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BUREAU OF AIR REGULATION

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APPLICATION FOR
AIR CONSTRUCTION PERMIT
DIXIE WASTE SERVICES
CROSS CITY, FLORIDA

Prepared For:
Dixie Waste Services, LLC
P.O. Box 850
Cross City, Florida 32628-0850

Prepared By:
Golder Associates Inc.
6241 NW 23rd Street, Suite 500
Gainesville, Florida 32653-1500

December 2005

0537608

DISTRIBUTION:
4 Copies – FDEP
2 Copies – Dixie Waste Services, LLC
1 Copy – Golder Associates Inc.

Department of
Environmental Protection
Division of Air Resource Management
APPLICATION FOR AIR PERMIT - LONG FORM
I. APPLICATION INFORMATION

Air Construction Permit – Use this form to apply for an air construction permit for a proposed project:

- subject to prevention of significant deterioration (PSD) review, nonattainment area (NAA) new source review, or maximum achievable control technology (MACT) review; or
- where the applicant proposes to assume a restriction on the potential emissions of one or more pollutants to escape a federal program requirement such as PSD review, NAA new source review, Title V, or MACT; or
- at an existing federally enforceable state air operation permit (FESOP) or Title V permitted facility.

Air Operation Permit – Use this form to apply for:

- an initial federally enforceable state air operation permit (FESOP); or
- an initial/revised/renewal Title V air operation permit.

Air Construction Permit & Revised/Renewal Title V Air Operation Permit (Concurrent Processing Option) – Use this form to apply for both an air construction permit and a revised or renewal Title V air operation permit incorporating the proposed project.

To ensure accuracy, please see form instructions.

Identification of Facility

1. Facility Owner/Company Name: **Dixie Waste Services LLC**
2. Site Name: **Dixie Waste Services Waste Gasification/Thermal Oxidizer**
3. Facility Identification Number:
4. Facility Location...:
   Street Address or Other Locator: **322 NE 264th Street**
   City: **Cross City** County: **Dixie County** Zip Code: **32628**
5. Relocatable Facility? ☐ Yes ☒ No
6. Existing Title V Permitted Facility? ☐ Yes ☒ No

Application Contact

1. Application Contact Name: **Anthony Fraccalvieri**
2. Application Contact Mailing Address...
   Organization/Firm: **Dixie Waste Services LLC**
   Street Address: **P.O. Box 850**
   City: **Cross City** State: **FL** Zip Code: **32628-0850**
3. Application Contact Telephone Numbers...
   Telephone: (**352**) **346 - 4746** ext. Fax: (**352**) **398 - 1209**
4. Application Contact Email Address: **FRCCLVR@yahoo.com**

Application Processing Information (DEP Use)

1. Date of Receipt of Application:	Application Copy (Submitted to NED Office)
2. Project Number(s):	
3. PSD Number (if applicable):	
4. Siting Number (if applicable):	

APPLICATION INFORMATION

Purpose of Application

This application for air permit is submitted to obtain: (Check one)

Air Construction Permit

☒ Air construction permit.

Air Operation Permit

☐ Initial Title V air operation permit.

☐ Title V air operation permit revision.

☐ Title V air operation permit renewal.

☐ Initial federally enforceable state air operation permit (FESOP) where professional engineer (PE) certification is required.

☐ Initial federally enforceable state air operation permit (FESOP) where professional engineer (PE) certification is not required.

Air Construction Permit and Revised/Renewal Title V Air Operation Permit (Concurrent Processing)

☐ Air construction permit and Title V permit revision, incorporating the proposed project.

☐ Air construction permit and Title V permit renewal, incorporating the proposed project.

Note: By checking one of the above two boxes, you, the applicant, are requesting concurrent processing pursuant to Rule 62-213.405, F.A.C. In such case, you must also check the following box:

☐ I hereby request that the department waive the processing time requirements of the air construction permit to accommodate the processing time frames of the Title V air operation permit.

Application Comment

This air construction application is for a new 150 ton per day (TPD) waste gasification/thermal oxidizer (WG/TO).

APPLICATION INFORMATION

Scope of Application

Emissions Unit ID Number	Description of Emissions Unit	Air Permit Type	Air Permit Proc. Fee
	150 TPD Waste Gasification/Thermal Oxidizer	ACIB	5,000

Application Processing Fee

Check one: ☒ Attached - Amount: $ 5,000 ☐ Not Applicable

APPLICATION INFORMATION

Owner/Authorized Representative Statement

Complete if applying for an air construction permit or an initial FESOP.

1. Owner/Authorized Representative Name :
   Anthony Fraccalvieri

2. Owner/Authorized Representative Mailing Address...
   Organization/Firm: **Dixie Waste Services LLC**
   Street Address: **P.O. Box 850**
   City: **Cross City** State: **FL** Zip Code: **32628-0850**

3. Owner/Authorized Representative Telephone Numbers...
   Telephone: **(352) 346-4746** ext. Fax: **(352) 398-1209**

4. Owner/Authorized Representative Email Address: **FRCCLVR@yahoo.com**

5. Owner/Authorized Representative Statement:

   I, the undersigned, am the owner or authorized representative of the facility addressed in this air permit application. I hereby certify, based on information and belief formed after reasonable inquiry, that the statements made in this application are true, accurate and complete and that, to the best of my knowledge, any estimates of emissions reported in this application are based upon reasonable techniques for calculating emissions. The air pollutant emissions units and air pollution control equipment described in this application will be operated and maintained so as to comply with all applicable standards for control of air pollutant emissions found in the statutes of the State of Florida and rules of the Department of Environmental Protection and revisions thereof and all other requirements identified in this application to which the facility is subject. I understand that a permit, if granted by the department, cannot be transferred without authorization from the department, and I will promptly notify the department upon sale or legal transfer of the facility or any permitted emissions unit.

   Signature

   12-8-05
   Date

APPLICATION INFORMATION

Application Responsible Official Certification

Complete if applying for an initial/revised/renewal Title V permit or concurrent processing of an air construction permit and a revised/renewal Title V permit. If there are multiple responsible officials, the "application responsible official" need not be the "primary responsible official."

1. Application Responsible Official Name:

2. Application Responsible Official Qualification (Check one or more of the following options, as applicable):
   - ☐ For a corporation, the president, secretary, treasurer, or vice-president of the corporation in charge of a principal business function, or any other person who performs similar policy or decision-making functions for the corporation, or a duly authorized representative of such person if the representative is responsible for the overall operation of one or more manufacturing, production, or operating facilities applying for or subject to a permit under Chapter 62-213, F.A.C.
   - ☐ For a partnership or sole proprietorship, a general partner or the proprietor, respectively.
   - ☐ For a municipality, county, state, federal, or other public agency, either a principal executive officer or ranking elected official.
   - ☐ The designated representative at an Acid Rain source.

3. Application Responsible Official Mailing Address...
Organization/Firm:
Street Address:
City: State: Zip Code:

4. Application Responsible Official Telephone Numbers...
Telephone: ( ) - ext. Fax: ( ) -

5. Application Responsible Official Email Address:

6. Application Responsible Official Certification:

I, the undersigned, am a responsible official of the Title V source addressed in this air permit application. I hereby certify, based on information and belief formed after reasonable inquiry, that the statements made in this application are true, accurate and complete and that, to the best of my knowledge, any estimates of emissions reported in this application are based upon reasonable techniques for calculating emissions. The air pollutant emissions units and air pollution control equipment described in this application will be operated and maintained so as to comply with all applicable standards for control of air pollutant emissions found in the statutes of the State of Florida and rules of the Department of Environmental Protection and revisions thereof and all other applicable requirements identified in this application to which the Title V source is subject. I understand that a permit, if granted by the department, cannot be transferred without authorization from the department, and I will promptly notify the department upon sale or legal transfer of the facility or any permitted emissions unit. Finally, I certify that the facility and each emissions unit are in compliance with all applicable requirements to which they are subject, except as identified in compliance plan(s) submitted with this application.

Signature Date

APPLICATION INFORMATION

Professional Engineer Certification

1. Professional Engineer Name: **Bernardo Susi, P.E.**
   Registration Number: **35042**
2. Professional Engineer Mailing Address...
   Organization/Firm: **Golder Associates Inc.****
   Street Address: **6241 NW 23rd Street, Suite 500**
   City: **Gainesville** State: **FL** Zip Code: **32653**
3. Professional Engineer Telephone Numbers...
   Telephone: **(352) 336-5600** ext.**525** Fax: **(352) 336-6603**
4. Professional Engineer Email Address: **bsusi@golder.com**
5. Professional Engineer Statement:

I, the undersigned, hereby certify, except as particularly noted herein, that:*

(1) To the best of my knowledge, there is reasonable assurance that the air pollutant emissions unit(s) and the air pollution control equipment described in this application for air permit, when properly operated and maintained, will comply with all applicable standards for control of air pollutant emissions found in the Florida Statutes and rules of the Department of Environmental Protection; and

(2) To the best of my knowledge, any emission estimates reported or relied on in this application are true, accurate, and complete and are either based upon reasonable techniques available for calculating emissions or, for emission estimates of hazardous air pollutants not regulated for an emissions unit addressed in this application, based solely upon the materials, information and calculations submitted with this application.

(3) If the purpose of this application is to obtain a Title V air operation permit (check here ☐, if so), I further certify that each emissions unit described in this application for air permit, when properly operated and maintained, will comply with the applicable requirements identified in this application to which the unit is subject, except those emissions units for which a compliance plan and schedule is submitted with this application.

(4) If the purpose of this application is to obtain an air construction permit (check here ☒, if so) or concurrently process and obtain an air construction permit and a Title V air operation permit revision or renewal for one or more proposed new or modified emissions units (check here ☐, if so), I further certify that the engineering features of each such emissions unit described in this application have been designed or examined by me or individuals under my direct supervision and found to be in conformity with sound engineering principles applicable to the control of emissions of the air pollutants characterized in this application.

(5) If the purpose of this application is to obtain an initial air operation permit or operation permit revision or renewal for one or more newly constructed or modified emissions units (check here ☐, if so), I further certify that, with the exception of any changes detailed as part of this application, each such emissions unit has been constructed or modified in substantial accordance with the information given in the corresponding application for air construction permit and with all provisions contained in such permit.

Signature

12-20-05
Date

(seal)

* Attach any exception to certification statement.
**** Board of Professional Engineers Certificate of Authorization #00001670**

II. FACILITY INFORMATION

A. GENERAL FACILITY INFORMATION

Facility Location and Type

1. Facility UTM Coordinates... Zone **17** East (km) **297.6** North (km) **3279.5**	2. Facility Latitude/Longitude... Latitude (DD/MM/SS) **29-37-44** Longitude (DD/MM/SS) **83-05-25**

3. Governmental Facility Code: **0**	4. Facility Status Code: **C**	5. Facility Major Group SIC Code: **49**	6. Facility SIC(s): **4953**

7. Facility Comment :
Plant is located east of Rollison Road and west of existing Dixie County transfer station.

Facility Contact

1. Facility Contact Name:
Anthony Fraccalvieri

2. Facility Contact Mailing Address...
Organization/Firm: **Dixie Waste Services LLC**
Street Address: **P.O. Box 850**
City: **Cross City** State: **FL** Zip Code: **32628-0850**

3. Facility Contact Telephone Numbers:
Telephone: **(352) 346-4746** ext. Fax: **(352) 398-1209**

4. Facility Contact Email Address: **FRCCLVR@yahoo.com**

Facility Primary Responsible Official

Complete if an "application responsible official" is identified in Section I. that is not the facility "primary responsible official."

1. Facility Primary Responsible Official Name:

2. Facility Primary Responsible Official Mailing Address...
Organization/Firm:
Street Address:
City: State: Zip Code:

3. Facility Primary Responsible Official Telephone Numbers...
Telephone: ( ) - ext. Fax: ( ) -

4. Facility Primary Responsible Official Email Address:

FACILITY INFORMATION

Facility Regulatory Classifications

Check all that would apply *following* completion of all projects and implementation of all other changes proposed in this application for air permit. Refer to instructions to distinguish between a "major source" and a "synthetic minor source."

1. ☐ Small Business Stationary Source	☐ Unknown
2. ☐ Synthetic Non-Title V Source	
3. ☒ Title V Source	
4. ☒ Major Source of Air Pollutants, Other than Hazardous Air Pollutants (HAPs)	
5. ☐ Synthetic Minor Source of Air Pollutants, Other than HAPs	
6. ☐ Major Source of Hazardous Air Pollutants (HAPs)	
7. ☐ Synthetic Minor Source of HAPs	
8. ☒ One or More Emissions Units Subject to NSPS (40 CFR Part 60)	
9. ☒ One or More Emissions Units Subject to Emission Guidelines (40 CFR Part 60)	
10. ☐ One or More Emissions Units Subject to NESHAP (40 CFR Part 61 or Part 63)	
11. ☐ Title V Source Solely by EPA Designation (40 CFR 70.3(a)(5))	
12. Facility Regulatory Classifications Comment:	

FACILITY INFORMATION

List of Pollutants Emitted by Facility

1. Pollutant Emitted	2. Pollutant Classification	3. Emissions Cap [Y or N]?
NO_x	**A**	**Y**
PM	**B**	**N**
CO	**B**	**N**
SO_2	**B**	**N**
VOC / DIOX	**B**	**N**
Hydrochloric Acid	**B**	**N**
Antimony	**B**	**N**
Arsenic	**B**	**N**
Beryllium	**B**	**N**
Cadmium	**B**	**N**
Chromium	**B**	**N**
Cobalt	**B**	**N**
Manganese	**B**	**N**
Mercury	**B**	**N**
Nickel	**B**	**N**
Lead	**B**	**N**
Selenium	**B**	**N**
Zinc	**B**	**N**
HAPs	**B**	**N**

B. EMISSIONS CAPS

Facility-Wide or Multi-Unit Emissions Caps

1. Pollutant Subject to Emissions Cap	2. Facility Wide Cap [Y or N]? (all units)	3. Emissions Unit ID Nos. Under Cap (if not all units)	4. Hourly Cap (lb/hr)	5. Annual Cap (ton/yr)	6. Basis for Emissions Cap
NO_x				**249**	**ESCPSD**

7. Facility-Wide or Multi-Unit Emissions Cap Comment:
The facility will manage the throughput of waste stream to maintain minor source status and avoid PSD.

C. FACILITY ADDITIONAL INFORMATION

Additional Requirements for All Applications, Except as Otherwise Stated

1. Facility Plot Plan: (Required for all permit applications, except Title V air operation permit revision applications if this information was submitted to the department within the previous five years and would not be altered as a result of the revision being sought)
   ☒ Attached, Document ID:**DWS-FI-C1** ☐ Previously Submitted, Date:_____
2. Process Flow Diagram(s): (Required for all permit applications, except Title V air operation permit revision applications if this information was submitted to the department within the previous five years and would not be altered as a result of the revision being sought)
   ☒ Attached, Document ID:**DWS-FI-C2** ☐ Previously Submitted, Date:_____
3. Precautions to Prevent Emissions of Unconfined Particulate Matter: (Required for all permit applications, except Title V air operation permit revision applications if this information was submitted to the department within the previous five years and would not be altered as a result of the revision being sought)
   ☒ Attached, Document ID: **See DWS-F1-C3** ☐ Previously Submitted, Date:_____

Additional Requirements for Air Construction Permit Applications

1. Area Map Showing Facility Location:
   ☒ Attached, Document ID:**DWS-FI-CC1** ☐ Not Applicable (existing permitted facility)
2. Description of Proposed Construction or Modification:
   ☒ Attached, Document ID: **See Attachment A**
3. Rule Applicability Analysis:
   ☐ Attached, Document ID:**See Attachment A**
4. List of Exempt Emissions Units (Rule 62-210.300(3)(a) or (b)1., F.A.C.):
   ☐ Attached, Document ID:_____ ☒ Not Applicable (no exempt units at facility)
5. Fugitive Emissions Identification (Rule 62-212.400(2), F.A.C.):
   ☐ Attached, Document ID:_____ ☒ Not Applicable
6. Preconstruction Air Quality Monitoring and Analysis (Rule 62-212.400(5)(f), F.A.C.):
   ☐ Attached, Document ID:_____ ☒ Not Applicable
7. Ambient Impact Analysis (Rule 62-212.400(5)(d), F.A.C.):
   ☐ Attached, Document ID:_____ ☒ Not Applicable
8. Air Quality Impact since 1977 (Rule 62-212.400(5)(h)5., F.A.C.):
   ☐ Attached, Document ID:_____ ☒ Not Applicable
9. Additional Impact Analyses (Rules 62-212.400(5)(e)1. and 62-212.500(4)(e), F.A.C.):
   ☐ Attached, Document ID:_____ ☒ Not Applicable
10. Alternative Analysis Requirement (Rule 62-212.500(4)(g), F.A.C.):
    ☐ Attached, Document ID:_____ ☒ Not Applicable

Additional Requirements for FESOP Applications

1. List of Exempt Emissions Units (Rule 62-210.300(3)(a) or (b)1., F.A.C.):
   ☐ Attached, Document ID:_____ ☐ Not Applicable (no exempt units at facility)

Additional Requirements for Title V Air Operation Permit Applications

1. List of Insignificant Activities (Required for initial/renewal applications only):
   ☐ Attached, Document ID:_____ ☐ Not Applicable (revision application)
2. Identification of Applicable Requirements (Required for initial/renewal applications, and for revision applications if this information would be changed as a result of the revision being sought):
   ☐ Attached, Document ID:_____
   ☐ Not Applicable (revision application with no change in applicable requirements)
3. Compliance Report and Plan (Required for all initial/revision/renewal applications):
   ☐ Attached, Document ID:_____
   Note: A compliance plan must be submitted for each emissions unit that is not in compliance with all applicable requirements at the time of application and/or at any time during application processing. The department must be notified of any changes in compliance status during application processing.
4. List of Equipment/Activities Regulated under Title VI (If applicable, required for initial/renewal applications only):
   ☐ Attached, Document ID:_____
   ☐ Equipment/Activities On site but Not Required to be Individually Listed
   ☐ Not Applicable
5. Verification of Risk Management Plan Submission to EPA (If applicable, required for initial/renewal applications only) :
   ☐ Attached, Document ID:_____ ☐ Not Applicable
6. Requested Changes to Current Title V Air Operation Permit:
   ☐ Attached, Document ID:_____ ☐ Not Applicable

Additional Requirements Comment

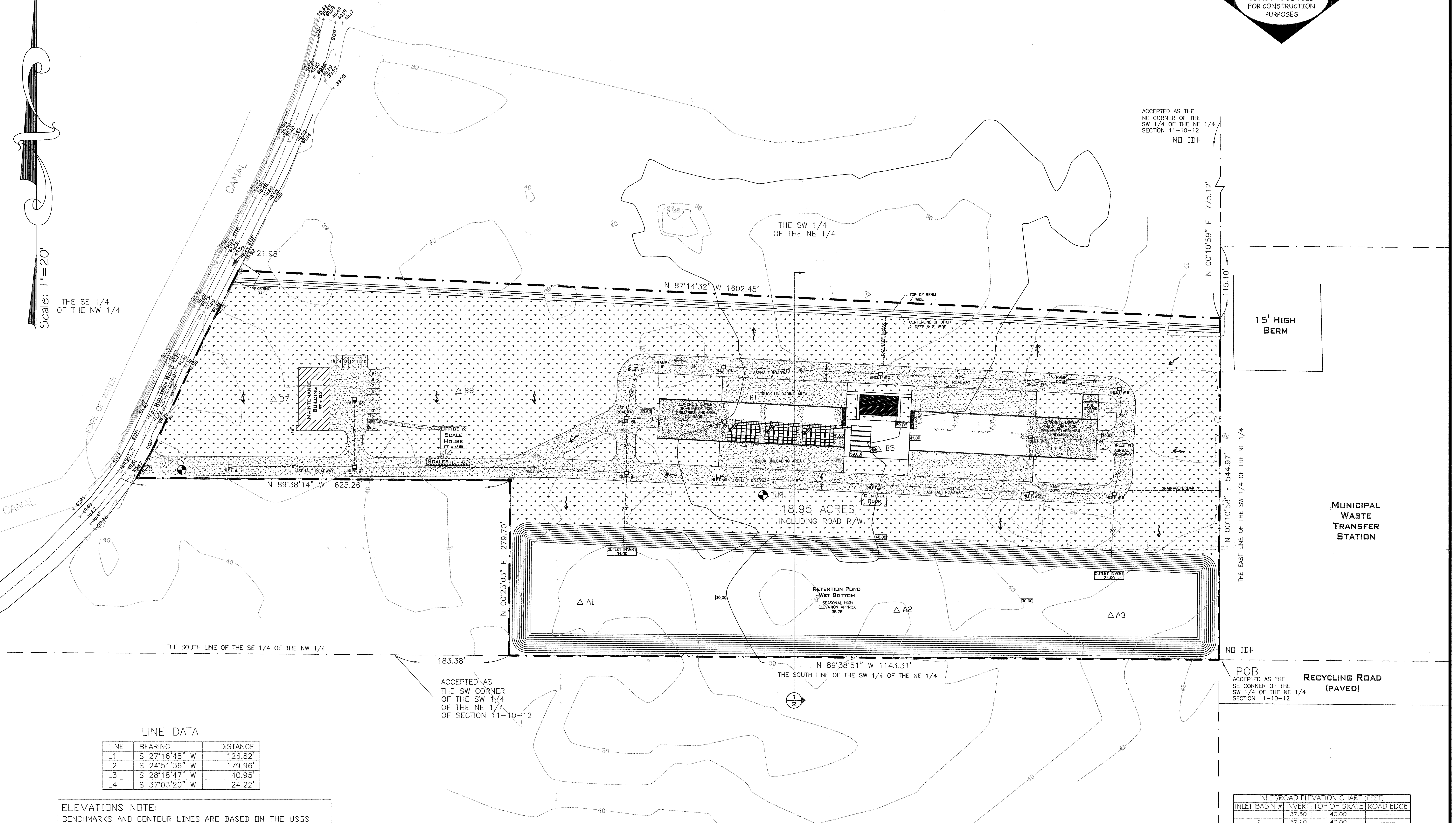
ATTACHMENT DWS-FI-C1

FACILITY PLOT PLAN

DIXIE WASTE PLANT

SECTION 11, TOWNSHIP 10 SOUTH, RANGE 12 EAST
DIXIE COUNTY, FLORIDA

NOTE:
THIS PRELIMINARY PLAN
IS NOT TO BE USED
FOR CONSTRUCTION
PURPOSES



GENERAL NOTES

1- A 6' CHAIN LINK FENCE SHALL BE INSTALL AROUND THE ENTIRE PERIMETER OF THE SITE. THE SAME TYPE FENCE SHALL BE INSTALLED ON THE NORTH SIDE OF THE RETENTION POND GOING EAST TO WEST.

2- ALL STORMWATER PIPES SHALL BE REINFORCED CONCRETE PIPES.

