____] cubic meters feet of air against a static head of [_____] mm inches of water at an atmospheric temperature of 16 degrees C 60 degrees F and a barometric pressure of 101 kPa 14.7 psi, centrifugal type with [backward-curved] [forward-curved] [radial-tip] blades, and statically and dynamically balanced fan wheels. Comply with the fan standards of AMCA 99, and CID A-A-59222, applicable to centrifugal furnace fans, rated for flow rate, pressure, power, speed of rotation, and efficiency in accordance with AMCA 210. Provide induced draft fans, where required, designed for handling hot flue gas at the maximum outlet temperature of the incinerator. Provide induced draft fan housings with drain holes to accommodate the drainage of condensation, [air-cooled] [water cooled] drat fan bearings, and fan scroll sheets and rotor blades with protective liners.

2.9.7 Ash Removal

Provide the unit with provisions for [manual] [automatic] removal of the ash through the cleanout door upon completion of the burnout and cool-down

cycles. Ash removal shall be as indicated for use with portable containers.

2.10 PAINTING AND FINISHING

2.10.1 Treatment

Clean the inner surfaces of the outer casing of the incinerator, the exterior surfaces of the outer casing, the control panel, and piping, except corrosion-resistant steel, to base metal for removal of oil and rust before primer is applied at the factory.

2.10.2 Factory Painting

Factory paint equipment and component items with the manufacturer's standard finish. Provide a weather resistant finish on all items located outside the building.

PART 3 EXECUTION

3.1 EXAMINATION

After becoming familiar with all details of the work, verify dimensions in the field, and advise the Contracting Officer of any discrepancy before performing the work.

3.2 MANUFACTURER'S SERVICES

Provide the services of the manufacturer's representative experienced in the installation, adjustment, and operation of the equipment specified, who will supervise the installing, adjusting, and commissioning and compliance testing of the equipment.

3.3 INSTALLATION

Install equipment and material as indicated and in accordance with manufacturer's written instructions and NFPA 82, with combustion air supply and ventilation in accordance with NFPA 31 or NFPA 54 as applicable.

3.3.1 Foundation

a. Construct the incinerator foundation using [21] [_____] MPa [3000] [_____] psi concrete as specified in Section 03 30 00.00 10 CAST-IN-PLACE CONCRETE. Extend the foundation a minimum of 1 m 3 feet beyond the incinerator on 3 sides and not less than 2.5 m 8 feet on the side where the ashes are removed. Install the incinerator in accordance with manufacturer's written instructions.

b. Make proper provision for expansion and contraction between incinerator foundation and floor; pack the joint with suitable nonasbestos rope and fill with suitable compound that will not become soft at a temperature of 40 degrees C 100 degrees F.

c. Provide incinerator supports which permit free expansion and contraction of each portion of the incinerator without placing undue stress on any part of the incinerator or setting. Set anchor bolts accurately, and of adequate length to install the incinerator. When embedded in concrete, provide anchor bolts with plates welded on the head and protect against damage until the equipment is installed.

3.3.2 Stack Support

****
NOTE: Indicate design wind force that the stack will have to withstand. Also include in structural design seismic resistance, and coordinate with subparagraph Lateral Loads under paragraph SYSTEM DESCRIPTION.
****

Provide stack support in accordance with NFPA 82 and NFPA 211, as applicable. Provide vertical and lateral supports for exterior chimneys to withstand wind forces of [_____] km/hour mph.

3.4 FIELD PAINTING

Perform painting required for surfaces not otherwise specified, and finish painting of items only primed at the factory, as specified in Section 09 90 00 PAINTS AND COATINGS.

3.5 FIELD TRAINING

****
NOTE: Consult equipment manufacturer for recommended time required to train personnel for the proper operation of the unit, and insert number of hours.
****

a. Submit [Six] [_____] complete copies of operating instructions outlining the step-by-step procedures required for system startup, operation and shutdown. Include in instructions the manufacturer's name, model number, service manual, parts list, and brief description of all equipment and their basic operating features. And [Six] [_____] complete copies of maintenance instructions listing routine maintenance procedures, possible breakdowns and repairs, troubleshooting guides, and simplified schematic diagrams for the system as installed.

b. Submit Incinerator Data Package 4 in accordance with Section 01 78 23 OPERATION AND MAINTENANCE DATA.

c. Conduct a training course for the operating staff, as designated by the Contracting Officer, consisting of a total [_____] hours of normal working time, and starting after the system is functionally completed but prior to final acceptance tests. Cover in field instructions all of the items contained in the operating and maintenance instructions, as well as demonstrations of routine maintenance operations. Notify the Contracting Officer at least 14 days prior to starting date of the training course.

3.6 ADJUSTING AND TESTING

3.6.1 Performance Test

a. Upon completion of all related work and prior to acceptance, subject the incinerator and associated equipment and instrumentation to the tests required to demonstrate specified performance. Notify the Contracting Officer [_____] days prior to conducting the test.

b. Furnish all instruments and personnel required for the tests, including all equipment, apparatus, and materials, except waste materials, used for testing. The Government will supply [fuel,] [water,] [electric power,] [and] waste materials. Make two instruction manuals available at all times during the tests. The Contracting Officer's presence is required at all tests.

c. Submit certified test reports in booklet form showing field tests performed to adjust each component, and all field tests performed to prove compliance with the specified performance criteria, upon completion and testing of the installed system. Indicate the final position of controls in each test report.

3.6.2 Fuel Systems

Provide fuel system tests in accordance with Section 33 56 10 FACTORY-FABRICATED FUEL STORAGE TANKS.

3.6.3 Performance

Preheat the incinerator for [4] [_____] hours to reach the firing temperature of [982] [_____] degrees C [1800] [_____] degrees F. Weigh and record the total charge weight. Charge the incinerator at the rated burning capacity in kg pounds per hour for a period of [4] [_____] hours and operate in accordance with the manufacturer's written instructions. Include in performance testing the operation of the mechanical charging facilities, the incinerator, [the heat recovery boiler,] the air pollution control equipment, the ash handling equipment, and the operation monitoring facilities. Perform testing full scale for a full-operation cycle, and monitor performance to verify compliance with the contract requirements; submit a report on monitoring results. Reduce the waste to a fine ash residue. Follow normal burnout procedure. After the incinerator has cooled, weigh the residue. The weight of the residue shall not exceed [5.0] [_____] percent combustible material of the total charge weight. After clean-out, the incinerator shall not show any evidence of deterioration, such as slagged or spalling refractory, warping of parts, and discolored exterior paint.

3.6.4 Control

Test the incinerator under actual firing conditions. Verify with testing that all controls function within the maximum and minimum limits for temperature or timing. Simulate actual unsafe conditions such as high temperatures and flame failure by reducing the settings for the activation of limit and safety controls.

3.6.5 Shell Temperature

Operate the incinerator under normal load conditions for not less than [4] [_____] hours. After [4] [_____] hours, temperature readings of the outer shell, taken at not less than 5 random locations, shall not exceed the temperature limitation of paragraph FURNACE CONSTRUCTION.

-- End of Section --