LEGEND

95.9	EXISTING ELEVATION
95.5	PROPOSED ELEVATION

LINE DATA

LINE	BEARING	DISTANCE
L1	S 27°16'48" W	126.82'
L2	S 24°51'36" W	179.96'
L3	S 28°18'47" W	40.95'
L4	S 37°03'20" W	24.22'

ELEVATIONS NOTE:
BENCHMARKS AND CONTOUR LINES ARE BASED ON THE USGS
BENCHMARK "G282 1966", ELEVATION 39.73 FEET, NGVD 1929
BM 1 IS A SPIKE IN 8" PINE, ELEVATION = 41.82' NGVD 1929
BM 2 IS A SPIKE IN 18" OAKE, ELEVATION = 40.33' NGVD 1929

LEGAL DESCRIPTION:

Section 11, a distance of 544.97 feet to a rebar I.D. #2548; thence N 87°14'32" W a distance of 1602.45 feet to the centerline of Rollison Road; thence S 27°16'48" W along the said centerline, 126.82 feet; thence S 24°51'36" W along the said centerline, 179.96 feet; thence S 28°18'47" W along the said centerline, 40.95 feet; thence S 37°03'20" W along the said centerline, 24.22 feet; thence leaving the said centerline, S 89°38'14" E a distance of 625.26 feet; thence S 00°23'03" W a distance of 279.70 feet to the south line of the said SW 1/4 of the NE 1/4; thence S 89°38'51" E along the said south line, 1143.31 feet to the Point of Beginning.
CONTAINING: 18.95 acres, and subject to the maintained R/W for an existing paved County road know as Rollison Road.

SITE PLAN

Scale: 1" = 80'

INLET/ROAD ELEVATION CHART (FEET)			
INLET BASIN #	INVERT	TOP OF GRATE	ROAD EDGE
1	37.50	40.00	-------
2	37.20	40.00	-------
3	37.50	42.00	-------
4	36.50	40.00	-------
5	35.50	45.79	-------
6	37.00	40.00	-------
7	42.79	45.79	-------
8	37.00	40.00	-------
9	56.30	59.30	59.50
10	56.30	59.30	59.50
11	56.00	59.30	59.50
12	56.00	59.30	59.50
13	55.70	59.30	59.50
14	55.70	59.30	59.50
15	37.00	40.00	-------
16	36.75	45.00	-------
17	37.00	40.00	-------
18	42.00	45.00	-------

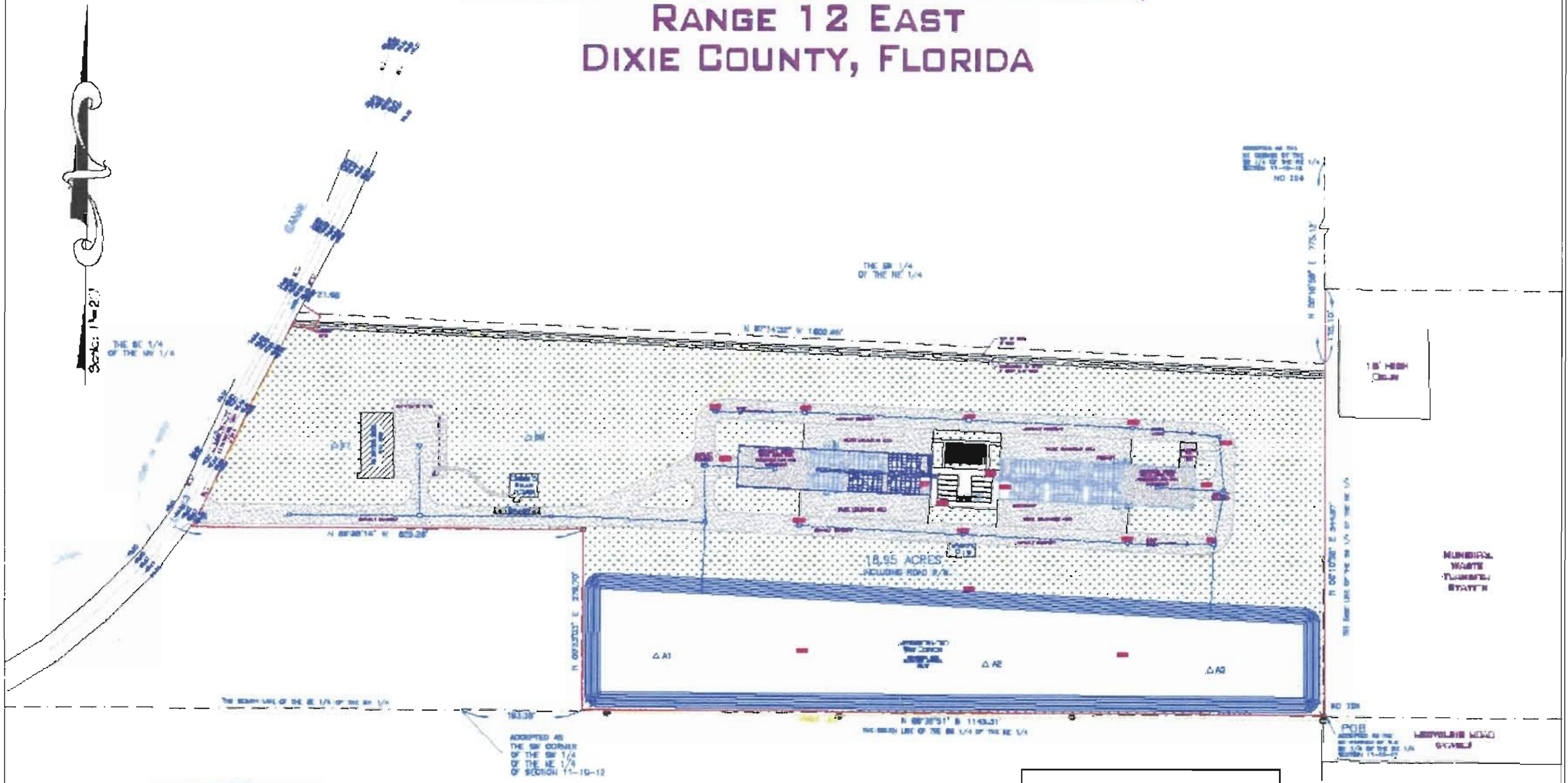
RWMEISSNER &
ASSOCIATES, INC.
Engineering Business # 6232
Robert W. Meissner, P.E. # 6630
216 WEST MAIN STREET
PERRY, FLORIDA 32347
PHONE # 850-584-3887 FAX # 850-223-1159
E-MAIL: rwmi@gtcom.net
President: Angela S. Cruce
Vice-President: Robert W. Meissner, P.E.

DRAFTING BY:
ANGELA S. CRUCE

Project Name:
Dixie Waste Plant
Dixie County, Florida

Project #: 1331-060126-Dixie Waste	Sheet 1 of 2
Date: January 26, 2005	
Scale: 1"=80'	
Paper Size: 24x36	

DIXIE WASTE PLANT
SECTION 11, TOWNSHIP 10 SOUTH, RANGE 12 EAST
DIXIE COUNTY, FLORIDA



LINE DATA

LINE	BEARING	DISTANCE
L1	S 27°16'48" W	126.82'
L2	S 24°51'36" W	179.96'
L3	S 38°18'47" W	40.80'
L4	S 37°03'20" W	24.22'

ELEVATIONS NOTE:
BENCHMARKS AND CONTOUR LINES ARE BASED ON THE USGS BENCHMARK "G802 1966", ELEVATION 39.78 FEET, NGVD 1929
BM 1 IS A SPIKE IN 8" PINE, ELEVATION = 41.88' NGVD 1929
BM 2 IS A SPIKE IN 18" OAK, ELEVATION = 48.88' NGVD 1929

LEGAL DESCRIPTION:

Section 11, a distance of 344.97 feet to a rebar I.D. #2548; thence N 87°14'32" W a distance of 1600.45 feet to the centerline of Robison Road; thence S 27°16'48" W along the said centerline, 126.82 feet; thence S 24°51'36" W along the said centerline, 179.96 feet; thence S 38°18'47" W along the said centerline, 40.80 feet; thence S 37°03'20" W along the said centerline, 24.22 feet; thence leaving the said centerline, S 89°38'14" E a distance of 625.26 feet; thence S 00°23'02" W a distance of 275.75 feet to the south line of the said SW 1/4 of the NE 1/4; thence S 89°38'51" E along the said south line, 1143.31 feet to the Point of Beginning.
CONTAINING 18.95 acres, and subject to the maintained R/W for an existing paved County road know as Robison Road

Legend

▇	Project
▇	Future Phases

SITE PLAN

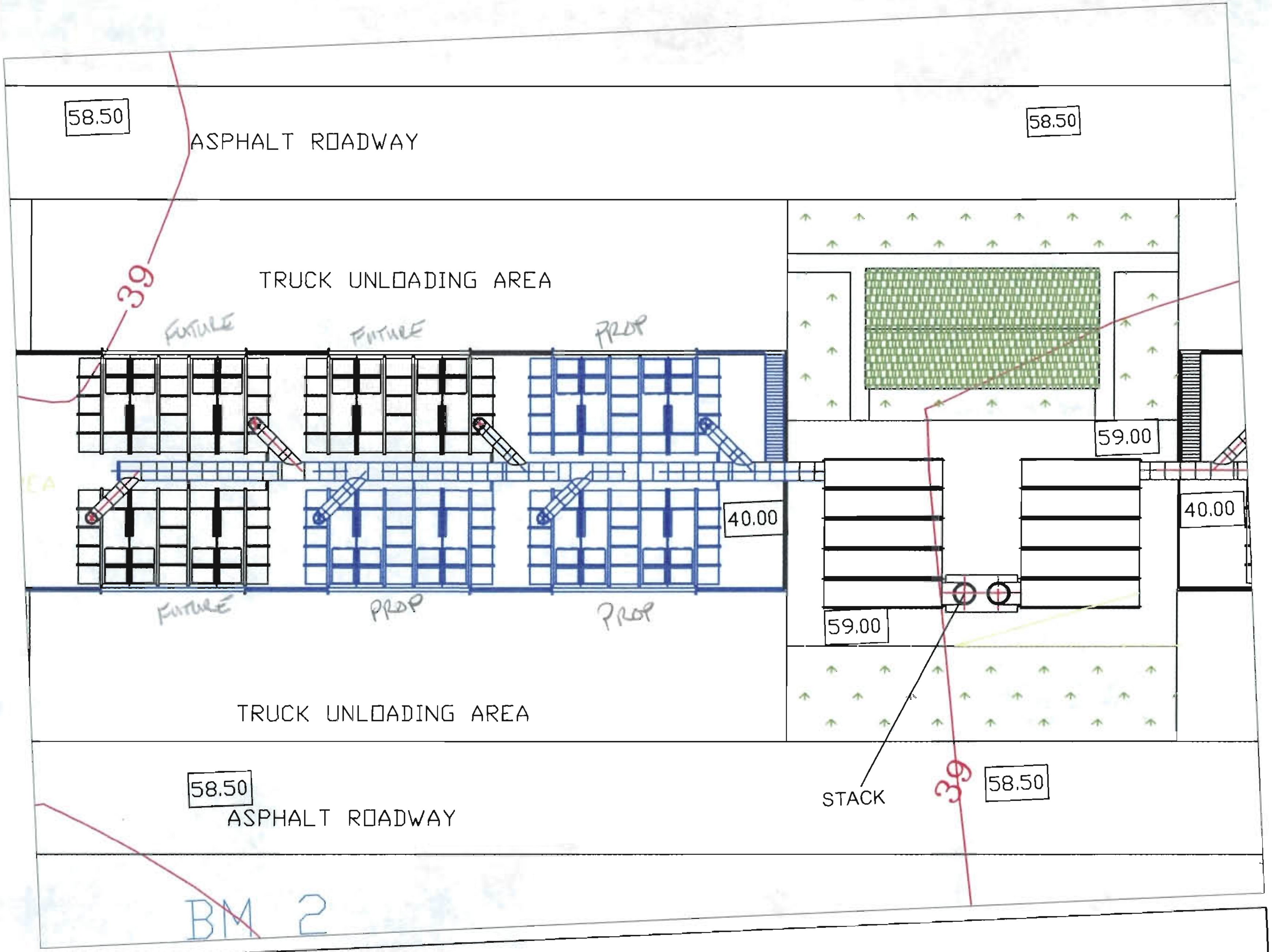
Scale: 1" = 80'

RWMeissner & Associates, Inc.
[illegible]
201 WEST MAIN STREET
[illegible]

DRAFTING BY:
ANGELA B. CRUCE

Project Name:
Dixie Waste Plant
Dixie County, Florida

Project #: [illegible]
Date: November 7, 2008
Scale: [illegible]
Paper Size: [illegible]
Sheet 1 of 1

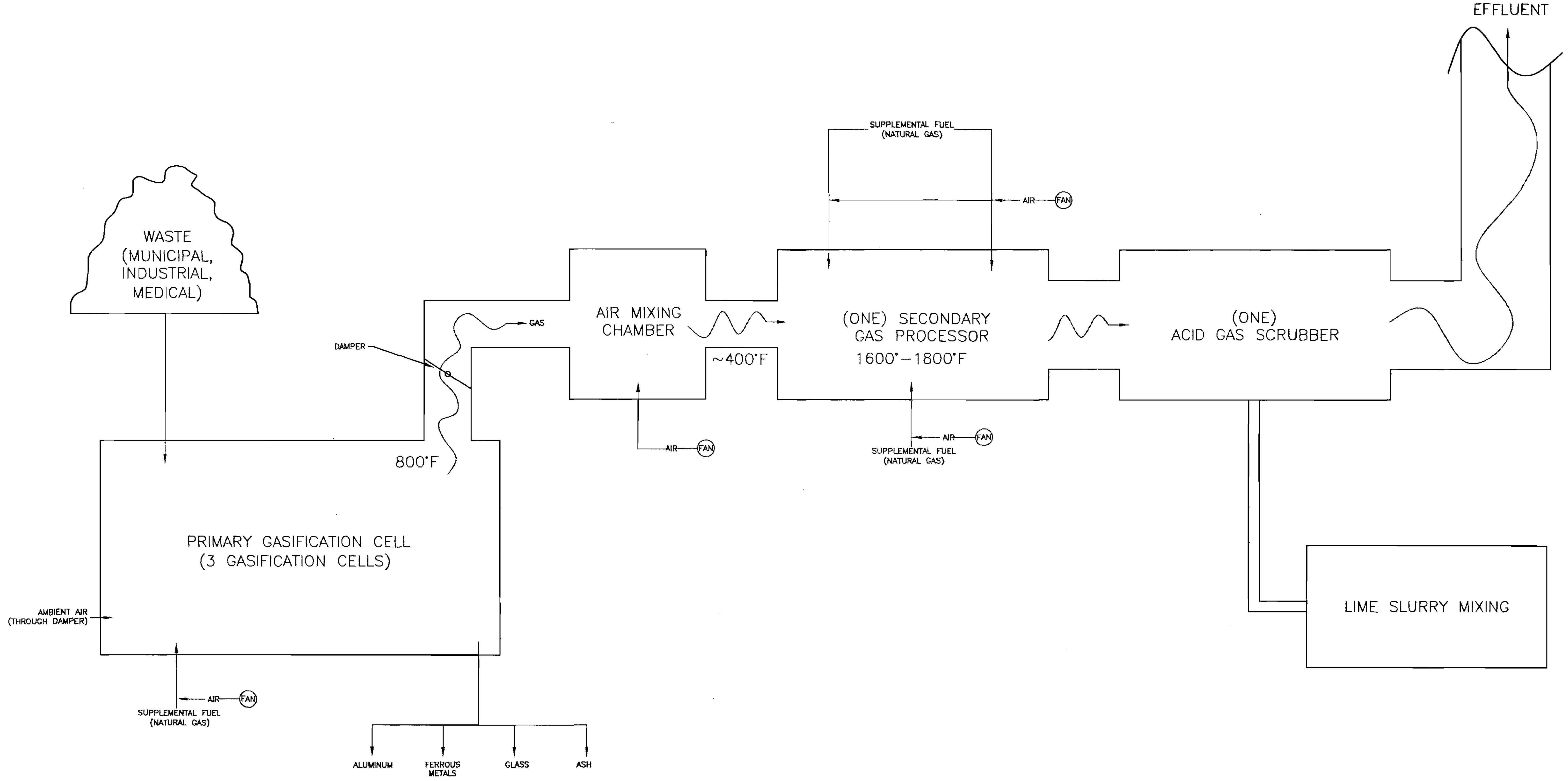


ATTACHMENT DWS-FI-C1a. PROJECT AREA
DIXIE WASTE PLANT, DIXIE COUNTY, FLORIDA

0537608/4.4/DWS-FI-C1a. dwg

ATTACHMENT DWS-FI-C2

PROCESS FLOW DIAGRAM



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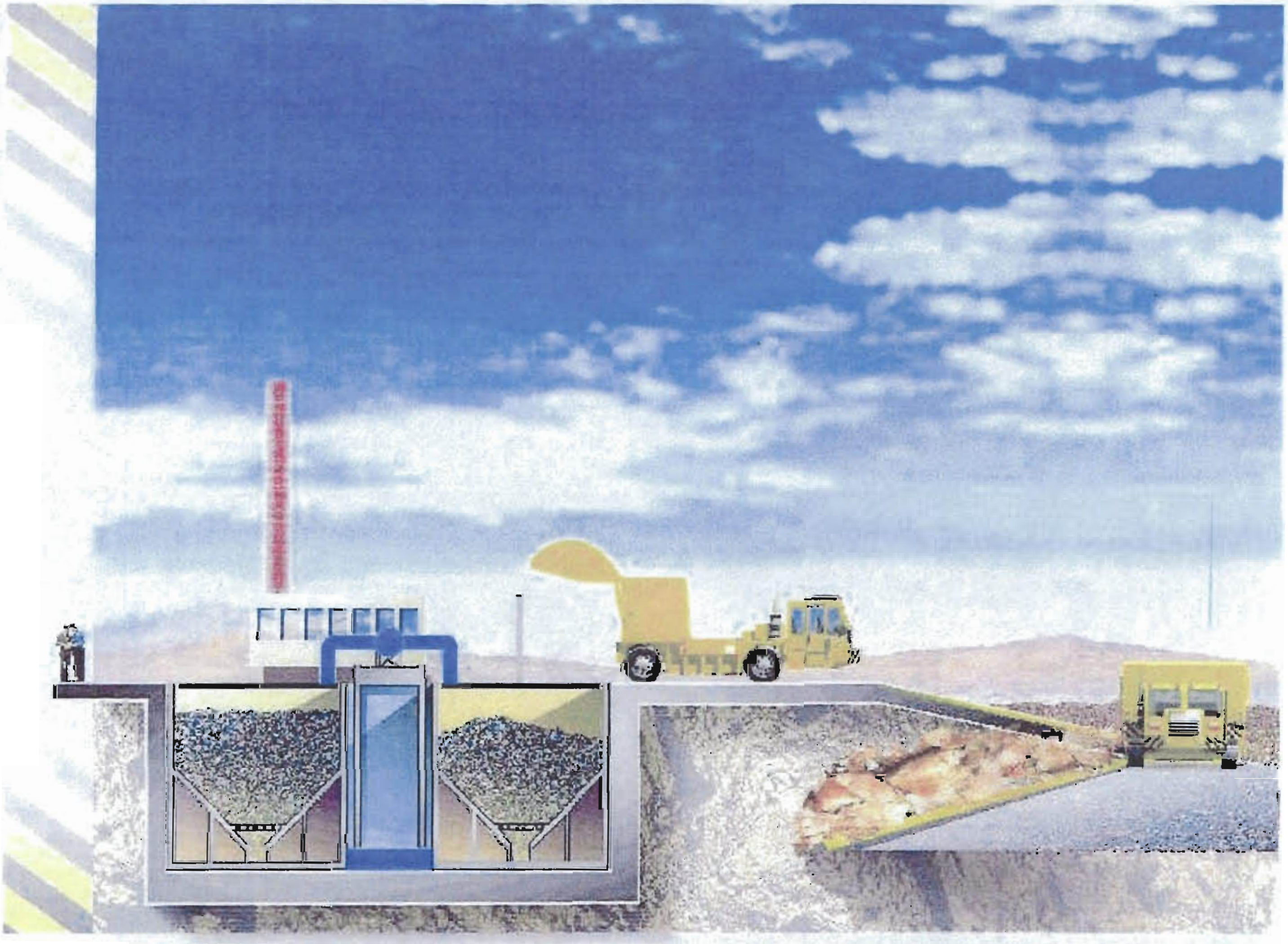
REV.	DATE	DESCRIPTION	BY
0	11/14/97	PRELIMINARY ENGINEERING	CRD

INTERNATIONAL ENVIRONMENTAL TECHNOLOGIES, INC.
Holiday Plaza, Suite 200
465 Denmark Drive
Danville, Kentucky 40422

DATE: 11/14/97
SCALE: NOT TO SCALE
DRAWN BY: CRD

PROCESS FLOW DIAGRAM

0537608/4.4/DWS-FI-C2a
DWG. NO.



Sectional End View / Concept Only

International Environmental Technologies, Inc.

Y:/0537608//4.4/DWS-FI-C2-B.pdf

ATTACHMENT DWS-FI-C3

PRECAUTIONS TO PREVENT EMISSIONS OF UNCONFINED PARTICULATE MATTER

ATTACHMENT DWS-FI-C3

PRECAUTIONS TO PREVENT EMISSIONS OF UNCONFINED PARTICULATE MATTER

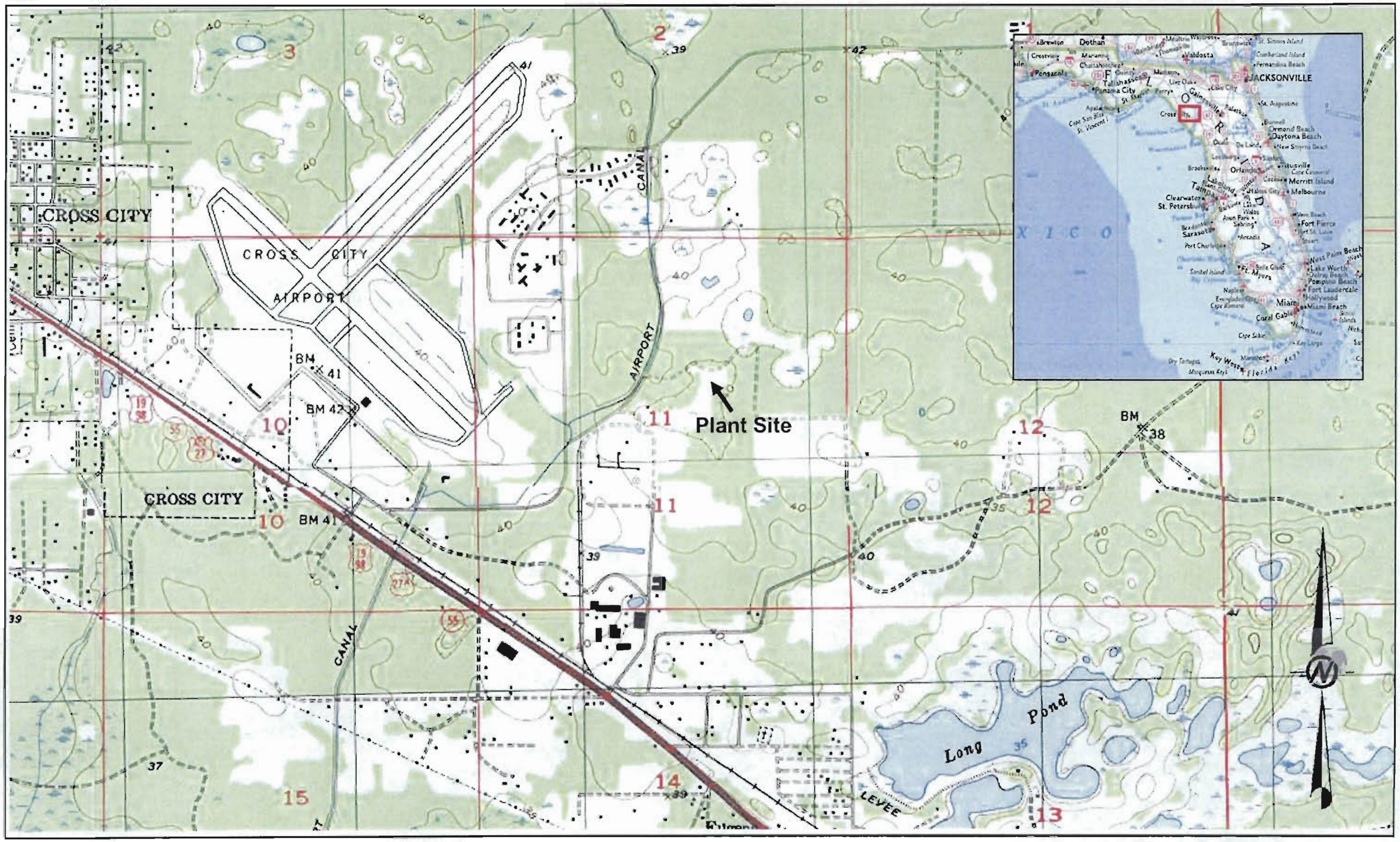
The owner or operators shall not cause, let, permit, suffer, or allow the emissions of unconfined particulate matter (PM) from any source whatsoever, including, but not limited to, vehicular movement, transportation of materials, construction, alteration, demolition or wrecking, or industrially related activities such as loading, unloading, storing, or handling, without taking reasonable precautions to prevent such emissions.

DWS will employ reasonable precautions to control emissions of unconfined PM. These reasonable precautions may include, but are not limited to, the following:

1. Paving and maintenance of roads, parking areas, and yards;
2. Applying water or chemicals to control emissions from such activities as demolition of buildings, grading roads, construction, and land clearing;
3. Applying asphalt, water, oil, chemicals, or other dust suppressants to unpaved roads, yards, open stockpiles, and similar activities;
4. Removing PM from roads and other paved areas under the control of the owner or operator of the facility to prevent re-entrainment, and from buildings or work areas to prevent particulate from becoming airborne;
5. Confining abrasive blasting where possible;
6. Landscaping and planting of vegetation;
7. Using hoods, fans, filters, and similar equipment to contain, capture, and/or vent PM;
8. Enclosing or covering of conveyor systems; and
9. Locating water supply lines, hoses, and sprinklers near all unenclosed materials to prevent unconfined PM emissions.

ATTACHMENT DWS-FI-CC1

AREA MAPS



ATTACHMENT DWS-FI-CC1
Site Location Map
Y:/0537608/4.4/DWS-FI-CC1.doc

Source: National Geographic TOPO!®, 2000; Golder, 2005.

Golder Associates

III. EMISSIONS UNIT INFORMATION

Title V Air Operation Permit Application - For Title V air operation permitting only, emissions units are classified as regulated, unregulated, or insignificant. If this is an application for Title V air operation permit, a separate Emissions Unit Information Section (including subsections A through I as required) must be completed for each regulated and unregulated emissions unit addressed in this application for air permit. Some of the subsections comprising the Emissions Unit Information Section of the form are optional for unregulated emissions units. Each such subsection is appropriately marked. Insignificant emissions units are required to be listed at Section II, Subsection C.

Air Construction Permit or FESOP Application - For air construction permitting or federally enforceable state air operation permitting, emissions units are classified as either subject to air permitting or exempt from air permitting. The concept of an "unregulated emissions unit" does not apply. If this is an application for air construction permit or FESOP, a separate Emissions Unit Information Section (including subsections A through I as required) must be completed for each emissions unit subject to air permitting addressed in this application for air permit. Emissions units exempt from air permitting are required to be listed at Section II, Subsection C.

Air Construction Permit and Revised/Renewal Title V Air Operation Permit Application – Where this application is used to apply for both an air construction permit and a revised/renewal Title V air operation permit, each emissions unit is classified as either subject to air permitting or exempt from air permitting for air construction permitting purposes and as regulated, unregulated, or insignificant for Title V air operation permitting purposes. **The air construction permitting classification must be used to complete the Emissions Unit Information Section of this application for air permit.** A separate Emissions Unit Information Section (including subsections A through I as required) must be completed for each emissions unit subject to air permitting addressed in this application for air permit. Emissions units exempt from air construction permitting and insignificant emissions units are required to be listed at Section II, Subsection C.

If submitting the application form in hard copy, the number of this Emissions Unit Information Section and the total number of Emissions Unit Information Sections submitted as part of this application must be indicated in the space provided at the top of each page.

A. GENERAL EMISSIONS UNIT INFORMATION

Title V Air Operation Permit Emissions Unit Classification

1. Regulated or Unregulated Emissions Unit? (Check one, if applying for an initial, revised or renewal Title V air operation permit. Skip this item if applying for an air construction permit or FESOP only.)

   ☐ The emissions unit addressed in this Emissions Unit Information Section is a regulated emissions unit.

   ☐ The emissions unit addressed in this Emissions Unit Information Section is an unregulated emissions unit.

Emissions Unit Description and Status

1. Type of Emissions Unit Addressed in this Section: (Check one)

   ☒ This Emissions Unit Information Section addresses, as a single emissions unit, a single process or production unit, or activity, which produces one or more air pollutants and which has at least one definable emission point (stack or vent).

   ☐ This Emissions Unit Information Section addresses, as a single emissions unit, a group of process or production units and activities which has at least one definable emission point (stack or vent) but may also produce fugitive emissions.

   ☐ This Emissions Unit Information Section addresses, as a single emissions unit, one or more process or production units and activities which produce fugitive emissions only.

2. Description of Emissions Unit Addressed in this Section:
Waste Gasification / Thermal Oxidizer

3. Emissions Unit Identification Number:

4. Emissions Unit Status Code: **C**	5. Commence Construction Date:	6. Initial Startup Date:	7. Emissions Unit Major Group SIC Code: **49**	8. Acid Rain Unit? ☐ Yes ☒ No

9. Package Unit:
Manufacturer: **Andersen 2000, Inc.** Model Number: **Ejector Scrubber**

10. Generator Nameplate Rating: MW

11. Emissions Unit Comment: **See Attachment A**

Emissions Unit Control Equipment

1. Control Equipment/Method(s) Description:
Wet Scrubber, High Efficiency
Thermal Oxidizer

2. Control Device or Method Code(s): **001**

B. EMISSIONS UNIT CAPACITY INFORMATION

(Optional for unregulated emissions units.)

Emissions Unit Operating Capacity and Schedule

1. Maximum Process or Throughput Rate:	
2. Maximum Production Rate:	
3. Maximum Heat Input Rate:	million Btu/hr
4. Maximum Incineration Rate:	pounds/hr [✓ **150** tons/day]
5. Requested Maximum Operating Schedule:	**24** hours/day **52** weeks/year **7** days/week **8,760** hours/year

6. Operating Capacity/Schedule Comment:

Municipal Solid Waste (MSW)	**2.81 TPH**	**45%**	**By weight or**	**67.4 TPD**
Tire-Derived Fuel (TDF)	**2.94 TPH**	**47%**	**By weight or**	**70.6 TPD**
Medical Waste (MW)	**0.50 TPH**	**8%**	**By weight or**	**12 TPD**

Facility requests flexibility to operate 8,760 hours per year.
Actual combustion in each cell will vary from 8 to 12 hours per day.

TPD based on maximum heating for fuels as follows:
4,500 Btu/lb for MSW
15,500 Btu/lb for TDF
8,500 Btu/lb for MW

450 300 tpd

The above limits are based on the ideal annual mix.

PER CELL
1 BATCH @ 50 TPD
3 CELL
150

2 BATCH PER CELL = 300

BATCH EVERY
14.4 HRS @ 8760
7250

$\frac{250}{150}$ = 1.67 BATCH

1.67 BATCH = 1 BACTH

C. EMISSION POINT (STACK/VENT) INFORMATION
(Optional for unregulated emissions units.)

Emission Point Description and Type

1. Identification of Point on Plot Plan or Flow Diagram: **Wet Scrubber**	2. Emission Point Type Code: **1**	
3. Descriptions of Emission Points Comprising this Emissions Unit for VE Tracking:		
4. ID Numbers or Descriptions of Emission Units with this Emission Point in Common:		
5. Discharge Type Code: **V**	6. Stack Height: **30** feet	7. Exit Diameter: **5.0** feet
8. Exit Temperature: **100**°F	9. Actual Volumetric Flow Rate: **155,000** acfm	10. Water Vapor: **20** %
11. Maximum Dry Standard Flow Rate: **3,263** dscfm	12. Nonstack Emission Point Height: feet	
13. Emission Point UTM Coordinates... Zone: East (km): North (km):	14. Emission Point Latitude/Longitude... Latitude (DD/MM/SS) Longitude (DD/MM/SS)	
15. Emission Point Comment: **One exhaust stack for the secondary chamber (thermal oxidizer and wet scrubber) that is connected to all 3 waste-gasification cells.**		

D. SEGMENT (PROCESS/FUEL) INFORMATION

Segment Description and Rate: Segment 1 of 5

1. Segment Description (Process/Fuel Type): **Solid waste disposal – Industrial: Incineration MSW**		
2. Source Classification Code (SCC): **5-03-001-03**	3. SCC Units: **Tons burned**	
4. Maximum Hourly Rate: **2.81**	5. Maximum Annual Rate: **24,601**	6. Estimated Annual Activity Factor:
7. Maximum % Sulfur: **0**	8. Maximum % Ash: **2**	9. Million Btu per SCC Unit: **9**

10. Segment Comment:
MSW heat content = 4,500 Btu/lb
4,500 Btu/lb x 2,000 lb/ton x $\frac{1\ \text{MMBtu}}{1 \times 10^6\ \text{Btu}}$ = 9 MMBtu/ton

Segment Description and Rate: Segment 2 of 5

1. Segment Description (Process/Fuel Type): **Solid Waste Disposal – Industrial: Incineration – Tire-Derived Fuel (TDF)**		
2. Source Classification Code (SCC): **5-03-001-03**	3. SCC Units: **Tons burned**	
4. Maximum Hourly Rate: **2.94**	5. Maximum Annual Rate: **25,769**	6. Estimated Annual Activity Factor:
7. Maximum % Sulfur:	8. Maximum % Ash: **2**	9. Million Btu per SCC Unit: **31**

10. Segment Comment:
TDF heat content = 15,500 Btu/lb
15,500 Btu/lb x 2,000 lb/ton x $\frac{1\ \text{MMBtu}}{1 \times 10^6\ \text{Btu}}$ = 31 MMBtu/ton

D. SEGMENT (PROCESS/FUEL) INFORMATION

Segment Description and Rate: Segment **3** of **5**

1. Segment Description (Process/Fuel Type): **Solid Waste Disposal – Industrial: Incineration – Medical Waste**		
2. Source Classification Code (SCC): **5-03-001-03**	3. SCC Units: **Tons burned**	
4. Maximum Hourly Rate: **0.50**	5. Maximum Annual Rate: **4,380**	6. Estimated Annual Activity Factor:
7. Maximum % Sulfur:	8. Maximum % Ash: **6**	9. Million Btu per SCC Unit: **17**
10. Segment Comment: **Medical Waste heat content = 8,500 Btu/lb** **8,500 Btu/lb x 2,000 lb/ton x $\frac{1 \text{ MMBtu}}{1 \times 10^6 \text{ Btu}}$ = 17 MMBtu/ton**		

Segment Description and Rate: Segment of **4** of **5**

1. Segment Description (Process/Fuel Type): **Solid Waste Disposal – Industrial: Auxiliary Fuel** PROPANE - THERMAL OXID.		
2. Source Classification Code (SCC): **5-03-900**	3. SCC Units: **1,000 gallons burned**	
4. Maximum Hourly Rate: **3.8×10^{-3}**	5. Maximum Annual Rate: **4.38**	6. Estimated Annual Activity Factor:
7. Maximum % Sulfur: **0**	8. Maximum % Ash: **0**	9. Million Btu per SCC Unit: **91.5**
10. Segment Comment: **Propane gas used as auxiliary fuel in thermal oxidizer.** **91,500 Btu/gal or 91.5 MMBtu/1,000 gal.** **Maximum Fuel Usage During Start-Up = 3.8 gal/hr** **Average Fuel Usage = 0.5 gal/hr**		

D. SEGMENT (PROCESS/FUEL) INFORMATION

Segment Description and Rate: Segment of 5 of 5

1. Segment Description (Process/Fuel Type): **Solid waste disposal – Industrial: Auxiliary Fuel** DIST OIL → PRIMARY CELL		
2. Source Classification Code (SCC): **5-03-900-05**	3. SCC Units: **1,000 gallons burned**	
4. Maximum Hourly Rate: **0.30**	5. Maximum Annual Rate: **3.65**	6. Estimated Annual Activity Factor:
7. Maximum % Sulfur: **0.05**	8. Maximum % Ash: **0**	9. Million Btu per SCC Unit: **136**
10. Segment Comment: **Distillate fuel oil used as auxiliary fuel in primary cell.** **136,000 Btu/gal or 136 MMBtu/1,000 gal.** **Maximum Fuel Usage During Start-Up = 10 gal/day x 365 days = 3,650 gal/yr**		

E. EMISSIONS UNIT POLLUTANTS

List of Pollutants Emitted by Emissions Unit

1. Pollutant Emitted	2. Primary Control Device Code	3. Secondary Control Device Code	4. Pollutant Regulatory Code
NO_x			EL
PM	001		NS
CO		021	NS
SO_2	001		NS
VOC	001	021	NS
HAPS	001	021	NS
Cadmium	001		NS
Lead	001		NS
Mercury	001		NS

F1. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION – POTENTIAL/ESTIMATED FUGITIVE EMISSIONS

(Optional for unregulated emissions units.)

Potential/Estimated Fugitive Emissions

Complete for each pollutant identified in Subsection E if applying for an air construction permit or concurrent processing of an air construction permit and a revised or renewal Title V permit. Complete for each emissions-limited pollutant identified in Subsection E if applying for an air operation permit.

1. Pollutant Emitted: **NO_x**

2. Total Percent Efficiency of Control:

3. Potential Emissions: **69.8** lb/hour **249.7** tons/year

4. Synthetically Limited? ☒ Yes ☐ No

5. Range of Estimated Fugitive Emissions (as applicable): to tons/year

6. Emission Factor: **1.24 lb/MMBtu for medical waste**

Reference: **Stack test.**

7. Emissions Method Code: **1**

8. Calculation of Emissions:

See Attachment A, Tables 2-1 through 2-4, for detailed calculations.

Maximum hourly emissions are based on the highest emission factor for each fuel.

100%

Annual emissions are based on the fuel mix of 45 percent MSW, 47 percent TDF, and 8 percent medical waste, which produced the highest annual emissions for this pollutant.

9. Pollutant Potential/Estimated Fugitive Emissions Comment:

F2. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION - ALLOWABLE EMISSIONS

Complete if the pollutant identified in Subsection F1 is or would be subject to a numerical emissions limitation.

Allowable Emissions Allowable Emissions 1 of 2

1. Basis for Allowable Emissions Code: **ESCPSD**	2. Future Effective Date of Allowable Emissions:
3. Allowable Emissions and Units: **102 ppmvd**	4. Equivalent Allowable Emissions: **69.8** lb/hour **249.4** tons/year
5. Method of Compliance:	
6. Allowable Emissions Comment (Description of Operating Method): **Project allowable emissions are below NSPS; see Table 2-6.**	

Allowable Emissions Allowable Emissions 2 of 2

1. Basis for Allowable Emissions Code: **Rule**	2. Future Effective Date of Allowable Emissions:
3. Allowable Emissions and Units: **500 ppmvd**	4. Equivalent Allowable Emissions: **732** lb/hour tons/year
5. Method of Compliance: **Class II units under NSPS for Subpart AAAA do not require demonstration of compliance with NO_x. However, applicant proposes to install continuous emission monitoring (CEM)**	
6. Allowable Emissions Comment (Description of Operating Method):	

Allowable Emissions Allowable Emissions _____ of _____

1. Basis for Allowable Emissions Code:	2. Future Effective Date of Allowable Emissions:
3. Allowable Emissions and Units:	4. Equivalent Allowable Emissions: lb/hour tons/year
5. Method of Compliance:	
6. Allowable Emissions Comment (Description of Operating Method):	

F1. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION – POTENTIAL/ESTIMATED FUGITIVE EMISSIONS

(Optional for unregulated emissions units.)

Potential/Estimated Fugitive Emissions

Complete for each pollutant identified in Subsection E if applying for an air construction permit or concurrent processing of an air construction permit and a revised or renewal Title V permit. Complete for each emissions-limited pollutant identified in Subsection E if applying for an air operation permit.

1. Pollutant Emitted: **PM**	2. Total Percent Efficiency of Control: **95**
3. Potential Emissions: **2.0** lb/hour **7.1** tons/year	4. Synthetically Limited? ☐ Yes ☒ No
5. Range of Estimated Fugitive Emissions (as applicable): to tons/year	
6. Emission Factor: **0.714 lb/MMBtu for medical waste** Reference: **Stack Test**	7. Emissions Method Code: **1**
8. Calculation of Emissions: **Emissions based on 95% control efficiency.** **See Attachment A, Tables 2-1 through 2-4, for detailed calculations.** **Maximum hourly emissions are based on the highest emission factor for each fuel.** **Annual emissions are based on the fuel mix of 81 percent MSW, 0 percent TDF, and 0 percent medical waste, which produced the highest annual emissions for this pollutant.**	
9. Pollutant Potential/Estimated Fugitive Emissions Comment:	

81%

F2. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION - ALLOWABLE EMISSIONS

Complete if the pollutant identified in Subsection F1 is or would be subject to a numerical emissions limitation.

Allowable Emissions Allowable Emissions 1 of 2

1. Basis for Allowable Emissions Code:	2. Future Effective Date of Allowable Emissions:
3. Allowable Emissions and Units: **5.0 mg/dscm**	4. Equivalent Allowable Emissions: **2.0** lb/hour **7.1** tons/year
5. Method of Compliance: **EPA Method 5**	
6. Allowable Emissions Comment (Description of Operating Method): **Based on 3-run average for annual stack test.**	

Allowable Emissions Allowable Emissions 2 of 2

1. Basis for Allowable Emissions Code: **Rule**	2. Future Effective Date of Allowable Emissions:
3. Allowable Emissions and Units: **24 mg/dscm**	4. Equivalent Allowable Emissions: **59.9** lb/hour tons/year
5. Method of Compliance:	
6. Allowable Emissions Comment (Description of Operating Method): **Project allowable emissions are below NSPS; see Table 2-6.**	

Allowable Emissions Allowable Emissions _____ of _____

1. Basis for Allowable Emissions Code:	2. Future Effective Date of Allowable Emissions:
3. Allowable Emissions and Units:	4. Equivalent Allowable Emissions: lb/hour tons/year
5. Method of Compliance:	
6. Allowable Emissions Comment (Description of Operating Method):	

F1. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION – POTENTIAL/ESTIMATED FUGITIVE EMISSIONS

(Optional for unregulated emissions units.)

Potential/Estimated Fugitive Emissions

Complete for each pollutant identified in Subsection E if applying for an air construction permit or concurrent processing of an air construction permit and a revised or renewal Title V permit. Complete for each emissions-limited pollutant identified in Subsection E if applying for an air operation permit.

1. Pollutant Emitted: **CO**	2. Total Percent Efficiency of Control:
3. Potential Emissions: **6.7** lb/hour **29.3** tons/year	4. Synthetically Limited? ☐ Yes ☒ No
5. Range of Estimated Fugitive Emissions (as applicable): to tons/year	
6. Emission Factor: **1.76 lb/MMBtu for medical waste** Reference: **Stack Test**	7. Emissions Method Code: **1**

8. Calculation of Emissions:

See Attachment A, Tables 2-1 through 2-4, for detailed calculations.

Maximum hourly emissions are based on the highest emission factor for each fuel.

Annual emissions are based on the fuel mix of 0 percent MSW, 92 percent TDF, and 100% **8 percent medical waste, which produced the highest annual emissions for this pollutant.**

9. Pollutant Potential/Estimated Fugitive Emissions Comment:

F2. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION - ALLOWABLE EMISSIONS

Complete if the pollutant identified in Subsection F1 is or would be subject to a numerical emissions limitation.

Allowable Emissions Allowable Emissions 1 of 2

1. Basis for Allowable Emissions Code:	2. Future Effective Date of Allowable Emissions:
3. Allowable Emissions and Units: **11 ppmvd**	4. Equivalent Allowable Emissions: **6.7** lb/hour **29.3** tons/year
5. Method of Compliance: **Continuous Emissions Monitoring (CEM)**	
6. Allowable Emissions Comment (Description of Operating Method):	

Allowable Emissions Allowable Emissions 2 of 2

1. Basis for Allowable Emissions Code: **Rule**	2. Future Effective Date of Allowable Emissions:
3. Allowable Emissions and Units: **50 ppmvd**	4. Equivalent Allowable Emissions: **30.5** lb/hour tons/year
5. Method of Compliance:	
6. Allowable Emissions Comment (Description of Operating Method): **Project allowable emissions are below NSPS; see Table 2-6.**	

Allowable Emissions Allowable Emissions _____ of _____

1. Basis for Allowable Emissions Code:	2. Future Effective Date of Allowable Emissions:
3. Allowable Emissions and Units:	4. Equivalent Allowable Emissions: lb/hour tons/year
5. Method of Compliance:	
6. Allowable Emissions Comment (Description of Operating Method):	

F1. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION – POTENTIAL/ESTIMATED FUGITIVE EMISSIONS

(Optional for unregulated emissions units.)

Potential/Estimated Fugitive Emissions

Complete for each pollutant identified in Subsection E if applying for an air construction permit or concurrent processing of an air construction permit and a revised or renewal Title V permit. Complete for each emissions-limited pollutant identified in Subsection E if applying for an air operation permit.

1. Pollutant Emitted: SO_2	2. Total Percent Efficiency of Control: 98
3. Potential Emissions: 9.5 lb/hour 41.6 tons/year	4. Synthetically Limited? ☐ Yes ☒ No
5. Range of Estimated Fugitive Emissions (as applicable): to tons/year	
6. Emission Factor: 0.61 lb/MMBtu for MSW Reference: Stack Test	7. Emissions Method Code: 1

8. Calculation of Emissions:

Emissions based on 98% control efficiency.

See Attachment A, Tables 2-1 through 2-4, for detailed calculations.

Maximum hourly emissions are based on the highest emission factor for each fuel.

Annual emissions are based on the fuel mix of 0 percent MSW, 100 percent TDF, and 0 percent medical waste, which produced the highest annual emissions for this pollutant.

9. Pollutant Potential/Estimated Fugitive Emissions Comment:

F2. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION - ALLOWABLE EMISSIONS

Complete if the pollutant identified in Subsection F1 is or would be subject to a numerical emissions limitation.

Allowable Emissions Allowable Emissions 1 of 2

1. Basis for Allowable Emissions Code:	2. Future Effective Date of Allowable Emissions:
3. Allowable Emissions and Units: **6.5 ppmvd**	4. Equivalent Allowable Emissions: **9.5** lb/hour **41.6** tons/year
5. Method of Compliance: **CEM**	
6. Allowable Emissions Comment (Description of Operating Method):	

Allowable Emissions Allowable Emissions 2 of 2

1. Basis for Allowable Emissions Code: **Rule**	2. Future Effective Date of Allowable Emissions:
3. Allowable Emissions and Units: **30 ppmvd**	4. Equivalent Allowable Emissions: **43.8** lb/hour tons/year
5. Method of Compliance:	
6. Allowable Emissions Comment (Description of Operating Method): **Project allowable emissions are below NSPS; see Table 2-6.**	

Allowable Emissions Allowable Emissions _____ of _____

1. Basis for Allowable Emissions Code:	2. Future Effective Date of Allowable Emissions:
3. Allowable Emissions and Units:	4. Equivalent Allowable Emissions: lb/hour tons/year
5. Method of Compliance:	
6. Allowable Emissions Comment (Description of Operating Method):	

F1. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION – POTENTIAL/ESTIMATED FUGITIVE EMISSIONS

(Optional for unregulated emissions units.)

Potential/Estimated Fugitive Emissions

Complete for each pollutant identified in Subsection E if applying for an air construction permit or concurrent processing of an air construction permit and a revised or renewal Title V permit. Complete for each emissions-limited pollutant identified in Subsection E if applying for an air operation permit.

1. Pollutant Emitted: **DIOX / FURANS**	2. Total Percent Efficiency of Control: **98**
3. Potential Emissions: **7.15 x 10^{-7}** lb/hour **1.3 x 10^{-6}** tons/year	4. Synthetically Limited? ☐ Yes ☒ No
5. Range of Estimated Fugitive Emissions (as applicable): to tons/year	
6. Emission Factor: **DIOX: 3.22 x 10^{-9} lb/MMBtu for MW** **Furans: 4.21 x 10^{-6} lb/MMBtu for MW** Reference: **AP-42**	7. Emissions Method Code: **3**

8. Calculation of Emissions:

See Attachment A, Tables 2-1 through 2-4, for detailed calculations.

Maximum hourly emissions are based on the highest emission factor for each fuel.

Annual emissions are based on the fuel mix of 81 percent MSW, 0 percent TDF, and 0 percent medical waste, which produced the highest annual emissions for this pollutant.

81%?

Potential Emissions: **DIOX = 6.84 x 10^{-9} lb/hr**
FURANS = 8.94 x 10^{-6} lb/hr

9. Pollutant Potential/Estimated Fugitive Emissions Comment:

F2. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION - ALLOWABLE EMISSIONS

Complete if the pollutant identified in Subsection F1 is or would be subject to a numerical emissions limitation.

Allowable Emissions Allowable Emissions 1 of 2

1. Basis for Allowable Emissions Code:	2. Future Effective Date of Allowable Emissions:
3. Allowable Emissions and Units: **0.92 nanograms/dscm**	4. Equivalent Allowable Emissions: **7.15 x 10^{-7}**lb/hour **1.3 x 10^{-6}** tons/year
5. Method of Compliance: **EPA Method 23**	
6. Allowable Emissions Comment (Description of Operating Method):	

Allowable Emissions Allowable Emissions 2 of 2

1. Basis for Allowable Emissions Code: **Rule**	2. Future Effective Date of Allowable Emissions:
3. Allowable Emissions and Units: **13 nanograms/dscm**	4. Equivalent Allowable Emissions: **1 x 10^{-5}**lb/hour tons/year
5. Method of Compliance:	
6. Allowable Emissions Comment (Description of Operating Method): **Project allowable emissions are below NSPS; see Table 2-6.**	

Allowable Emissions Allowable Emissions _____ of _____

1. Basis for Allowable Emissions Code:	2. Future Effective Date of Allowable Emissions:
3. Allowable Emissions and Units:	4. Equivalent Allowable Emissions: lb/hour tons/year
5. Method of Compliance:	
6. Allowable Emissions Comment (Description of Operating Method):	

F1. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION – POTENTIAL/ESTIMATED FUGITIVE EMISSIONS

(Optional for unregulated emissions units.)

Potential/Estimated Fugitive Emissions

Complete for each pollutant identified in Subsection E if applying for an air construction permit or concurrent processing of an air construction permit and a revised or renewal Title V permit. Complete for each emissions-limited pollutant identified in Subsection E if applying for an air operation permit.

1. Pollutant Emitted: **Hydrochloric Acid**	2. Total Percent Efficiency of Control: **98**
3. Potential Emissions: **0.58** lb/hour **2.2** tons/year	4. Synthetically Limited? ☐ Yes ☒ No
5. Range of Estimated Fugitive Emissions (as applicable): to tons/year	
6. Emission Factor: **1.97 lb/MMBtu** Reference: **AP-42**	7. Emissions Method Code: **3**

8. Calculation of Emissions:

Emissions based on 98% control efficiency.

See Attachment A, Tables 2-1 through 2-4, for detailed calculations.

Maximum hourly emissions are based on the highest emission factor for each fuel.

✓ 100%

Annual emissions are based on the fuel mix of 45 percent MSW, 47 percent TDF, and 8 percent medical waste, which produced the highest annual emissions for this pollutant.

9. Pollutant Potential/Estimated Fugitive Emissions Comment:

F2. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION - ALLOWABLE EMISSIONS

Complete if the pollutant identified in Subsection F1 is or would be subject to a numerical emissions limitation.

Allowable Emissions Allowable Emissions 1 of 2

1. Basis for Allowable Emissions Code:	2. Future Effective Date of Allowable Emissions:
3. Allowable Emissions and Units: **0.7 ppmvd**	4. Equivalent Allowable Emissions: **0.58** lb/hour **2.2** tons/year
5. Method of Compliance: **EPA Method 26, annual stack test**	
6. Allowable Emissions Comment (Description of Operating Method): **Based on 3-run average (minimum run duration – 1 hour).**	

Allowable Emissions Allowable Emissions 2 of 2

1. Basis for Allowable Emissions Code: **Rule**	2. Future Effective Date of Allowable Emissions:
3. Allowable Emissions and Units: **25 ppmvd**	4. Equivalent Allowable Emissions: **30.1** lb/hour tons/year
5. Method of Compliance:	
6. Allowable Emissions Comment (Description of Operating Method): **Project allowable emissions are below NSPS; see Table 2-6.**	

Allowable Emissions Allowable Emissions _____ of _____

1. Basis for Allowable Emissions Code:	2. Future Effective Date of Allowable Emissions:
3. Allowable Emissions and Units:	4. Equivalent Allowable Emissions: lb/hour tons/year
5. Method of Compliance:	
6. Allowable Emissions Comment (Description of Operating Method):	

F1. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION – POTENTIAL/ESTIMATED FUGITIVE EMISSIONS

(Optional for unregulated emissions units.)

Potential/Estimated Fugitive Emissions

Complete for each pollutant identified in Subsection E if applying for an air construction permit or concurrent processing of an air construction permit and a revised or renewal Title V permit. Complete for each emissions-limited pollutant identified in Subsection E if applying for an air operation permit.

1. Pollutant Emitted: **HAPS**

2. Total Percent Efficiency of Control:

3. Potential Emissions: **0.63** lb/hour **2.3** tons/year

4. Synthetically Limited? ☐ Yes ☒ No

5. Range of Estimated Fugitive Emissions (as applicable):
to tons/year

6. Emission Factor: **See Table 2-2**
Reference: **Stack Test/AP-42**

7. Emissions Method Code: **1**

8. Calculation of Emissions:

See Attachment A, Tables 2-1 through 2-4, for detailed calculations.

Maximum hourly emissions are based on the highest emission factor for each fuel.

Annual emissions are based on the fuel mix that provides the highest annual emissions for HAPs.

9. Pollutant Potential/Estimated Fugitive Emissions Comment:

F2. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION - ALLOWABLE EMISSIONS

Complete if the pollutant identified in Subsection F1 is or would be subject to a numerical emissions limitation.

Allowable Emissions Allowable Emissions _____ of _____

1. Basis for Allowable Emissions Code:	2. Future Effective Date of Allowable Emissions:
3. Allowable Emissions and Units:	4. Equivalent Allowable Emissions: lb/hour tons/year
5. Method of Compliance:	
6. Allowable Emissions Comment (Description of Operating Method):	

Allowable Emissions Allowable Emissions _____ of _____

1. Basis for Allowable Emissions Code:	2. Future Effective Date of Allowable Emissions:
3. Allowable Emissions and Units:	4. Equivalent Allowable Emissions: lb/hour tons/year
5. Method of Compliance:	
6. Allowable Emissions Comment (Description of Operating Method):	

Allowable Emissions Allowable Emissions _____ of _____

1. Basis for Allowable Emissions Code:	2. Future Effective Date of Allowable Emissions:
3. Allowable Emissions and Units:	4. Equivalent Allowable Emissions: lb/hour tons/year
5. Method of Compliance:	
6. Allowable Emissions Comment (Description of Operating Method):	

F1. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION – POTENTIAL/ESTIMATED FUGITIVE EMISSIONS

(Optional for unregulated emissions units.)

Potential/Estimated Fugitive Emissions

Complete for each pollutant identified in Subsection E if applying for an air construction permit or concurrent processing of an air construction permit and a revised or renewal Title V permit. Complete for each emissions-limited pollutant identified in Subsection E if applying for an air operation permit.

1. Pollutant Emitted: **Cadmium**	2. Total Percent Efficiency of Control: **95**
3. Potential Emissions: **8.3×10^{-4}** lb/hour **2.67×10^{-3}** tons/year	4. Synthetically Limited? ☐ Yes ☒ No
5. Range of Estimated Fugitive Emissions (as applicable): to tons/year	
6. Emission Factor: **3.22×10^{-4} lb/MMBtu** Reference: **AP-42**	7. Emissions Method Code: **3**

8. Calculation of Emissions:

See Attachment A, Tables 2-1 through 2-4, for detailed calculations.

Maximum hourly emissions are based on the highest emission factor for each fuel.

Annual emissions are based on the fuel mix of 81 percent MSW, 0 percent TDF, and 0 percent medical waste, which produced the highest annual emissions for this pollutant.

9. Pollutant Potential/Estimated Fugitive Emissions Comment:

F2. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION - ALLOWABLE EMISSIONS

Complete if the pollutant identified in Subsection F1 is or would be subject to a numerical emissions limitation.

Allowable Emissions Allowable Emissions 1 of 2

1. Basis for Allowable Emissions Code:	2. Future Effective Date of Allowable Emissions:
3. Allowable Emissions and Units: **0.002 mg / dscm**	4. Equivalent Allowable Emissions: **8.3×10^{-4}** lb/hour **2.67×10^{-3}** tons/year
5. Method of Compliance: **EPA Method 29 and Method 3 A, annual stack test**	
6. Allowable Emissions Comment (Description of Operating Method): **Based on 3-run average.**	

Allowable Emissions Allowable Emissions 2 of 2

1. Basis for Allowable Emissions Code: **Rule**	2. Future Effective Date of Allowable Emissions:
3. Allowable Emissions and Units: **0.020 mg / dscm**	4. Equivalent Allowable Emissions: **0.5** lb/hour tons/year
5. Method of Compliance:	
6. Allowable Emissions Comment (Description of Operating Method): **Project allowable emissions are below NSPS; see Table 2-6.**	

Allowable Emissions Allowable Emissions _____ of _____

1. Basis for Allowable Emissions Code:	2. Future Effective Date of Allowable Emissions:
3. Allowable Emissions and Units:	4. Equivalent Allowable Emissions: lb/hour tons/year
5. Method of Compliance:	
6. Allowable Emissions Comment (Description of Operating Method):	

F1. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION – POTENTIAL/ESTIMATED FUGITIVE EMISSIONS

(Optional for unregulated emissions units.)

Potential/Estimated Fugitive Emissions

Complete for each pollutant identified in Subsection E if applying for an air construction permit or concurrent processing of an air construction permit and a revised or renewal Title V permit. Complete for each emissions-limited pollutant identified in Subsection E if applying for an air operation permit.

1. Pollutant Emitted: **Lead**	2. Total Percent Efficiency of Control: **95**
3. Potential Emissions: **0.0023** lb/hour **0.0102** tons/year	4. Synthetically Limited? ☐ Yes ☒ No
5. Range of Estimated Fugitive Emissions (as applicable): to tons/year	
6. Emission Factor: **4.28 x 10^{-3} lb/MMBtu** Reference: **AP-42**	7. Emissions Method Code: **3**
8. Calculation of Emissions: **See Attachment A, Tables 2-1 through 2-4, for detailed calculations.** **Maximum hourly emissions are based on the highest emission factor for each fuel.** **Annual emissions are based on the fuel mix of 0 percent MSW, 92 percent TDF, and 8 percent medical waste, which produced the highest annual emissions for this pollutant.**	
9. Pollutant Potential/Estimated Fugitive Emissions Comment:	

F2. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION - ALLOWABLE EMISSIONS

Complete if the pollutant identified in Subsection F1 is or would be subject to a numerical emissions limitation.

Allowable Emissions Allowable Emissions 1 of 2

1. Basis for Allowable Emissions Code:	2. Future Effective Date of Allowable Emissions:
3. Allowable Emissions and Units: **0.006 mg / dscm**	4. Equivalent Allowable Emissions: **0.0023** lb/hour **0.01** tons/year
5. Method of Compliance: **EPA Method 29 and Method 3 A, annual stack test**	
6. Allowable Emissions Comment (Description of Operating Method): **Based on 3-run average.**	

Allowable Emissions Allowable Emissions 2 of 2

1. Basis for Allowable Emissions Code: **Rule**	2. Future Effective Date of Allowable Emissions:
3. Allowable Emissions and Units: **0.20 mg / dscm**	4. Equivalent Allowable Emissions: **0.077** lb/hour tons/year
5. Method of Compliance:	
6. Allowable Emissions Comment (Description of Operating Method): **Project allowable emissions are below NSPS; see Table 2-6.**	

Allowable Emissions Allowable Emissions _____ of _____

1. Basis for Allowable Emissions Code:	2. Future Effective Date of Allowable Emissions:
3. Allowable Emissions and Units:	4. Equivalent Allowable Emissions: lb/hour tons/year
5. Method of Compliance:	
6. Allowable Emissions Comment (Description of Operating Method):	

F1. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION – POTENTIAL/ESTIMATED FUGITIVE EMISSIONS

(Optional for unregulated emissions units.)

Potential/Estimated Fugitive Emissions

Complete for each pollutant identified in Subsection E if applying for an air construction permit or concurrent processing of an air construction permit and a revised or renewal Title V permit. Complete for each emissions-limited pollutant identified in Subsection E if applying for an air operation permit.

1. Pollutant Emitted: **Mercury**	2. Total Percent Efficiency of Control:
3. Potential Emissions: **3.22×10^{-2}** lb/hour **1.14×10^{-1}** tons/year	4. Synthetically Limited? ☐ Yes ☒ No
5. Range of Estimated Fugitive Emissions (as applicable): to tons/year	
6. Emission Factor: **6.22×10^{-4} lb/MMBtu** Reference: **AP-42**	7. Emissions Method Code: **3**

8. Calculation of Emissions:

See Attachment A, Tables 2-1 through 2-4, for detailed calculations.

Maximum hourly emissions are based on the highest emission factor for each fuel.

Annual emissions are based on the fuel mix of 81 percent MSW, 0 percent TDF, and 0 percent medical waste, which produced the highest annual emissions for this pollutant. 81%

9. Pollutant Potential/Estimated Fugitive Emissions Comment:

F2. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION - ALLOWABLE EMISSIONS

Complete if the pollutant identified in Subsection F1 is or would be subject to a numerical emissions limitation.

Allowable Emissions Allowable Emissions 1 of 2

1. Basis for Allowable Emissions Code:	2. Future Effective Date of Allowable Emissions:
3. Allowable Emissions and Units: **0.080 mg / dscm**	4. Equivalent Allowable Emissions: **3.22 x 10^{-2}** lb/hour **1.14 x 10^{-1}** tons/year

5. Method of Compliance:
EPA Method 29 and Method 3 A, annual stack test

6. Allowable Emissions Comment (Description of Operating Method):
Based on 3-run average.

Allowable Emissions Allowable Emissions 2 of 2

1. Basis for Allowable Emissions Code: **Rule**	2. Future Effective Date of Allowable Emissions:
3. Allowable Emissions and Units: **0.080 mg / dscm**	4. Equivalent Allowable Emissions: **3.22 x 10^{-2}** lb/hour tons/year

5. Method of Compliance:

6. Allowable Emissions Comment (Description of Operating Method):
Project allowable emissions are below NSPS; see Table 2-6.

Allowable Emissions Allowable Emissions _____ of _____

1. Basis for Allowable Emissions Code:	2. Future Effective Date of Allowable Emissions:
3. Allowable Emissions and Units:	4. Equivalent Allowable Emissions: lb/hour tons/year

5. Method of Compliance:

6. Allowable Emissions Comment (Description of Operating Method):

F1. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION – POTENTIAL/ESTIMATED FUGITIVE EMISSIONS

(Optional for unregulated emissions units.)

Potential/Estimated Fugitive Emissions

Complete for each pollutant identified in Subsection E if applying for an air construction permit or concurrent processing of an air construction permit and a revised or renewal Title V permit. Complete for each emissions-limited pollutant identified in Subsection E if applying for an air operation permit.

1. Pollutant Emitted: **VOC**

2. Total Percent Efficiency of Control: **98**

3. Potential Emissions: **0.000** lb/hour **0.00** tons/year

4. Synthetically Limited? ☐ Yes ☒ No

5. Range of Estimated Fugitive Emissions (as applicable): to tons/year

6. Emission Factor: **1.76×10^{-2} lb/MMBtu**

Reference: **AP-42**

7. Emissions Method Code: **3**

8. Calculation of Emissions:

See Attachment A, Tables 2-1 through 2-4, for detailed calculations.

Maximum hourly emissions are based on the highest emission factor for each fuel.

Annual emissions are based on the fuel mix of 45 percent MSW, 47 percent TDF, and 8 percent medical waste, which produced the highest annual emissions for this pollutant.

9. Pollutant Potential/Estimated Fugitive Emissions Comment:

F2. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION - ALLOWABLE EMISSIONS

Complete if the pollutant identified in Subsection F1 is or would be subject to a numerical emissions limitation.

Allowable Emissions Allowable Emissions _____ of _____

1. Basis for Allowable Emissions Code:	2. Future Effective Date of Allowable Emissions:
3. Allowable Emissions and Units:	4. Equivalent Allowable Emissions: lb/hour tons/year
5. Method of Compliance:	
6. Allowable Emissions Comment (Description of Operating Method):	

Allowable Emissions Allowable Emissions _____ of _____

1. Basis for Allowable Emissions Code:	2. Future Effective Date of Allowable Emissions:
3. Allowable Emissions and Units:	4. Equivalent Allowable Emissions: lb/hour tons/year
5. Method of Compliance:	
6. Allowable Emissions Comment (Description of Operating Method):	

Allowable Emissions Allowable Emissions _____ of _____

1. Basis for Allowable Emissions Code:	2. Future Effective Date of Allowable Emissions:
3. Allowable Emissions and Units:	4. Equivalent Allowable Emissions: lb/hour tons/year
5. Method of Compliance:	
6. Allowable Emissions Comment (Description of Operating Method):	

G. VISIBLE EMISSIONS INFORMATION

Complete if this emissions unit is or would be subject to a unit-specific visible emissions limitation.

Visible Emissions Limitation: Visible Emissions Limitation 1 of 1

1. Visible Emissions Subtype: **VE10**	2. Basis for Allowable Opacity: ☒ Rule ☐ Other
3. Allowable Opacity: Normal Conditions: **10** % Exceptional Conditions: % Maximum Period of Excess Opacity Allowed: min/hour	
4. Method of Compliance: **EPA Method 9**	
5. Visible Emissions Comment: **40 CFR Subpart AAAA**	

Visible Emissions Limitation: Visible Emissions Limitation _____ of _____

1. Visible Emissions Subtype:	2. Basis for Allowable Opacity: ☐ Rule ☐ Other
3. Allowable Opacity: Normal Conditions: % Exceptional Conditions: % Maximum Period of Excess Opacity Allowed: min/hour	
4. Method of Compliance:	
5. Visible Emissions Comment:	

H. CONTINUOUS MONITOR INFORMATION

Complete if this emissions unit is or would be subject to continuous monitoring.

Continuous Monitoring System: Continuous Monitor 1 of 1

1. Parameter Code: **EM**	2. Pollutant(s): **SO_2, CO, O_2, and NO_x**
3. CMS Requirement:	☒ Rule ☐ Other
4. Monitor Information... Manufacturer: Model Number:	Serial Number:
5. Installation Date:	6. Performance Specification Test Date:
7. Continuous Monitor Comment: **Applicant proposes to monitor NO_x using CEM** **40 CFR Subpart AAAA**	

Continuous Monitoring System: Continuous Monitor _____ of _____

1. Parameter Code:	2. Pollutant(s):
3. CMS Requirement:	☐ Rule ☐ Other
4. Monitor Information... Manufacturer: Model Number:	Serial Number:
5. Installation Date:	6. Performance Specification Test Date:
7. Continuous Monitor Comment:	

I. EMISSIONS UNIT ADDITIONAL INFORMATION

Additional Requirements for All Applications, Except as Otherwise Stated

1. Process Flow Diagram (Required for all permit applications, except Title V air operation permit revision applications if this information was submitted to the department within the previous five years and would not be altered as a result of the revision being sought)
☒ Attached, Document ID: **DWS-FI-C2** ☐ Previously Submitted, Date _____

2. Fuel Analysis or Specification (Required for all permit applications, except Title V air operation permit revision applications if this information was submitted to the department within the previous five years and would not be altered as a result of the revision being sought)
☒ Attached, Document ID: **DWS-EU1-I2** ☐ Previously Submitted, Date _____

3. Detailed Description of Control Equipment (Required for all permit applications, except Title V air operation permit revision applications if this information was submitted to the department within the previous five years and would not be altered as a result of the revision being sought)
☒ Attached, Document ID: **DWS-EU1-I3** ☐ Previously Submitted, Date _____

4. Procedures for Startup and Shutdown (Required for all operation permit applications, except Title V air operation permit revision applications if this information was submitted to the department within the previous five years and would not be altered as a result of the revision being sought)
☐ Attached, Document ID: _____ ☐ Previously Submitted, Date _____
☒ Not Applicable (construction application)

5. Operation and Maintenance Plan (Required for all permit applications, except Title V air operation permit revision applications if this information was submitted to the department within the previous five years and would not be altered as a result of the revision being sought)
☐ Attached, Document ID: _____ ☐ Previously Submitted, Date _____
☒ Not Applicable

6. Compliance Demonstration Reports/Records
☐ Attached, Document ID: _____
Test Date(s)/Pollutant(s) Tested: _____

☐ Previously Submitted, Date: _____
Test Date(s)/Pollutant(s) Tested: _____

☐ To be Submitted, Date (if known): _____
Test Date(s)/Pollutant(s) Tested: _____

☒ Not Applicable

Note: For FESOP applications, all required compliance demonstration records/reports must be submitted at the time of application. For Title V air operation permit applications, all required compliance demonstration reports/records must be submitted at the time of application, or a compliance plan must be submitted at the time of application.

7. Other Information Required by Rule or Statute
☒ Attached, Document ID: **Attachment A** ☐ Not Applicable

Additional Requirements for Air Construction Permit Applications

1. Control Technology Review and Analysis (Rules 62-212.400(6) and 62-212.500(7), F.A.C.; 40 CFR 63.43(d) and (e))
☐ Attached, Document ID: _____ ☒ Not Applicable

2. Good Engineering Practice Stack Height Analysis (Rule 62-212.400(5)(h)6., F.A.C., and Rule 62-212.500(4)(f), F.A.C.)
☒ Attached, Document ID: **Attachment A** ☐ Not Applicable

3. Description of Stack Sampling Facilities (Required for proposed new stack sampling facilities only)
☒ Attached, Document ID: **Attachment A** ☐ Not Applicable

Additional Requirements for Title V Air Operation Permit Applications

1. Identification of Applicable Requirements
☐ Attached, Document ID: _____ ☐ Not Applicable

2. Compliance Assurance Monitoring
☐ Attached, Document ID: _____ ☐ Not Applicable

3. Alternative Methods of Operation
☐ Attached, Document ID: _____ ☐ Not Applicable

4. Alternative Modes of Operation (Emissions Trading)
☐ Attached, Document ID: _____ ☐ Not Applicable

5. Acid Rain Part Application
- ☐ Certificate of Representation (EPA Form No. 7610-1)
  - ☐ Copy Attached, Document ID: _____
- ☐ Acid Rain Part (Form No. 62-210.900(1)(a))
  - ☐ Attached, Document ID: _____
  - ☐ Previously Submitted, Date: _____
- ☐ Repowering Extension Plan (Form No. 62-210.900(1)(a)1.)
  - ☐ Attached, Document ID: _____
  - ☐ Previously Submitted, Date: _____
- ☐ New Unit Exemption (Form No. 62-210.900(1)(a)2.)
  - ☐ Attached, Document ID: _____
  - ☐ Previously Submitted, Date: _____
- ☐ Retired Unit Exemption (Form No. 62-210.900(1)(a)3.)
  - ☐ Attached, Document ID: _____
  - ☐ Previously Submitted, Date: _____
- ☐ Phase II NOx Compliance Plan (Form No. 62-210.900(1)(a)4.)
  - ☐ Attached, Document ID: _____
  - ☐ Previously Submitted, Date: _____
- ☐ Phase II NOx Averaging Plan (Form No. 62-210.900(1)(a)5.)
  - ☐ Attached, Document ID: _____
  - ☐ Previously Submitted, Date: _____
- ☐ Not Applicable

Additional Requirements Comment

ATTACHMENT DWS-EU1-I2

FUEL ANALYSIS

ATTACHMENT DWS-EU1-I2

FUEL ANALYSIS
PROPANE (TYPICAL)

Emission unit #1 may occasionally use propane fuel as auxiliary fuel for the thermal oxidizer. The propane fuel is supplied by a commercial vendor and will be stored in tanks located near the thermal oxidizer. The chemical formula for propane is C_3H_8.

Parameter	Typical Value	Specifications
Specific gravity (@ 60°F)	0.51	None
Heat content (MBtu/bbl)	600 - 1,000	None
% sulfur	0.0031	None
% nitrogen	No specification	None
% ash	No specification	none

ATTACHMENT DWS-EU1-I2

FUEL ANALYSIS
NO. 2 DISTILLATE OIL (TYPICAL)

Emission unit #1 may occasionally use distillate fuel oil to start off the combustion process in the primary cells.

Parameter	Typical Value	Specifications
API gravity (@ 60°F)	35.0	30 - 40
Heat content (MBtu/bbl)	5,700 - 5,800	None
% sulfur	0.03 - 0.05	0.05 maximum
% nitrogen	No specification	None
% ash	<0.01	0.01

ATTACHMENT DWS-EU1-I3

DESCRIPTION OF CONTROL EQUIPMENT

ANDERSEN 2000 INC

A Crown Andersen Company

- ENGINEERING
- EQUIPMENT
- TURNKEY INSTALLATION

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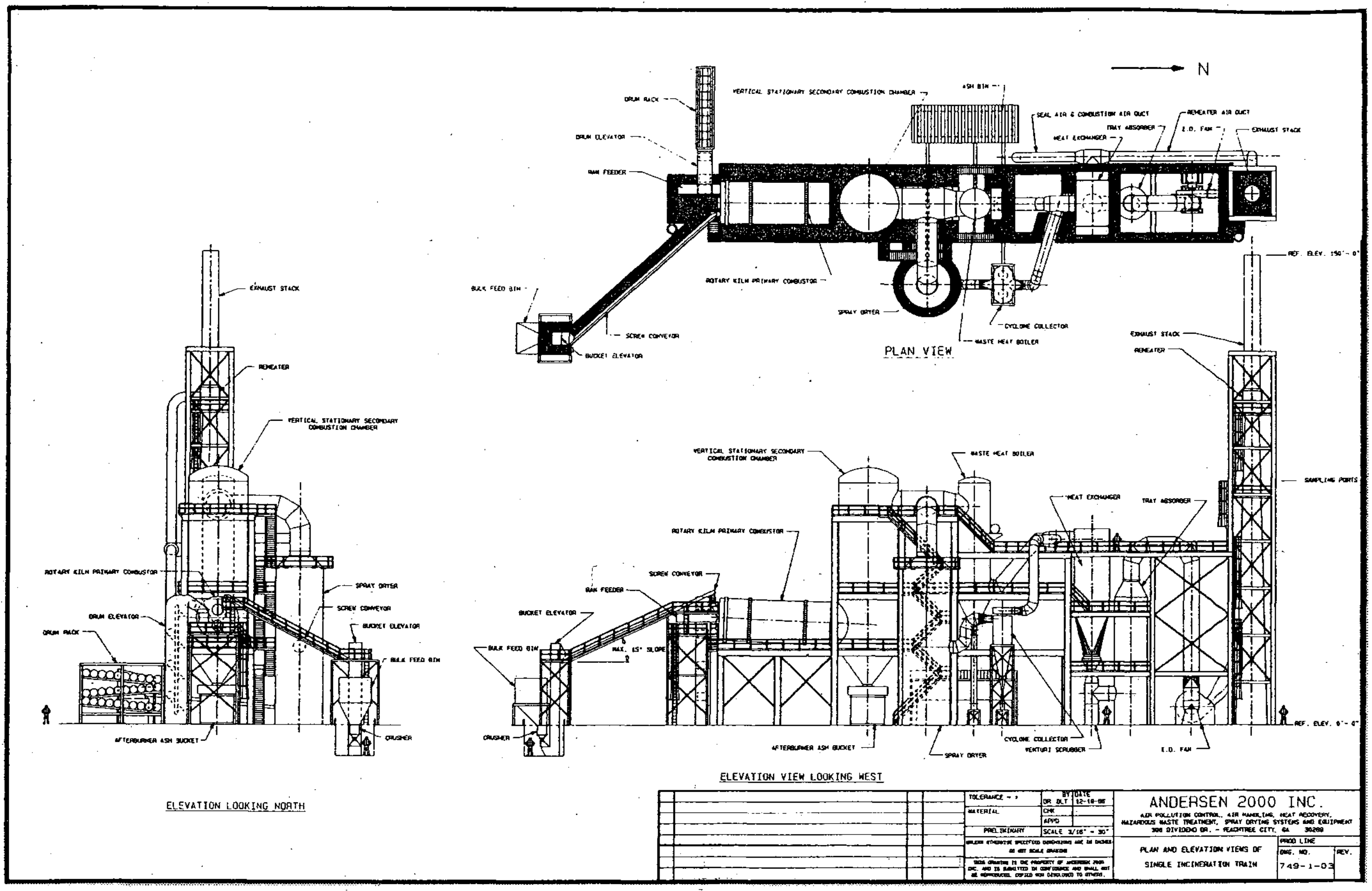
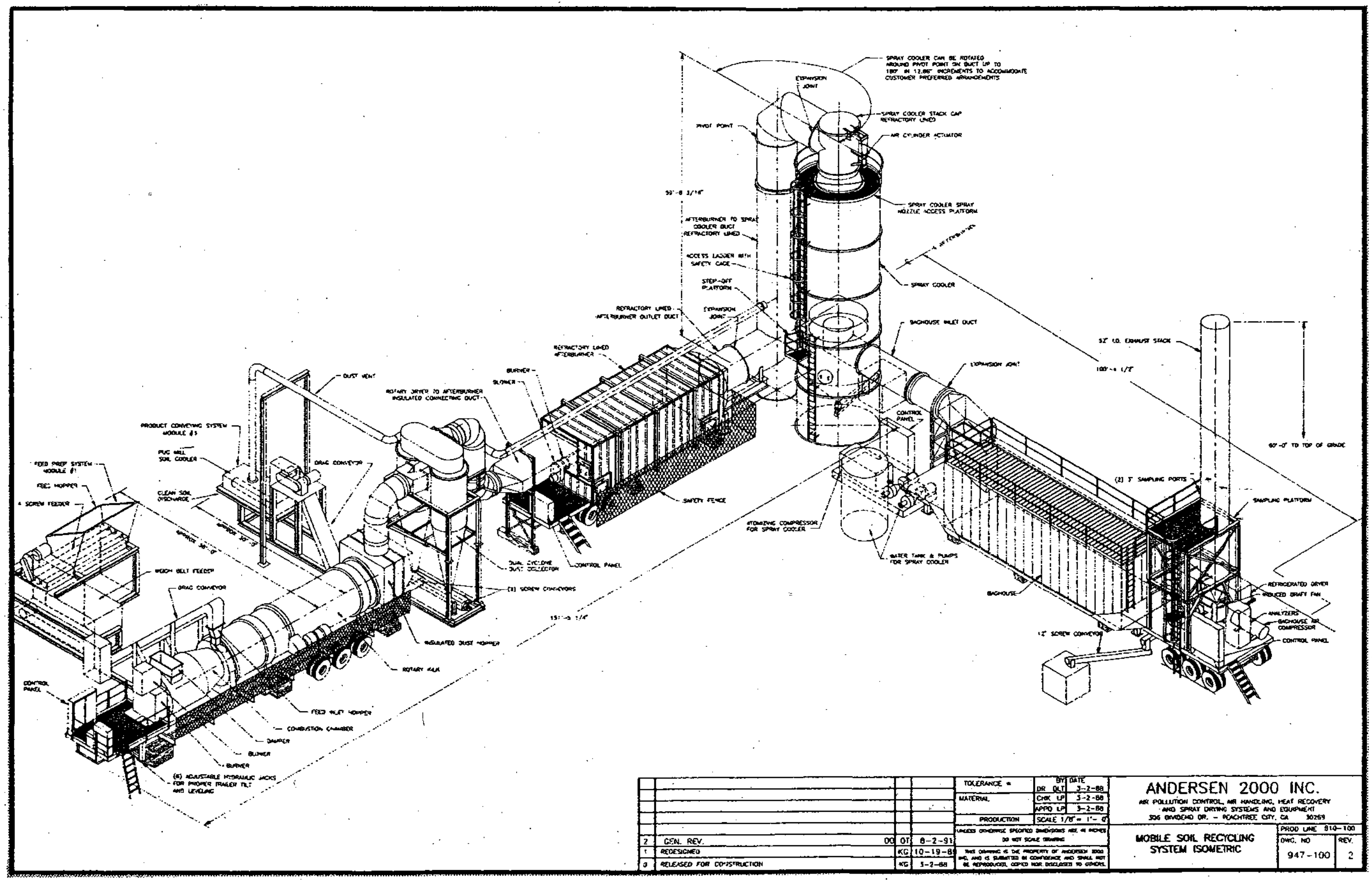
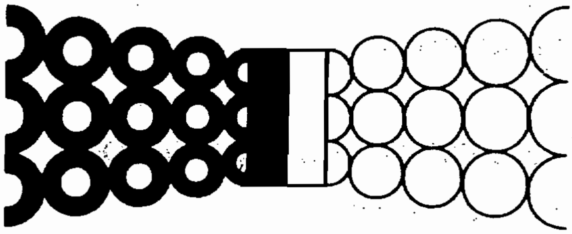


COMPLETE HAZARDOUS WASTE INCINERATION PLANT WITH WET SCRUBBING SYSTEM



MOBILE SOIL DECONTAMINATION SYSTEM WITH DRY SCRUBBING SYSTEM

EMISSION CONTROL SYSTEMS FOR INCINERATORS AND OXIDIZERS



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JANUARY 1999

TABLE OF CONTENTS

EMISSION CONTROL SYSTEMS FOR INCINERATORS AND OXIDIZERS

I. INTRODUCTION

In waste disposal technology, the late 1980s and 1990s will become known as the age of incineration. Incinerator use has increased dramatically for three waste disposal applications. These are (1) municipal waste (garbage) disposal; (2) hospital and infectious waste disposal, and; (3) hazardous and chemical waste disposal. Although there are many differences in the compositions and properties of these wastes, there are similarities as well. All of the waste materials contain some ash which distributes between bottom ash and airborne particulate matter at the combustor discharge. All of the waste materials need excess air (more than stoichiometric) to completely destroy the organic content in them. All produce some gaseous air pollutants and all require high temperatures (1475-2700°F or 800-1500°C) to achieve complete combustion. Incinerators employed in these three applications are significantly different in their basic design. The municipal waste incinerators are normally large units with traveling grate or stoker feed systems which are connected directly to waste heat boilers to produce steam and then electric power which is sold to a local utility power grid. Fluid bed combustion is also being considered in municipal waste incineration. For small communities where only limited quantities of waste are available, small controlled air incinerators can be used.

In hazardous waste incineration, the rotary kiln combustor, followed by a secondary afterburner chamber, is the most commonly employed device. There are also some relatively simple liquid injection and fume-type incinerators employed. Most of the new technology being developed in incineration is being directed to the hazardous waste incineration arena. Electrically generated plasmas, infrared furnaces, molten salt systems, and molten glass systems are being extensively studied.

For hospital and infectious waste incineration, the most common furnace is the controlled air, fixed hearth, two chamber, packaged incinerator. This type of unit is normally quite small (less than 2500#/hr. (1134Kg/hr.)) and is sometimes operated on a batch basis rather than a continuous basis.

Because of the differences in combustor operating characteristics, the types of emission control systems and the operating conditions for these systems differ quite widely. There are, however, some universal design considerations which apply to any of these systems on any of these wastes. Fuel consumption in the combustor depends upon the heating value of the waste being burned, the excess air rate through the furnace, the temperature at which the furnace must be operated, the heat losses associated with the furnace design, and the presence or absence of heat recovery equipment. In general, low excess air rates, high waste material heating values, carefully controlled furnace temperatures, heat recovery in the form of both steam production and combustion air preheating, and highly insulated furnaces result in low operating costs. In addition, careful attention to waste blending to generate a consistent heating value waste material results in consistent operating conditions in the furnace and produces more economic operation than batch-type firing or processing of highly variable waste materials.

Unfortunately, some of the conditions which result in low operating costs also make compliance with regulatory requirements difficult. Furthermore, maintenance costs may be quite high when optimum combustion conditions are maintained. As an example, in hazardous waste incineration applications, many regulatory agencies dictate that the exhaust gas must contain a minimum 3% (vol) oxygen. This is done to ensure that the organic materials in the waste are fully oxidized. There are, however, many applications in which hazardous solvents with very high heating values are available. These solvents are often easy to burn and can be burned quite adequately with excess oxygen concentrations in the exhaust gas streams of 2% (vol) or less. The reduced oxygen level would result in a considerable energy savings, but because of the regulatory requirement, this savings cannot be realized. In addition, at low excess oxygen levels, halogenated hydrocarbons convert more easily to the hydrogen halide equivalent gas, rather than to the elemental halogen gas. The hydrogen halide gases are much more easily controlled in emission control systems than are the elemental halogens. Thus, the higher oxygen requirement in the exhaust gas stream may produce secondary emissions which are more difficult to control in air pollution control systems. As another example, when waste heat boilers are employed on hazardous waste incinerators, and when heat recovery is maximized, accelerated corrosion is frequently encountered in the waste heat boiler section because the gases from which the heat has been recovered are frequently contaminated with hydrogen chloride, sulfur dioxide, hydrogen fluoride, and a variety of similar corrosive gases. As the water dew point or the acid dew point of the gas stream is approached, corrosion can be quite rapid on metal surfaces and quite devastating to mechanical equipment. Thus, while heat recovery may produce revenues to offset operating costs, maintenance costs often offset any gains.

Air pollution regulations are being imposed on most new incinerator installations throughout the world. We expect that virtually every new incineration application will be regulated in one fashion or another, no matter where it is located. The available choices for pollution control systems depend on what is being burned, how stringent the regulations are, and what operating costs can be tolerated. The common systems employed are: (1) gas cooling by waste heat boilers or air-air heat exchangers, followed by fabric filtration or electrostatic precipitation for particulate removal only; (2) alkaline spray absorbers followed by fabric filters (dry scrubbers) for particulate and acid gas removal; (3) wet scrubbers for simultaneous particulate and acid gas removal; and (4) spray evaporation systems followed by wet scrubbing for particulate and acid gas removal (semi-dry scrubbers).

This brochure discusses the emissions which are produced in various incineration systems, the operating characteristics of the incinerators which must employ pollution control systems, provides some information on the types of emissions produced by specific wastes, and then includes a detailed review of the available pollution control systems and their performance characteristics. The systems discussed in this brochure are all available from Andersen 2000 Inc on either an equipment only or a turnkey installed basis.

II. EMISSIONS OF CONCERN

Regulations on incinerator emissions include particulate concentration in the exhaust gas, opacity or nonwater vapor visible emissions, carbon monoxide concentrations, acid gas concentrations (including HCl, HF, SO_2 and NO_X), and residual (unburned) hydrocarbon concentrations, with some specific organic DREs (destruction and removal efficiencies). These emissions are discussed in this section. The various methods of expressing regulatory standards are also discussed.

A. Particulate Emissions

There are three major sources of particulate emissions and two minor sources of particulate emissions in incineration applications. Table I discusses those emissions.

The most common particulate source is the large group of refractory oxides which are present in waste materials being burned in incinerators. These include clay fillers which are incorporated in many paper and plastic products; soil components, which include many metal oxides and calcium and magnesium compounds; paint and dye pigments, which are commonly metal oxides in a finely divided form; and many nonvolatile metals which convert to their oxides during combustion. Once the organic matrix in which these refractory oxides are contained has been converted to a gaseous product, the refractory oxides are discharged either as bottom ash or as fly ash (suspended in the gas stream). These oxides are usually 0.8 micron in diameter and larger and have high particle densities. The most common ones are titanium dioxide, iron oxide, calcium oxide, and aluminum oxide. Titanium dioxide is a particularly prevalent compound because of its extensive use as a white pigment in plastics, papers, and paints.

TABLE 1
PARTICULATE EMISSIONS
FROM INCINERATORS

DERIVED FROM	CHARACTERISTIC OF PARTICULATE
A. REFRACTORY OXIDES IN WASTE FILLERS IN PAPER & PLASTICS, SOILS PAINT & DYE INORGANIC PIGMENTS, NON-VOLATILE METALS.	GENERALLY ARE OXIDES OF METALS OR OF CALCIUM & MAGNESIUM. USUALLY ARE 0.8 MICRON IN DIAMETER OR LARGER WITH HIGH PARTICLE DENSITY. COMMON ONES ARE IRON OXIDE, CALCIUM OXIDE, TITANIUM DIOXIDE & ALUMINUM OXIDE.
B. INORGANIC SALTS IN WASTE, DISSOLVED SALTS IN AQUEOUS WASTES.	MOST COMMON ARE SODIUM CHLORIDE, SODIUM SULFATE, POTASSIUM CHLORIDE AND CALCIUM CHLORIDE. OFTEN PRESENT IN VERY LOW CONCENTRATION BUT WITH VERY SMALL PARTICLE SIZE DISTRIBUTION - OFTEN LESS THAN 0.5 MICRON IN DIAMETER.
C. *SULFUR IN WASTE, SULFURIC ACID IN* WASTE, PHOSPHORUS & SILICON OR THEIR SALTS IN WASTE.	EXTREMELY SMALL (<0.3 MICRON IN DIAM.) PARTICULATE WHICH IS VERY DIFFICULT TO REMOVE FROM GAS STREAM. OFTEN DESCRIBED AS AN AEROSOL. THESE AEROSOLS ARE ALL PRESENT AS OXIDES (P_2O_5, SiO_2, SO_3 WHICH HYDRATES TO H_2SO_4, ETC.).
D. VOLATILE METALS AND METAL CHLORIDES IN WASTE, MERCURY ZINC, CADMUIM, LEAD, IRON (AS CHLORIDE).	CONDENSED AEROSOLS OF THE METALS OR THEIR OXIDES. CONCENTRATION DEPENDS ON GAS TEMPERATURE. USUALLY SMALL SIZE (LESS THAN 0.5 MICRON DIAMETER).
E. UNBURNED ORGANICS	CONDENSED TARS AND HIGH MOLECULAR WEIGHT ORGANICS WHICH FORM AS AEROSOLS (0.5 MICRON IN DIAMETER AND SMALLER). THESE ACCOUNT FOR MUCH OF THE "BLUE SMOKE" ONE MAY SEE AT AN INCINERATOR EXHAUST STACK.

The second most common source of particulate emissions is water soluble inorganic salts, including sodium chloride, sodium sulfate, potassium chloride, and calcium chloride. These compounds are normally first dried from their water matrix in the incinerator and are then elevated in temperature to the point that their vapor pressures cause partial evaporation into the gas stream. When the gas stream exits the furnace and begins to cool somewhat, these salts condense into submicron aerosols which are extremely difficult to remove from the gas stream. Most of these salts end up in aerosol form at less than 0.5 micron in diameter. Their concentration is normally quite low, but because of their very small particle size and very high surface area, they tend to produce highly visible particulate emissions.

The third common particulate emission source is a small group of volatile elements which easily convert to submicron oxide aerosols. Phosphorus is the most common of these elements. Iron as the chloride will also behave in a similar fashion. Sulfur also burns to sulfur trioxide which, after coming in contact with water vapor, will form submicron sulfuric acid aerosol. Silicon, although not as volatile as phosphorus or sulfur, also produces a submicron oxide aerosol which, on contact with water, forms a fume sized hydrated oxide which is somewhat gelatinous in nature. All of these aerosols are commonly less than 0.3 micron in diameter and are the most difficult particulate emissions to collect in incinerator exhaust gas streams.

Because of their toxicity, some of the volatile metals (often referred to as heavy metals) are of significant regulatory concern. The most common are mercury, zinc, cadmium and lead. They are usually present in parts per million or parts per billion concentrations in the waste materials being processed. All of these metals have very high vapor pressures at the temperatures reached in incineration systems. They volatilize (convert to gases) in the furnace section and can only be collected if the temperature of the exhaust gas is dropped significantly. When they do condense in the exhaust gas stream at lowered temperatures, they form particles which are typically less than 0.5 micron in diameter. In general, the lower the exit gas temperature, the lower the volatile metal content of the discharged gases.

There is also a broad category of particulate emissions which are produced by unburned organic compounds which are volatilized during combustion but recondense at lower gas temperatures after leaving the furnace. These often condense into aerosols which are less than 0.5 micron in diameter, and they account for much of the "blue smoke" which can be seen at a poorly operating incinerator exhaust stack. These are of concern for three reasons. First, particulate emission regulations may prohibit their discharge. Second, they are an indication of poor combustion conditions in the incinerator and poor destruction and removal efficiency. If the organics being incinerated are toxic, one would suspect that the residual organics might also be toxic. Finally, they produce visible opacity at the exhaust stack which is often regulated and which attracts unwanted public attention to the incineration facility.

B. Acid Gases

Table II shows the most common gaseous emissions produced from incineration. Combustion conditions determine which of the products shown in Table II are produced and exhausted. For example, at 1500°C (2730°F), CO_2 dissociates to CO, a commonly regulated pollutant. Some of the extremely stable chlorinated organic compounds may require an incineration temperature this high to completely dissociate them and destroy them. This may result in excess CO emissions which would certainly not approach the toxicity of the organics being destroyed, but could jeopardize regulatory compliance. If halogenated organics are burned in excess oxygen, but in an environment where hydrogen or water vapor is available in only limited concentration, the halogenated organics convert to the elemental halogen, rather than to hydrogen chloride, hydrogen iodide, hydrogen fluoride, or hydrogen bromide. Brominated compounds are particularly sensitive to oxygen concentration and can tolerate essentially no excess oxygen if hydrogen bromide is the desired end product. Techniques are available using sulfur dioxide in relatively high concentration to assist in conversion of brominated compounds to hydrogen bromide. If the elemental halogens are produced, however, they are difficult, if not virtually impossible, to remove from the exhaust gas stream in the pollution control system. Equilibrium constants for the halogen-hydrogen halide (dissociation/reformation) reactions are different by orders of magnitude at equivalent temperatures and pressures. For example, at 1200°C, Kp (the dissociation constant) = 30 for Cl_2 and = 1.36×10^{14} for F_2. The equilibrium expression below shows the impact of these differences:

$$H_2O + Cl_2 \rightarrow 2\ HCl + \tfrac{1}{2}O_2$$

$$K_P = \frac{(pHCl)^2 \bullet (pO_2)^{1/2}}{pH_2O \bullet pCl_2}$$

Note: Partial pressures (p) are normally expressed in mm Hg.

TABLE II

INCINERATION OF ORGANIC COMPOUNDS

COMPONENTS	PRODUCTS OF COMBUSTION
C-H	CO_2, CO, H_2O
C-C	CO_2, CO
C-O	CO_2, CO
H-C-Cl	HCl, H_2O, CO_2, Cl_2
H-C-I	HI, H_2O, CO_2
H-C-F	HF, H_2O, CO_2
H-C-Br	HBr, Br_2, H_2O, CO_2
C-N	NO, NO_2, CO_2, N_2
C-S	SO_2, CO_2, SO_3

When fluorinated organics are burned, virtually all F_2 becomes HF. This is not true for Cl_2, however. With Kp = 30 for Cl_2 at 1200°C, this equation shows that high O_2 in the gas stream can cause low HCl and high Cl_2 production. It also shows that high H_2O enables higher O_2 and higher HCl in the gas stream. This means that steam injection can often be beneficial in converting halogenated compounds to their hydrogen halide equivalents. This also points out the advantages which natural gas has over either coal or oil as the supplemental fuel. Highly hydrogenated fuels produce high water vapor contents in the gas stream and high conversion efficiencies to the hydrogen halides. Methane (CH_4) in natural gas contains the highest possible hydrogen concentration per carbon mole and is thus favored over fuel oil or coal for high halogen waste streams. It is common to specify a minimum four moles of hydrogen in the fuel or waste per mole of chlorine present in the waste.

Nitrogen oxides are produced in two different manners. First, fuel-bound nitrogen is more likely to convert to nitrogen oxides than is elemental nitrogen in the combustion air. Thus high nitrogen content waste materials (amines in particular) can be expected to produce high NO_X concentrations in the exhaust gas stream. Pollution control systems are much less effective collecting nitrogen oxides than they are in collecting other acidic gases. The predominant nitrogen oxide produced in combustion systems is NO (nitric oxide). NO is the most difficult of the nitrogen oxides to collect in pollution control systems. The other common nitrogen oxide is NO_2 (nitrogen dioxide), which is somewhat easier to collect but which produces one mole of NO for two moles of NO_2 absorbed. There are catalytic de-NO_X systems available but these often require all other contaminants to be removed from the gas stream before they perform properly. They are also extremely expensive, in comparison with other types of pollution control systems. There are also chelating compounds available which complex with Fe^{2+} and can enhance nitrogen oxide removal, but which are extremely expensive to use. Ammonia and urea de-NO_X systems are also available. In general, the higher the temperature in incineration, the higher the formation of nitrogen oxides. Thus, ideal combustion conditions may result in higher nitrogen emissions than can be tolerated by regulatory requirements.

C. Unburned, Partially Burned, or Combustion Formed Hydrocarbons

In almost every discussion of an incineration system, potential dioxin emissions are mentioned. Frequently, furans are also mentioned as possible emissions. Polychlorinated dioxins and furans are thought to be among the most toxic man-made substances to humans. Dioxins are reportedly 500 times more toxic than strychnine and 10,000 times more toxic than cyanide.[1] They are regulated in many areas at such low levels that they are often difficult to detect. It has been theorized that they form during combustion in complex gas-gas reactions between volatile PVC plastics, chlorophenols, benzene, lignin and chlorine gas derived from the reactions discussed in the previous section. At the time this brochure was prepared, available analytical data on incinerator exhaust gas concentrations of dioxins and furans was very limited. However, the trends are that low Cl_2 concentrations (at conditions discussed in the previous section), absence of aromatic hydrocarbons in the waste (benzene, phenols, etc.). absence of incandescent particles in the gas stream, cooling of the fuel gas before discharge to the atmosphere (less than 300° F, or 149° C), presence of SO_2 in the gas stream (to inhibit Cl_2 formation via the "Deacon" reaction), high overall DREs, and absence of high excess air concentrations, all result in significant reductions in dioxin and furan emissions.

Products of incomplete combustion (PICs) are another type of organic emission receiving increased regulatory attention. It has long been known that at elevated temperatures, gas phase reactions can occur between chlorine and organic molecules. If significant concentrations of incompletely burned organics remain in the exhaust gas stream, and if the waste materials contain high concentrations of chlorinated compounds, chlorinated organic compounds are detected in the exhaust gases from these incinerators. Chloroform, for example, is a frequent product of incomplete combustion when compounds such as trichloroethylene and carbon tetrachloride are burned. The obvious solution to this problem is to improve the combustion conditions and completely destroy the organic molecules so that there are no organics present to react with the chlorine in the exhaust gas stream. The precursor organic compounds found in incinerator exhaust gases are often the same hydrocarbons found in exhaust gases from oil and coal fired boilers. Only the chlorine is missing in the coal and oil fired systems. Because of the regulatory scrutiny which the incinerator installations are subjected to, these emissions will eventually not be tolerated in incineration applications. For this reason, incinerator operators should assume that the regulations will only become more stringent in the future.

D. Regulations and Methods for Expressing Them

Regulatory requirements for incinerators are often very confusing. Particulate emissions may be regulated in pounds per million Btus, grains per standard dry cubic foot, grains per standard dry cubic foot adjusted to 12% CO_2, grains per standard dry cubic foot adjusted to 7% oxygen, milligrams per normal dry cubic meter, milligrams per normal dry cubic meter converted to 12% CO_2, milligrams per normal dry cubic meter converted to 6% oxygen, milligrams per normal dry cubic meter converted to 11% oxygen, and pounds per thousand pounds of flue gas. The corrections to 12% CO_2 and to 7% or 6% or 11% O_2 are attempts by the regulatory agencies to eliminate dilution of the exhaust gas stream as the mechanism for compliance with regulations. Twelve percent CO_2 in the exhaust gas stream is considered "perfect" combustion. Unfortunately, international agencies can't agree on the oxygen content of a gas stream at "perfect" combustion conditions and, depending upon which country the installation is located in, a regulation may require correction to 6%, 7% or 11% oxygen. There is also no universal international agreement on what standard conditions might be. Some countries consider a normal cubic meter to be referenced to 20°C (normal ambient) and sea level barometric pressure. Most countries, however, use 0°C and sea level barometric pressure. In the United States, some of the states cannot even agree with the federal government as to what constitutes a standard cubic foot. Some areas use 60°F, some 68°F, and some use 70°F at standard conditions. The only way to avoid regulatory problems in this type of environment is to know the exact regulations which apply to your installation and design the system to comply with them with some safety factor. For comparative purposes, Table III provides a listing of the equivalent levels of particulate emissions, expressed in the common regulatory units.

Gaseous emissions may be regulated using concentrations in ppm (vol), ppm (wt), milligrams per normal dry cubic meter, a fixed percentage removal efficiency, pounds per million Btus of fuel burned, etc. Again, some of these concentrations will be corrected to "perfect" combustion conditions and some will not. Again, Table III provides a comparison of some of these methods of expression.

Organic emissions are normally regulated in two different fashions. First, in hazardous waste incineration applications, a destruction and removal efficiency (DRE) requirement is established. For most compounds, this is 99.99%. For PCBs, dioxins and furans, this is 99.9999%. In addition, there are specific concentration regulations on specific organic compounds. Some locations even impose a total hydrocarbon emission regulation.

If history treats incinerator emission regulations as it has regulations on all other air pollutants, there will never be any standard regulatory process for incinerators and there will always be areas where it is thought to be virtually impossible to obtain permits for operation of incineration systems. In general, those areas of the world which have "smog" problems will impose more stringent regulations on incineration systems than those areas which do not have "smog" problems.

At the time this brochure was prepared, particulate emission regulations for incinerators varied from a high of about 0.1 gr/sdcf corrected to 12% CO_2 (225 mg/Nm^3 @ 12% CO_2) to a low of about 0.01 gr/sdcf (22.5 mg/Nm^3 [dry] @ 12% CO_2). HCl emission regulations varied from no control being required to as high as 99.8% removal being required. SO_2 is regulated from no controls required to as high as 99% removal being required. Some dioxin regulations establish outlet concentration requirements not exceeding 0.1 ng/Nm^3 (dry). Note this is one-tenth nanogram, not milligram.

III. INCINERATOR TYPES AND OPERATING CHARACTERISTICS

In this section, we will discuss rotary kiln incinerators, controlled air incinerators, fluid bed combustors, mass burn units, atomizing liquid waste incinerators, and fume incinerators. Because of differences in maintenance schedules, operator training, and equipment quality, some operators will take issue with some of the conclusions and adverse comments about incineration systems in this section. However, these comments represent many years of observations and probably apply to most installations. The operators, not the hardware, account for most of the operating problems.

A. Rotary Kilns

Rotary kilns are generally categorized as slagging or nonslagging. The distinction is a temperature distinction. If temperatures in the kiln are maintained high enough to convert inorganic salts into molten salts, the rotary kiln is a slagging kiln. If the temperatures are not high enough to convert the salts into molten salts, the incinerator is nonslagging. Slagging kilns are often advertised as being better than nonslagging kilns because the ash produced is more easily handled and occupies minimal volume. Unfortunately, slagging kilns also produce higher concentrations of aerosol sized particulate and suffer shorter refractory lives. Thus, for many installations, nonslagging kilns may be preferred.

TABLE III
EMISSION RATE AND GAS PROPERTY
EXPRESSIONS USED BY VARIOUS REGULATORY AGENCIES

EXAMPLE:
HOSPITAL WASTE INCINERATOR
1500#/HR FEED RATE (681Kg/HR) @ 8400 BTU#
WASTE HEAT BOILER REDUCES GAS TEMP. TO 500°F (260°C)
BOILER EXHAUST MAINTAINED AT -6" H_20 STATIC PRESSURE (-152.4MM H_20)
MEASUREMENTS TAKEN BEFORE POLLUTION CONTROL SYSTEM

GAS COMPOSITION:

COMPONENT	#/HR	Kg/HR	WT%	VOLUME %
H_20	1003.80	455.31	3.91	6.2874
CO_2	2606.60	1182.33	10.16	6.6832
O_2	3479.60	1578.31	13.56	12.2703
N_2	18543.40	8411.10	72.27	74.6949
HCl	17.00	7.71	0.07	0.0526
SO_2	6.60	2.99	0.03	0.0116
PARTICULATE	5.4543	2.2474	-------	-------
TOTALS	25662.45	11640.23	100.00	100.0000

PROPERTIES & RATES:

	ENGLISH UNITS	METRIC UNITS
FLOW:		
ACTUAL	10503.68 ACFM@500°F	17864.84Am³/H@ 260.0°C
STD. OR NORMAL	5713.28 SCFM @ 70°F	9012.13 Nm³/H@ 0°C
STD. OR NORMAL DRY	5353.82 SDCFM	8445.12 Nm³/H dry
PRESSURE:		
STATIC	-6" H_2O	-152.4MM H_20
ABSOLUTE	14.479 PSIA	1.018 Kg/cm²
TEMPERATURE:		
EMPIRICAL	500°F	260°C
ABSOLUTE	1060°R	533.2°K
PARTICULATE EMISSIONS:		
ACTUAL WET	0.1114 gr/scf	274.08 mg/Nm³
ACTUAL DRY	0.1189 gr/sdcf	292.95 mg/Nm³ dry
CORRECTED TO 12% CO_2 (DRY)	0.200 gr/sdcf @ 12% CO_2	492.91 mg/Nm³ dry@12% CO_2
CORRECTED TO 7% O_2 (DRY)	0.2116 gr/sdcf @ 7% O_2	521.45 mg/Nm³ dry@7% O_2
CORRECTED TO 6% O_2 (DRY)	0.2268 gr/sdcf @ 6% O_2	558.97 mg/Nm³ dry@6% O_2
OTHER	0.4278#/Million Btus	-----
	0.2126#/Thousand # Flue Gas	-----
GASEOUS EMISSIONS:		
ACTUAL		
HCl	525.44 ppm (VOL)	855.63 mg/Nm³
SO_2	116.34 ppm (VOL)	332.18 mg/Nm³
CORRECTED TO 7% O_2 (DRY)		
HCl	935.29 ppm (VOL)	1523.01 mg/Nm³ dry
SO_2	207.09 ppm (VOL)	591.29 mg/Nm³ dry
CORRECTED TO 6% O_2 (DRY)		
HCl	1002.57 ppm (VOL)	1632.58 mg/Nm³ dry
SO2	221.99 ppm (VOL)	633.83 mg/Nm³ dry

Rotary kilns normally are thermally inefficient. Because the cylindrical drum rotates around the axis of the cylinder, it must be equipped with dynamic seals at each end of the kiln to prevent air leakage into the kiln. At the very severe operating conditions these units are subjected to, these seals never are leak-free. As a result, there tends to be uncontrolled air leak into the kiln which prevents precise oxygen control in the kiln. The regulatory agencies may consider the high oxygen concentrations to be beneficial for destruction and removal efficiencies, but the operators consider the high oxygen concentrations to represent wasted heat. If the seal leaks become severe, localized condensation of aerosol sized particulate can occur and can create secondary emissions which are extremely difficult to collect.

Rotary kiln incinerators must be operated with pressures in the combustion zones less than atmospheric. Because of the seal mechanism, if they were operated at positive pressure, fugitive unburned emissions would be discharged from the seal area. In most installations, the rotary kiln portion of the incineration system is operated at a lower temperature than the secondary combustion zone. In this fashion, the organic materials are driven from the solid materials in gaseous form and are then fully combusted in the secondary chamber. The secondary combustor can often overcome a variety of operating difficulties in the rotary kiln by simply providing additional residence time and temperature for the gaseous compounds. Because the ash material is constantly being lifted up the slowly rotating cylinder wall, and discharged back to the bottom of the kiln area by falling through the open space through which flue gas is moving, rotary kiln incinerators tend to produce rather high particulate emission concentrations. It is often beneficial to install a high temperature cyclone collector between the secondary combustion chamber discharge and the pollution control device inlet to minimize abrasion caused by high concentrations of suspended particulate matter in the gas stream. Vertical, as opposed to horizontal, secondary chambers also help to control this excessive particulate carryover.

For a given quantity of waste, the rotary kiln normally produces a higher total exhaust gas flow rate than other types of incinerators and this gas contains more particulate matter than the other incineration devices. This means that the pollution control systems are the largest for rotary kilns and are subjected to the most severe particulate emissions. The rotary kiln, however, can tolerate upset conditions in waste feed which few of the other incineration devices can. The rotary kiln and secondary combustor combination tends to smooth out peaks in temperatures and peaks in gas flow rates caused by high variability in the waste materials being fed. In addition, rotary kilns are normally able to handle larger individual pieces of waste material than the other types of incinerators. Rotary kilns are commonly employed for hazardous waste incineration, particularly where mixed wastes (liquids, solids, and sludges) are handled. There are a limited number of municipal waste incinerators which employ rotary kilns, but these are being phased out in most instances, with the one possible exception being a proprietary rotary combustor which uses a boiler tube membrane wall on the rotary kiln to absorb waste heat. Figure 1 shows a simplified schematic diagram of a rotary kiln incinerator system, and Table IV lists typical operating conditions for such a unit.

FIGURE 1 – ROTARY KILN INCINERATOR

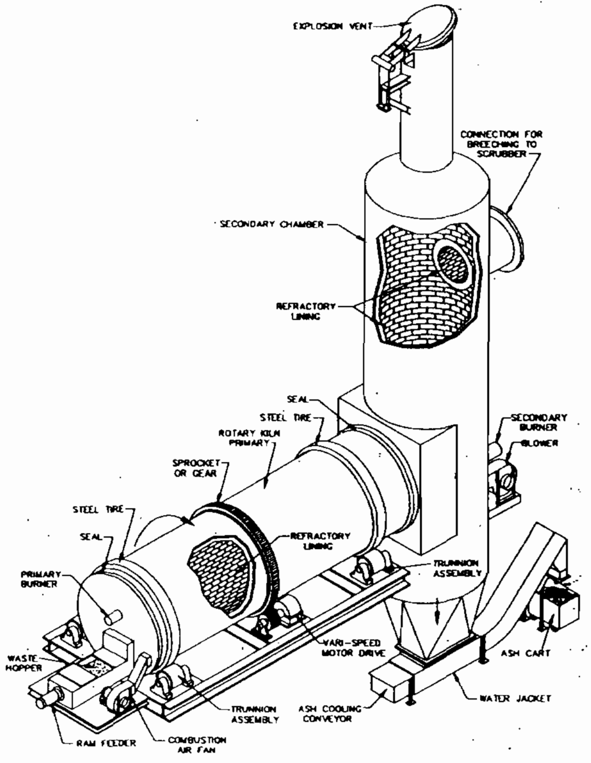


TABLE IV
TYPICAL ROTARY KILN INCINERATOR
OPERATING CONDITIONS

KILN EXHAUST GAS TEMPERATURE:	1500°F - 2200°F (815°C - 1200°C)
KILN HEAT RELEASE:	15,000 - 20,000 BTU/FT^3
ROTATIONAL SPEED:	0.2 - 3 RPM (APPROX 5-10 FT/MIN)
GAS VELOCITY IN KILN (AT PEAK TEMPERATURE):	10 - 15 FT/SEC (3 - 4.6m/SEC)
GAS RESIDENCE TIME IN KILN:	0.5 - 1.2 SEC
SOLIDS RESIDENCE TIME IN KILN:	20 MIN - 60 MIN
PARTICULATE AT KILN DISCHARGE:	0.7 - 2.0 GR/SDCF (1725 - 4925mg/Nm^3)
SECONDARY EXHAUST GAS TEMPERATURE:	1650°F - 2300°F (900°C - 1260°C)
GAS VELOCITY IN SECONDARY:	12 - 18 FT/SEC (3.7 - 5.5m/SEC)
GAS RESIDENCE TIME IN SECONDARY:	1 - 1.5 SEC
PARTICULATE AT SECONDARY DISCHARGE:	0.2 - 1.0 GR/SDCF (493 - 2464mg/Nm^3)

B. Controlled Air, Pyrolytic or Semi-Pyrolytic, Fixed Hearth Systems

This incinerator type is normally built in a modular, factory assembled, packaged and tested configuration. It normally includes a pyrolysis chamber (primary), a secondary oxidizing chamber, a waste feed system, an exhaust stack, burners, and burner controls. Waste is most commonly introduced into this type of incinerator using a ram feeder on a semi-batch basis. The waste is pushed onto a fixed hearth and air flow is controlled to create a pyrolytic or semi-pyrolytic condition. In the hearth section, underfire air is controlled at substoichiometric conditions to provide only enough oxygen to elevate the temperature of the waste stream and volatilize the organic content from the waste materials. These systems are operated at conditions which maximize destruction of fixed carbon and higher molecular weight organics in the solids bed while driving the lower molecular weight, gaseous organics into the secondary combustion chamber where excess air is introduced and where the temperature is elevated to ensure complete destruction. Generally, burners are employed in both chambers to allow for reasonable temperature control.

This incinerator type is most commonly used for small municipal waste incineration applications and for incineration of hospital and infectious wastes. There are also a number of such systems installed to destroy pathological wastes. Because these incinerators are not normally continuously fed with waste material, they tend to produce highly variable exhaust gas flow rates and temperatures. While the designers and startup engineers adjust these systems so that the temperature in the pyrolysis chamber is lower than that in the secondary combustor, we have seen as many units in the field with the primary chamber temperature higher than the secondary chamber temperature than we have seen in the other configuration. Furthermore, it is often difficult to maintain the oxygen concentration in the pyrolysis chamber low enough to create true pyrolytic conditions. Often, because of pluggage in the underfire air grates or tubes, the operator boosts the pressure of combustion air to the system, this air takes the path of least resistance (namely, the few open passages which are not covered over with waste material), and the actual oxygen concentration in the exit gas into the secondary combustor may be well in excess of stoichiometric. Maintaining uniform underfire air flow is one of the most difficult tasks in operating these systems. As the plastics content of waste materials increases routinely at the facilities where this type of incinerator is employed, the tendency toward plastics melting, running in molten streams into the underfire air holes and then blocking them off as the plastics cool when they come in contact with the combustion air, results in abnormal combustion conditions on frequent occasions. Air pollutants are directly affected by the condition of the underfire air system.

We have seen incinerators of this type where newspapers fed into the pyrolytic chamber can be recovered from the ash material and still be read. This occurs when the operator feeds too much waste material to the incinerator or when the underfire air system is not working properly. If the underfire air system does not work properly, and if large quantities of waste are fed onto the hearth, only the top portion of the waste material will burn, and that which is on the bottom will be insulated from the heat and discharged without being combusted.

We have also observed installations where an operator accumulates waste material for 10 hours and then feeds the entire 10 hours of collected waste through the incinerator in less than 1 hour. This might be an acceptable operating procedure if the incinerator were constructed to handle this mass flow rate. However, the incinerator was built to handle the waste material on a uniform hourly basis. The result was that the operator was simply "going through the motions" and producing an ash which was almost equal in mass and volume to the waste material which was fed to the incinerator. In addition, particulate emissions and gas flow rates from the incinerator during the one-hour burn were excessive.

Properly maintained and properly operated controlled air systems can be used quite effectively for hospital wastes and for small municipal incineration applications. If the quantity of waste fed through the ram feeder is controlled carefully, if the waste materials are mixed to produce a relatively uniform heating value, and if the combustion air systems are maintained properly, these systems can be operated with minimal particulate emissions and the emissions can be adequately controlled with conventional wet scrubbing systems. The ram feeders are equipped with air locks so that oxygen concentrations can be carefully controlled in these systems. Ash is normally dumped into a wet seal leg so that no oxygen enters the system through the ash discharge. There are no rotary seals to leak and refractory life is normally longer than would be the case in rotary kilns. There are some very experienced manufacturers of these systems available and highly reliable, efficient systems have been installed.

For a given quantity of waste, the pyrolytic unit typically produces the lowest exhaust gas flow rate of the incinerators discussed in this brochure, with a relatively low particulate content. Poorly maintained units, however, can produce some of the most severe emissions we have encountered at the pollution control device. Figure 2 shows a schematic drawing of a pyrolytic incineration system and Table V lists typical operating conditions for such a unit.

FIGURE 2 — CONTROLLED AIR INCINERATOR

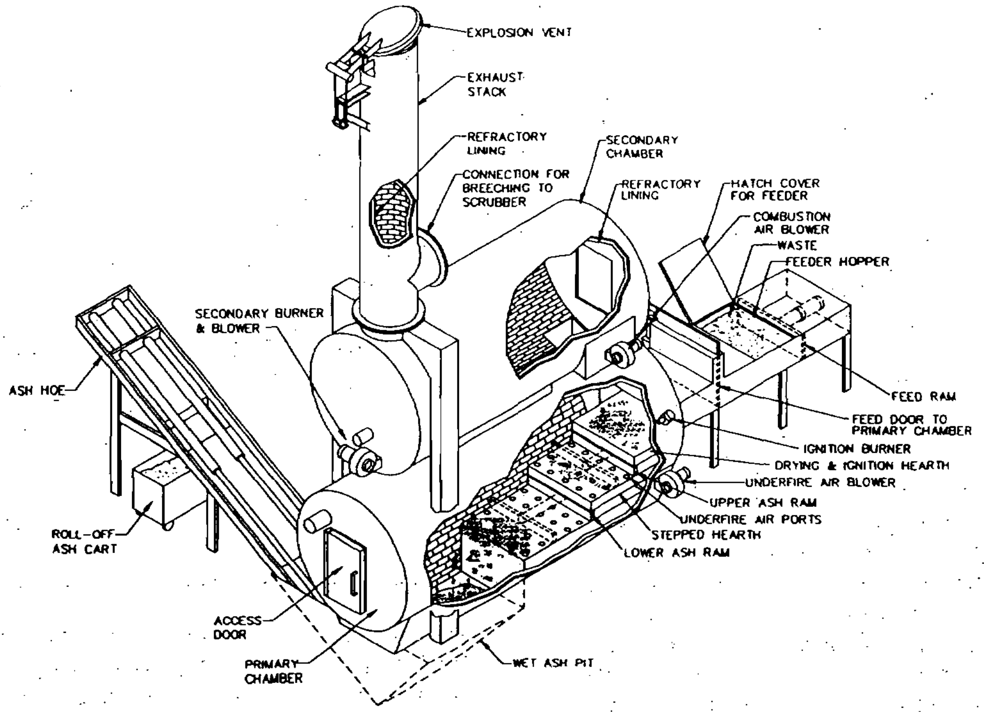


TABLE V
TYPICAL INCINERATOR OPERATING PARAMETERS FOR CONTROLLED AIR PYROLYTIC INCINERATOR[2]

PARAMETER	BATCH FEED INCINERATOR	INTERMITTENT FEED INCINERATOR	CONTINUOUS DUTY INCINERATOR
IGNITION CHAMBER TEMP. °F	1000° TO 1800°	1400° TO 1800°	1400° TO 1800°
IGNITION CHAMBER TEMP. °C	540° TO 980°	760° TO 980°	760° TO 980°
SECONDARY CHAMBER TEMP. °F	1800° TO 2200°	1800° TO 2200°	1800° TO 2200°
SECONDARY CHAMBER TEMP. °C	980° TO 1200°	980° TO 1200°	980° TO 1200°
CHARGING PROCEDURE	FILL CHAMBER AT START OF CYCLE	10 TO 25% OF RATED CAPACITY AT 5 TO 15 MINUTE INTERVALS	10 TO 25% OF RATED CAPACITY AT 5 TO 15 MINUTE INTERVALS
IGNITION CHAMBER EXCESS AIR (%)	30 TO 80	30 TO 80	30 TO 80
TOTAL EXCESS AIR (%)	140 TO 250	140 TO 250	140 TO 250
EXHAUST GAS OXYGEN (VOL %)	6 TO 14	6 TO 14	6 TO 14
IGNITION CHAMBER DRAFT (" W.G.)	-0.05 TO -0.1	-0.05 TO -0.1	-0.05 TO -0.1
IGNITION CHAMBER DRAFT (mm W.G.)	-1.2 TO -2.5	-1.2 TO -2.5	-1.2 TO -2.5
BURNDOWN PERIOD (HRS)	2 TO 5	2 TO 5	NOT APPLICABLE

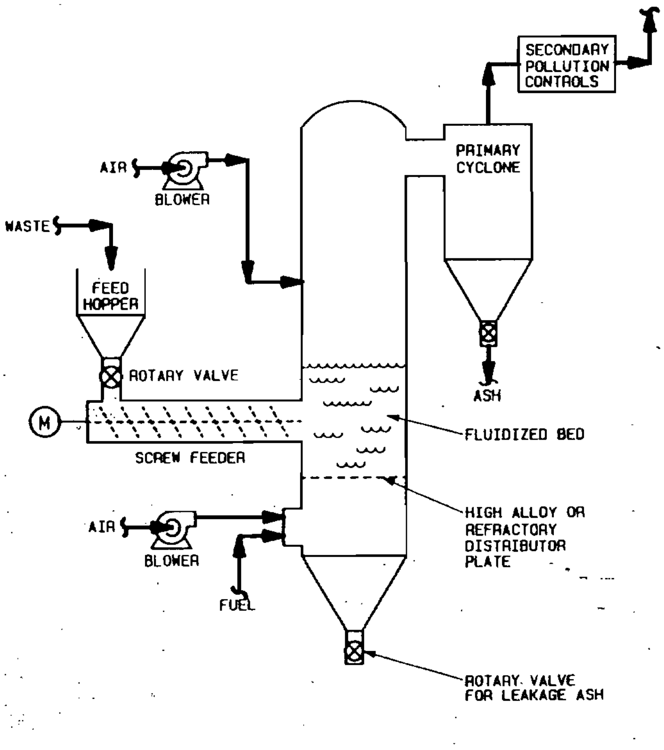
C. Fluid Bed Combustors

Fluid bed combustors are a relatively new development worldwide. They offer two advantages over conventional combustion systems. First, because combustion takes place in a very dense, solids laden environment, the temperature profile in the combustor is quite uniform. Once the system has been brought up to proper combustion temperature, all waste materials see about the same combustion conditions. Second, because it is often necessary to supply a granular heat transfer material as the fluidizing medium, this material can be supplemented with an alkaline absorption material which will react with acid gases produced during combustion and minimize exhaust gas emissions. The disadvantages of the fluid bed system are that it requires a relatively uniform waste particle size, it cannot tolerate materials which tend to fuse together, and it requires a highly uniform waste feed rate.

Fluid bed combustors have been built to operate at atmospheric pressure and at elevated pressure. The elevated pressure systems have all of the operating headaches one would expect from a high temperature system at a high positive pressure. The improvements in combustion efficiency, however, may offset the maintenance problems.

Fluid bed incinerators generally produce the lowest exhaust gas temperatures of any of the incineration systems we will discuss. As a result, the volumetric flow of exhaust gas is normally smallest in a fluid bed combustor per unit of waste combusted. Particulate loadings, however, are quite high, with some of the particulate matter being the bed material, rather than ash produced by combustion of the waste. Acid gas emissions are relatively low, compared with the other systems discussed, because they are absorbed in the bed itself and are discharged as part of the solid waste. Because of the need for uniformity in particle size for the waste material being fed to the fluid bed systems, fluid bed units are finding only limited application in industrial and municipal waste incineration. Figure 3 shows a schematic drawing of a fluid bed combustor.

FIGURE 3
FLUID BED COMBUSTOR



D. Mass Burn Units

Mass burn incineration systems were developed to burn municipal waste. They are basically adaptations of coal fired boilers using some form of moving grate mechanism to convey the solid waste material into the furnace, provide it with the proper mix of underfire and overfire air, and recover the waste heat in the form of steam in a conventional boiler section. Because they are typically rather large and the waste material is spread over a large grate area, it is difficult to maintain uniform combustion conditions in the waste bed. These systems thus employ unusually large furnace sections before the boiler to allow for relatively long residence time of the combustion products and unburned volatile hydrocarbons, and to produce some uniformity by mixing. Because the waste heat boiler is typically an integral part of the furnace system, exhaust gas temperatures are lower than for the other incineration systems. Most of these units do not have a true secondary combustor, but simply an enlarged furnace section preceding the boiler.

Because of their size, and resultant exhaust gas mass flow, regulatory agencies have imposed very stringent particulate emissions on them. Acid gas emissions, however, have been given far less attention and regulations on acid gas emissions are generally much more lenient than for the other incineration systems discussed above. Very few of these systems have actually installed acid gas control. We predict that most of these systems will be forced to retrofit with acid gas collectors within the next five years.

Some of the unique problems which these systems face, compared with their coal fired counterparts, relate to corrosion potential. There have been a significant number of boiler tube failures in these systems due to the hydrogen chloride content of the exhaust gas streams. Some of the new systems are employing high nickel alloy tubes in the boiler to overcome both the "cold end" corrosion problems and some very serious high temperature chloride attack problems.

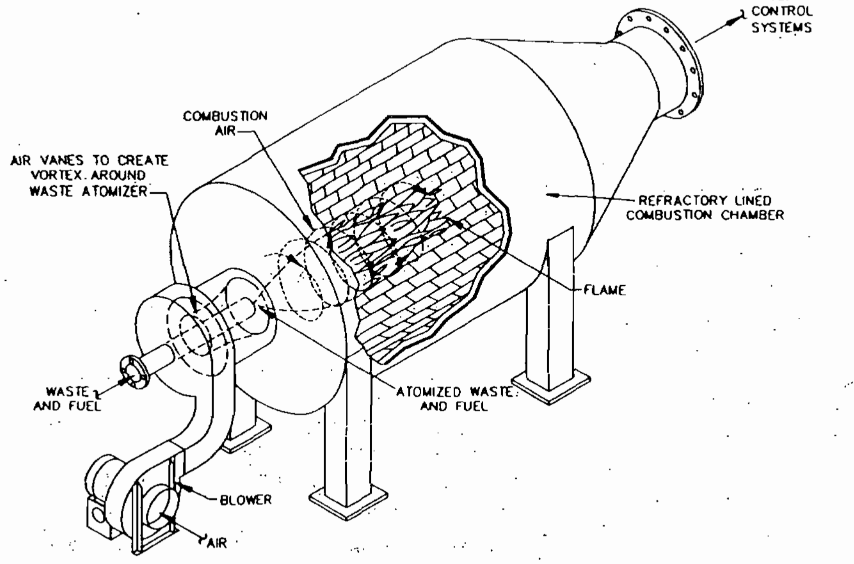
Many of the municipal refuse incineration systems have experienced difficulty in getting rid of ash from the furnace. Elevated levels of heavy metals have been found, and the large mass and volumetric quantities overwhelm the landfills which might be able to accommodate the ash.

E. Liquid Waste Incinerators

Chemical and pharmaceutical companies often produce waste liquids, which must be incinerated for both volume reduction and to eliminate toxicity. These liquids normally take one of two forms. The most common is a contaminated solvent which has a significant heat release and which is simply pumped through an atomizing burner, maintained at elevated temperature for a long enough residence time to destroy the organics, routed to an emission control system for acid gas removal, and then exhausted up the stack. The systems normally produce very little ash material and very low particulate loadings. In many instances, if there are no chlorinated compounds present, it is not even necessary to use an acid gas scrubber. The other is an aqueous liquid which requires either a high heating value solvent or a supplemental fuel to "burn" it. In this case, the water in the aqueous waste is first evaporated and the resultant salts and organics are then oxidized by the supplemental fuel. These systems frequently produce high particulate loadings which are very small in size and they also produce high acid gas concentrations. These systems must be controlled with a very sophisticated pollution control device.

In general, because these units are fired into relatively well-sealed combustion chambers, oxygen concentrations can be maintained at rather low levels, temperatures are quite high, and temperatures and pressures are relatively uniform. Virtually all particulate matter is discharged in the exhaust gas stream with very little ending up in bottom ash. Only a limited number of these systems use waste heat recovery after the incinerator. Thus, the incoming gas to the pollution control device is normally very hot, in excess of 2000°F (1093°C). These systems are often operated at a positive pressure and the discharge gases to the pollution control device are also produced at elevated pressures. Figure 4 shows a schematic drawing of a typical very simple liquid waste incinerator.

FIGURE 4
LIQUID INJECTION INCINERATOR



F. Fume Incinerators

Two types of fume incinerators are commonly employed. Where the gaseous waste material contains very little particulate matter and only small concentrations of volatile inorganics or metals, a catalytic-type incinerator is employed. A catalyst bed is used to promote oxidation of the contaminants at relatively low temperatures. It is not uncommon for these systems to operate at temperatures of between 800°F and 1000°F (427°C and 538°C). Because the exit gas stream from catalytic incinerators is commonly very low in corrosive gas content or particulate content, air-air heat exchangers can be used to recover waste heat from the exhaust gas stream and return it to the combustion air source. There are also a number of such systems which provide heat for building heat purposes. Some systems operate with as much as 80% heat recovery.

Where catalyst beds are incompatible with the combustion products or the suspended particulate matter which may exit the fume incinerator, temperatures are elevated to much greater levels in refractory lined chambers which utilize supplemental burners and supplemental fuel to produce the necessary temperature. These systems are installed with and without heat recovery equipment. Emission characteristics are similar to those which exist in catalytic incineration systems except that the exhaust gas temperatures are higher. Most fume incinerators do not require secondary air pollution control systems. The emphasis is normally on heat recovery prior to discharging the exhaust gases to atmosphere.

IV. WASTE TYPES AND EMISSIONS PRODUCED

A. Hospital and Infectious Waste

There is a great deal of confusion about what hospital waste is. There is a tendency for the regulatory agencies to classify pathological wastes, infectious wastes, and medical laboratory wastes in a general sense as hospital wastes. Unfortunately, these wastes have very different properties and require different combustion conditions to thermally oxidize them. In addition, the emission control technologies required to bring incinerators into regulatory compliance are substantially different for each of these waste types.

Pathological wastes should be viewed as a completely different category of waste from normal hospital waste. Pathological wastes are generally animal or human carcasses which are incinerated for volume reduction. They have very high moisture contents but produce almost no acid gas emissions. Particulate emissions are normally oxides of calcium and are relatively harmless. These wastes are normally burned on a batch basis in a separate incineration facility from that which processes normal hospital waste.

Hospital waste streams have changed significantly in the past ten years. Disposable plastics have been replacing glass and clothing. Many of these plastics contain chlorine and generate hydrogen chloride emissions during incineration. The plastics content of hospital waste has grown from about 10% to over 30% from the late 1970s to the late 1990s. Table VI lists typical components in hospital waste with their heating values, bulk densities, and moisture contents. There is probably no such thing as a typical hospital waste, since the type of waste produced depends upon the type of medicine that is practiced at the hospital, the extent to which laboratory work is done in the hospital, the number of beds in the hospital, the presence of specialty facilities, such as those that handle radioisotopes, and the general hospital philosophy about what goes to the incinerator. After installation of an incinerator at a hospital, most hospitals tend to route more and more of their waste to the incinerator and less to normal municipal solid waste disposal facilities. This generally increases the paper content of the waste over that which existed when the initial waste survey was done, prior to installation of the incinerator.

There have been many estimates of waste production rates for various segments of hospital operations. For the medical portion of the hospital, waste generation rates are between 10 and 15 pounds (4.5-6.8Kg) per occupied bed per day. If the hospital has an

TABLE VI
HOSPITAL WASTE COMPOSITION[3]

COMPONENT DESCRIPTION	HIGHER HEATING VALUE ON DRY BASIS BTU/LB*	BULK DENSITY AS FIRED LB/FT^3**	MOISTURE CONTENT WEIGHT%	HEATING VALUE AS FIRED, BTU/LB*
HUMAN ANATOMICAL	8000-12000	50-75	70-90	800-3600
PLASTICS	14000-20000	5-144	0-1	13900-20000
SWABS, ABSORBANTS	8000-12000	5-62	0-30	5600-12000
ALCOHOL, DISINFECTANTS	11000-14000	48-62	0-0.2	11000-14000
ANIMAL INFECTED ANATOMICAL	9000-16000	30-80	60-90	900-6400
GLASS	0	175-225	0	0
BEDDING, SHAVINGS, PAPER, FECAL MATTER	8000-9000	20-45	10-50	4000-8100
GAUZE, PADS, SWABS, GARMENTS, PAPER CELLULOSE	8000-12000	5-62	0-30	5600-12000
PLASTICS, PVC, SYRINGES	9700-20000	5-144	0-1	9600-20000
SHARPS, NEEDLES	60	450-500	0-1	60
FLUIDS, RESIDUALS	0-10000	62-63	80-100	0-8000

* MULTIPLY BY 0.555 TO CONVERT TO Kcal/Kg
** MULTIPLY BY 12.85 TO CONVERT TO Kg/m^3

affiliated rest home, waste generation is between 2 and 5 pounds (0.9 - 2.3Kg) per day per person for that facility. A laboratory in the hospital will generate on the order of 0.5 pounds (0.23Kg) of waste per patient per day. A hospital cafeteria will generate between 1.5 and 3 pounds (0.7 - 1.4Kg) per meal per day. Ash content of this waste will average between 10% and 20%. This means that for every 1000 pounds (454Kg) of waste incinerated, between 100 and 200 pounds (45 - 90Kg) of ash will be generated.

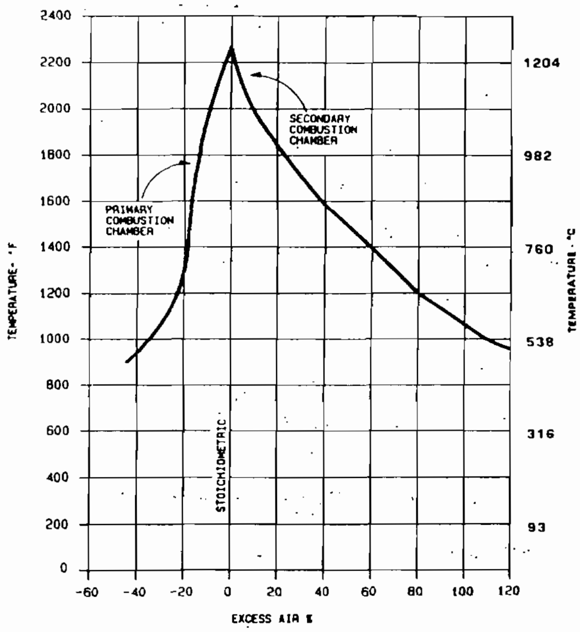
Many hospitals have laboratories located in them. Some of the solvents and chemicals used in these laboratories are regulated by RCRA legislation. If these chemicals find their way to the hospital waste incinerator, the incinerator becomes a RCRA regulated incinerator, which is much more difficult and much more expensive to permit. In addition, it is necessary to handle the ash from such an incinerator as a RCRA hazardous material. Thus, it would be possible for a hospital to process perhaps 50 pounds (23Kg) per hour of acetone, cyclohexane, ethyl alcohol, methyl alcohol, tetrahydrofuran and xylene through the incinerator but generate 200 pounds (90Kg) of ash, which would be subjected to the same hazardous waste regulations as the solvents produced in the lab. This would obviously not make economic sense, since the cost to dispose of the 200 pounds (90Kg) of ash would greatly exceed the cost to have disposed of the 50 pounds (23Kg) of solvents in the first place. Hospitals are thus well-advised to separate hazardous materials from normal hospital waste.

An "average" hospital waste will have a sufficiently high heating value to burn without supplemental fuel. One will seldom find a hospital waste which has a heating value of less than 5000 Btu/# (2,775Kcal/Kg). There is almost always adequate waste paper in a hospital to supplement the heating value of the waste and ensure complete combustion. Figure 5 shows the effect that excess air has on the combustion temperature in the incinerator. If air flow is less than stoichiometric, not all of the waste burns. If the system is operated exactly at stoichiometric air, it is almost impossible to control the furnace precisely enough to prevent the formation of high concentrations of carbon monoxide or unburned hydrocarbons. Thus, as discussed in Table V, excess air rates are typically controlled at somewhere between 140% and 200% in a typical hospital waste incinerator. Note, however, in Figure 5 that in the primary chamber of a hospital waste incinerator, where pyrolytic conditions are established by operating at typically 80% of stoichiometric air, anticipated temperatures fall somewhere in the 1200°F to 1400°F (649°C to 760°C) range. If excess air is added to the 140% level, it can be seen that the secondary combustion chamber temperature would drop below that of the primary chamber. Supplemental heat must be added in the secondary chamber to boost the temperature to higher than that in the primary chamber. This is necessary to ensure complete combustion of the waste materials.

The emissions produced from incinerators burning hospital waste are dependent upon not only the waste composition, but the operating conditions in the incinerator. As has been discussed in earlier sections, the chlorine content of the waste can be converted to elemental chlorine or to HCl. In most cases, it converts almost entirely to HCl. Typical hospital waste incinerator exhaust gases contain between 300 and 1000 ppm (vol) of HCl. They also contain between 100 and 600 ppm (vol) sulfur dioxide. As fluorocarbon materials find greater use in hospitals, hydrogen fluoride concentrations increase in the exhaust gas streams from incinerators. Typically, these will fall somewhere in the 10-30 ppm (vol) range. Iodine continues to be used in hospitals, and when it finds its way into the waste material in the incinerator, average hydrogen iodide concentrations are on the order of 1-5 ppm (vol).

FIGURE 5

ADIABATIC TEMPERATURE FROM COMBUSTION OF A CELLULOSE WASTE[1].



Particulate emissions are derived primarily from the white pigment used in many hospital products. This is almost always titanium dioxide. In addition, saline solutions (containing sodium chloride) are frequently used in hospitals. When these find their way into the waste stream, they produce fume sized particulate, as discussed in an earlier section of this brochure. Mercury and zinc are also common volatile metals which are found in hospital waste. Cadmium and copper salts also are used in hospitals and find their way into the waste stream. When these are added to the clay fillers in plastics and in paper, the particulate emissions from a hospital waste incinerator become quite complex.

A properly operated hospital waste incinerator will produce particulate emissions in the range of 0.08-0.20 gr/sdcf (190-475mg/Nm^{3}dry). In areas with less stringent particulate emission regulations, these may comply with regulatory requirements. However, some areas have imposed particulate regulations as low as 0.01 gr/sdcf (23mg/Nm^{3}dry). We are aware of no hospital waste incinerator anywhere in the world which emits this low a concentration of particulate matter without a secondary air pollution control system.

If one were to select specifications for an emission control device to go on a hospital waste incinerator anywhere in the world and comply with any regulatory requirement, the following criteria would be incorporated into the design specifications:

1) Incoming gas temperature to the pollution control device would be as high as 2200°F (1204°C) if a waste heat boiler was not employed and as high as 600°F (316°C) if a waste heat boiler was employed.
2) The inlet gas pressure to the gas cleaning system would be a minimum -1" (-25mm) W.G. static pressure and should probably tolerate up to -2" (-50mm) W.G. negative pressure at the inlet.
3) Gas flow rate will vary by 5:1.
4) Design inlet particulate loading to the gas cleaning system will be 0.25 gr/sdcf (590mg/Nm^{3}dry).
5) Design inlet HCl concentration will be 1000 ppm (vol).
6) Design inlet sulfur dioxide concentration will be 500 ppm (vol).
7) Hydrogen fluoride concentration at the pollution control device inlet will be 2 ppm (vol).
8) Elemental iodine concentration in the inlet gas stream to the pollution control device will be 5 ppm (vol).
9) Moisture content of the gas stream will be as high as 40% (vol) and as low as 25% (vol).
10) Minimum hydrogen chloride removal efficiency will be 99.5%.
11) Minimum particulate removal efficiency will produce an outlet particulate loading not exceeding 0.01 gr/sdcf (23mg/Nm^{3}dry), corrected to 12% CO_2 or 7% oxygen.
12) Sulfur dioxide removal efficiency will be 90% or greater.
13) Removal efficiency for HF an HI shall be sufficient to reduce outlet gas concentrations to less than 0.1 ppm (vol) for exhaust gas.
14) Maximum gas temperature shall be 200°F (93°C) or less through the pollution control device to ensure high removal efficiency for heavy metals and for condensible hydrocarbons. The gas stream can be reheated after the gas cleaning step without jeopardizing the emission removal efficiency.

More realistic design criteria for such a system would be the same temperatures, pressures, and inlet gas concentrations, but 99% HCl removal efficiency, 90% SO_2 removal efficiency, hydrogen fluoride and iodine emissions not exceeding 1 ppm (vol), and particulate emissions not exceeding 0.03 gr/sdcf (69mg/Nm^{3}dry), corrected to 12% CO_2 or 7% O_2.

It is obviously not possible to cover the entire subject of waste composition and emissions produced in this brochure. The reader is referred to a number of documents which discuss the subject in more detail.[2,4,5,6,7]

B. Hazardous and Toxic Waste

It is virtually impossible to do justice to a discussion of hazardous and toxic waste in a brochure as general as this. There are literally thousands of chemical compounds which have been identified as being hazardous and toxic under RCRA legislation. These include wastes which are toxic to humans and animals, acids and alkalis which are corrosive, reactive and explosive compounds, and flammable compounds. Most distillates are flammable and are thus RCRA hazardous by definition. Almost all of the chlorinated hydrocarbons are toxic to plants or animals and are included in the RCRA toxic list. Many volatile metals and their compounds are toxic to plants and animals and are included in RCRA hazardous listings.

Acids and alkalis are normally neutralized and then discharged without further treatment. Petroleum distillates are used as fuels or solvents and are subjected to safe handling techniques to avoid RCRA legislation. Even after all of these compounds are removed from the list of hazardous materials under RCRA, there are still more than 400 compounds to be concerned with in waste materials. These can range from compounds which have no heat release to compounds which have heat releases greater than 20,000 Btus/# (11,100Kcal/Kg). These can include compounds which have no chlorine content and compounds which have greater than 90% (wt) chlorine content. Heavy metals contents can be in the parts per billion range and can be as high as 1% or 2% (wt).

Perhaps the most difficult task in designing for a hazardous and toxic waste incineration system is identifying the waste materials which must be processed and the variability in composition for those wastes. Suffice it to say that virtually all hazardous and toxic waste incinerators produce high concentrations of hydrogenchloride, sulfur dioxide, hydrogen fluoride, and particulate emissions. Because of RCRA legislation, these units must achieve organic destruction and removal efficiencies greater than 99.99%. If PCBs, dioxins, or furans are present, the organic destruction and removal efficiencies must exceed 99.9999%. Thus, most hazardous and toxic waste incineration systems do not produce significant concentrations of unburned hydrocarbons. RCRA legislation in the United States currently dictates an outlet particulate loading from these incinerators of 34mg/Nm^3 or 0.015 gr/sdcf, corrected to 12% CO_2 on a dry basis. Hydrogen chloride removal efficiencies are 99%, with a lower limit of 4#/hr of hydrogen chloride. European regulations are equal to or more stringent than the U.S. RCRA legislation. Specific states in the United States, however, have imposed much more severe particulate emission regulations in recent years. For example, some states have imposed particulate emission regulations of 0.01 gr/sdcf (23mg/Nm^3), corrected to 12% CO_2.

Where the hazardous waste being burned contains high concentrations of sodium and potassium salts, fume sized particulate emissions can be a problem. In addition, substantial phosphorus content in the waste will generate submicron P_2O_5 particulate emissions which are extremely difficult to control. High concentrations of sulfur trioxide in the exhaust gas stream from an incinerator can also create secondary sulfuric acid aerosols which are difficult to remove without a diffusion controlled mist eliminator or aerosol filtration device.

C. Radioactive Waste

Low level radioactive waste materials are produced by medical and academic institutions, nuclear power plants, industrial firms, and government owned laboratories. Most low level radioactive wastes are solidified and shipped to burial sites or underground vaults for storage in the country in which they are produced. Many of these wastes are incinerable and can be reduced significantly in volume by incineration. Incineration facilities have been built in a very limited number throughout the world. A number of new facilities were being considered at the time this brochure was prepared. Common radioactive isotopes found in these waste materials include uranium, plutonium, iodine, cobalt, cesium, and iron. Often, these waste materials have also been contaminated with RCRA hazardous materials and become "mixed" wastes to which both radioactive materials and hazardous materials regulations apply.

The United States Nuclear Regulatory Commission has divided low level radioactive waste materials into three general classes: A, B and C. Class A wastes are those which are relatively innocuous. They have very low concentrations of radionuclides present, the radiation rates emitted from them are quite low, and the decay rates of the radioactive materials are high enough that the radioactive materials will not be present for long. These wastes include laboratory glassware, clothing, and biological wastes.

Class B wastes are more radioactive than Class A wastes and require packaging in a structurally stable form. The radioactivity in these materials will decay to levels that present an acceptable hazard to humans within 100 years. These include radioactive medicines and tracers, and animal carcasses on which these materials have been tested. Class C wastes are those wastes which will decay to a safe level of radiation within 500 years. These have special disposal and packaging requirements and some form of barrier to reduce the potential of inadvertent intrusion into the waste packages. These include used reactor parts, used filters, and many radioactive sludges from chemical processing operations.

Generally, the radioactive wastes can be incinerated using conventional incineration systems, followed by wet scrubbers. In addition, however, absolute filters (HEPA filters) are installed after the scrubbing systems. It is necessary to first reheat the gas before the HEPA filter to prevent moisture from blinding the filter. In addition, activated carbon adsorption systems are frequently installed after the HEPA filters to act as a polishing stage for the exhaust gases. Because the radioactive materials concentrate in the ash discharged from the incinerator, a great deal of attention is given to solidifying the ash material and properly packaging it. Because there is inadequate space in this brochure to discuss radioactive wastes in complete detail, we suggest that the reader refer to additional references for further information on the subject.[8,9,10]

D. Gaseous Waste

Gaseous wastes which can be treated by incineration include such compounds as phosgene, ethylene oxide, propylene oxide, chlorinated hydrocarbon fumes, benzene, xylene, toluene and related fumes, and literally thousands of others. If chlorinated compounds are present, a wet scrubbing system is normally employed after the fume incinerator to absorb the acid gas produced. In other instances, however, where no chlorides are present and where no secondary contaminants are generated, scrubbing systems are not employed and the concentration is on heat recovery from the exhaust gas stream to minimize fuel consumption. Fume incinerators are also often employed as odor control devices. Common odors handled with these units include the reduced sulfur compounds and ammoniacal compounds. Esters and aldehydes are also often incinerated to eliminate odor problems. Generally, once these compounds have been thermally oxidized, they retain no odor and produce no secondary hazardous emissions. Reduced sulfur compounds produce SO_2 and this may require wet scrubbing.

E. Municipal Solid Waste

As indicated in Part A. of this Section IV, it is very difficult to quantify municipal waste materials produced by any single facility or in any specific area. The composition of municipal solid waste differs substantially from season to season and from region to region. As a general rule, municipal solid waste contains more ash than hospital waste. It also normally contains higher moisture contents but lower concentrations of chlorine-containing compounds. Sulfur contents, however, are often higher than in hospital waste. One well researched document is available on stack emissions from municipal waste incinerators.[11]

V. EMISSION CONTROL SYSTEMS

Incinerators present unique emission control problems. Exhaust gas temperatures are normally higher than for most air pollution sources and the gas streams are normally very corrosive. Because of the elevated temperatures to which materials in the incinerator have been subjected, particulate matter is usually quite fine and difficult to collect. Volatile metals are present in gas phase, rather than particulate form. Unburned organics are also present in gaseous form, rather than droplet form. Technology has improved substantially in the past ten years. Technology will continue to improve during the next five years. There are, however, some general trends in emission control which can provide excellent guidelines to an incinerator operator when selecting the best pollution control system for a given incineration application.

For hospital waste incineration applications, the most commonly employed device is the wet scrubber. In almost all cases, dry sorbent injection systems or dry scrubbing systems are not applicable to these incinerators. These dry systems are much too expensive for the application and their performance is not equal to the wet scrubbing systems on the same application. There are obviously occasional exceptions to this, but the exceptions are limited. Special precautions must be taken in design of the wet scrubbing system to ensure compliance with particulate emission regulations.

For hazardous waste incineration, wet scrubbers have also been the favored emission control device. Most of these systems do not employ waste heat boilers and, as a result, produce exhaust gas emissions which leave the secondary combustor at temperatures in excess of 1900°F (1038°C). Conventional particulate removal systems other than scrubbers obviously cannot operate at these temperatures and if they are employed, it is necessary to reduce the gas temperature before the gas enters these collection devices. Scrubbers can be equipped with water quench systems which reduce the gas temperature to adiabatic saturation (typically between 150°F (65°C) and 185°F (85°C)) while simultaneously reducing the volumetric flow rate substantially. The wet scrubbers can sometimes be coupled to spray evaporators which utilize the sensible heat in the gas stream after the secondary combustor to evaporate the water away from the scrubber waste liquid and produce only dry salts as the effluent from the system.

Municipal waste incinerators have historically employed particulate collectors of either the baghouse-type or the electrostatic precipitator-type without any significant acid gas controls. Where acid gas controls have been installed, two different approaches have been used. First, dry scrubbers have been employed using a slurry of lime as the absorbant and the residual sensible heat in the gas stream to dry the reacted products and the unreacted lime from the slurry, producing a dry solid material which is then collected in the same particulate collection device used to collect fly ash. Other systems install wet scrubbers after the particulate collection device. Recently, dry sorbent injection systems have been considered for this application but very few have been installed.

There are also numerous auxiliary systems which can be operated in series with the conventional emission control devices. For example, where wet scrubbers are used, diffusion controlled mist eliminators or aerosol filtration devices can be employed to achieve extremely low particulate loadings in the outlet gas streams. Because of the regulatory scrutiny to which incineration applications are subjected, the emission control systems being employed on incinerators throughout the world are achieving some of the lowest emission levels ever reported for industrial sources anywhere in the world. Detection of these emissions has begun to push the limits of available instrumentation.

A. Venturi Scrubbers with Acid Gas Absorbers

When a hot gas stream is contacted with an aqueous scrubbing solution, sensible heat from the gas stream is absorbed by evaporating water and converting the heat into latent heat of evaporation. When the gas stream finally reaches adiabatic saturation, the recirculated liquid used as scrubbing fluid then equilibrates with the gas temperature at the scrubber outlet. In most incineration applications, the equilibrium temperature is between 150°F (65°C) and 185°F (85°C). At this temperature, many of the volatile metals have been condensed and many unburned organics also condense. As a result, the wet scrubbing systems have historically demonstrated the lowest heavy metals emissions and the lowest residual organic emissions of those devices used for incinerator emission controls. While the scope of this brochure is not sufficiently detailed to discuss heavy metals emissions in great detail, there are a number of literature references available for those who wish additional information. The most extensive studies indicate the the effectiveness of emission control systems on heavy metals is inversely related to the system outlet temperature. Wet scrubbers typically reduce metals emissions by as much as a factor of five over dry scrubbers or dry collection systems. This would certainly be expected, based on the vapor pressures of the metals in question at the temperatures involved. The gaseous metals are obviously not collected in any of the collectors while the condensed metals are collected as conventional particulates. The colder the gas stream, the more condensed metals and the less gas phase metals. High molecular weight organic compounds behave in exactly the same fashion.

Wet scrubbers consume more energy than either fabric filter collectors or electrostatic precipitators for particulate removal. This is because scrubbers depend on impaction rather than filtration or electrostatics to remove the submicron particulate matter. Fan horsepowers for equivalent performance scrubbing systems may be as high as four times those required for fabric filters. However, when one takes into consideration the heavy metals removal as a result of reduced gas temperature, this increased power cost may be justified.[12,13,14,15]

Acid gas absorption does not require large fan horsepowers and, in fact, does not require any more energy input than would a conventional baghouse on particulate emissions. The wet scrubbing systems are much more effective acid gas removal devices than the dry collectors. Chemical utilization (stoichiometry) is essentially 100% in wet scrubbing systems while it is frequently less than 50% in dry collection systems. In fact, on an acid gas removal comparison basis, the dry collectors will almost always use chemicals at such a high rate that the differential cost in chemicals may exceed the differential cost in electrical power for the particulate removal portion of the system. When one combines this fact with the much higher capital cost for the dry collection system, the wet system finds favor in many incineration applications.

The most common wet scrubber used on incineration applications is the venturi scrubber. This unit provides for efficient high energy contact between the gas stream and its suspended particulate matter and the scrubbing liquid. The gas and liquid pass co-currently through the venturi scrubber and most of the particulate collection which occurs in the scrubbing system occurs in the venturi throat. The gas is normally then discharged into an acid gas absorption system. The acid gas absorption system can be a packed tower scrubber where extended surface packing material is used to contact the gas stream with scrubbing liquid in either a counterflow configuration or in a cross-flow configuration. In the counterflow configuration, the gas normally moves upward while the liquid moves downward through the packed tower section. In a cross-flow configuration, the gas moves perpendicular to the liquid stream in a horizontal direction while the liquid moves downward. The countercurrent system is more efficient for acid gas removal but height limitations sometimes dictate use of the cross-flow configuration. Because of the inherent inefficiencies in cross-flow scrubbing, the cross-flow scrubber is normally more expensive than the counterflow scrubber.

When insoluble alkalis are used to absorb the acid gases, packed towers do not function properly. The suspended solids in the slurries deposit on the packing material and plug it. In these instances, spray towers, baffle towers, or tray towers are used for gas and liquid contact and mixing.

When the gases are absorbed into the scrubbing solution, they react with alkaline compounds to produce neutral chemical salts. Table VII shows the common scrubber chemical neutralization reactions for both sodium hydroxide (caustic soda) and for calcium hydroxide (slaked lime). As mentioned earlier, these reactions are essentially stoichiometric in wet scrubbers and none of the chemicals are wasted in the discharge stream. Chemical addition is normally controlled by pH control. Although many regulatory requirements dictate pH levels in excess of 7.0, the correct operating pH for a wet scrubber is 7.0 or less. Elevated pH results simply in waste of alkali, with no substantial improvement in acid gas removal efficiency. Furthermore, some of the heavy metals of concern are solubilized by alkaline solution while they are insoluble in neutral solution and can be filtered from it.

Figure 6 shows a typical venturi scrubber and packed tower acid gas absorber system used for an incinerator exhaust gas. This system would use either sodium hydroxide or sodium carbonate as the absorbing chemical in the packed tower. Both of these chemicals are water soluble and do not produce insoluble solids. If lime or one of the insoluble alkalis is used as the reactant for the acid gases, the scrubbing system shown in Figure 7 is employed. This uses open baffled sections for the liquid to cascade through while contacting the gas stream multiple times. The open baffle design eliminates pluggage problems and allows for the same 100% stoichiometry that is achieved in the packed tower absorber.

TABLE VII
COMMON SCRUBBER CHEMICAL NEUTRALIZATION REACTIONS

WITH NaOH									
	HCl	+	$NaOH$	--->	$NaCl$	+	H_2O		
MOLE Wt.	36.5	+	40	--->	58.5	+	18		
PER # or. kg HCl	1.00	+	1.09	--->	1.60	+	0.49		
	Cl_2	+	$2NaOH$	--->	$NaCl$	+	$NaOCl$	+	H_2O
MOLE Wt.	71	+	80	--->	58.5	+	74.5	+	18
PER # or kg Cl_2	1.00	+	1.12	--->	0.82	+	1.05	+	0.25
	HF	+	$NaOH$	--->	NaF	+	H_2O		
MOLE Wt.	20	+	40	--->	42	+	18		
PER # or kg HF	1.00	+	2.00	--->	2.10	+	0.90		
	SO_2	+	$2NaOH$	--->	Na_2SO_3	+	H_2O		
MOLE Wt.	64	+	80	--->	126	+	18		
PER # or kg SO_2	1.00	+	1.25	--->	1.97	+	0.28		
WITH $Ca(OH)_2$									
	$2HCl$	+	$Ca(OH)_2$	--->	$CaCl_2$	+	$2H_2O$		
MOLE Wt.	73	+	74	--->	111	+	36		
PER # or kg HCl	1.00	+	1.01	--->	1.52	+	0.49		
	$2Cl_2$	+	$2Ca(OH)_2$	--->	$CaCl_2$	+	$Ca(OCl)_2$	+	$2H_2O$
MOLE Wt.	142	+	1.48	--->	111	+	143	+	36
PER # or kg Cl_2	1.00	+	1.04	--->	0.78	+	1.01	+	0.25
	$2HF$	+	$Ca(OH)_2$	--->	CaF_2	+	$2H_2O$		
MOLE Wt.	40	+	74	--->	78	+	36		
PER # or kg HF	1.00	+	1.85	--->	1.95	+	0.90		
	SO_2	+	$Ca(OH)_2$	--->	$CaSO_3$	+	H_2O		
MOLE Wt.	64	+	74	--->	120	+	18		
PER # or kg SO_2	1.00	+	1.16	--->	1.88	+	0.28		

FIGURE 6

PARTICULATE SCRUBBING AND HCl ABSORPTION SYSTEM USING SOLUBLE ALKALI FOR WASTE INCINERATION EMISSIONS

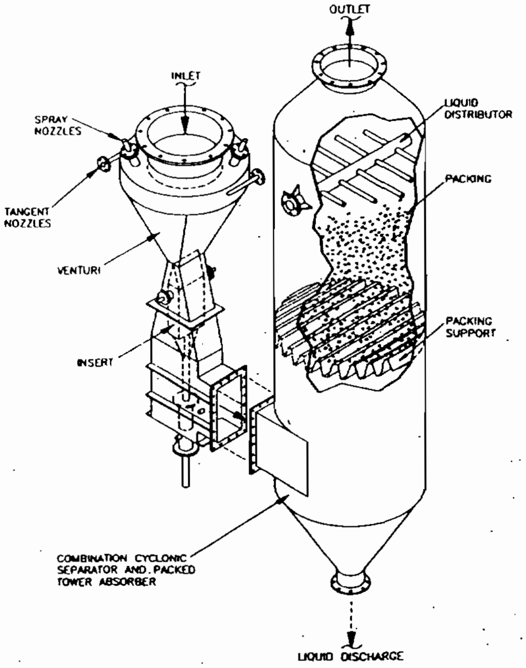


FIGURE 7

PARTICULATE SCRUBBING AND HCl ABSORPTION SYSTEM USING CALCIUM BASED ALKALI FOR WASTE INCINERATION EMISSIONS

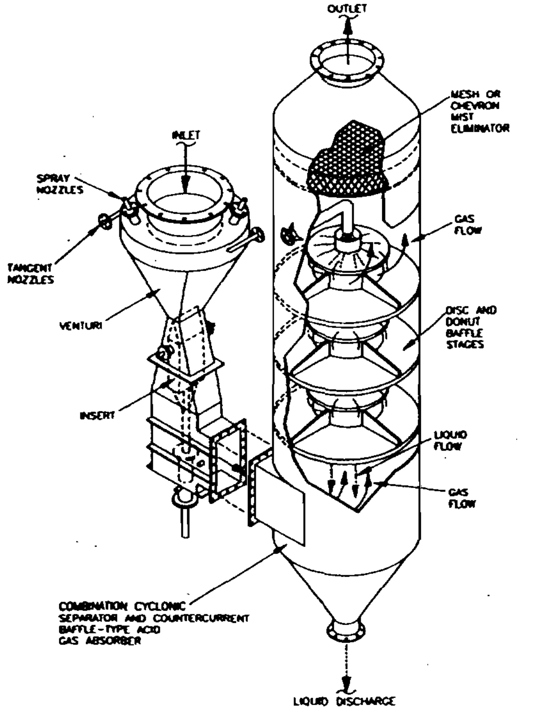


Figure 8 provides a process flowsheet and material balance for a hospital waste incineration system handling 1500 pounds per hour (680 Kg/Hr) of "typical" hospital waste. This particular flowsheet shows the types of emission levels which can be expected from a wet scrubbing system properly designed for this application. Outlet particulate loadings can be reduced to about 0.03 gr/sdcf (68mg/Nm^{3}dry), corrected to 7% O_2. HCl emissions can be reduced to less than 2 ppmv corrected to 7% oxygen on a dry basis. Sulfur dioxide concentrations can be reduced to less than 5 ppmv at 7% oxygen on a dry basis. Hydrogen fluoride emissions can be reduced to less than 0.5 ppmv at 7% O_2 on a dry basis. Note in Figure 8 that the scrubbing system includes a variable throat venturi scrubber, an acid gas absorption system, and a mist eliminator stage.

Diffusion controlled mist eliminators such as the CHEAF aerosol collection system made by Anderson 2000 Inc, have been employed in elemental phosphorus plants to control these emissions to concentrations of less than 0.01 gr/sdcf (23mg/Nm^{3}dry), for more than 30 years. The same devices are used on ammonium nitrate and urea prill towers where similar fume sized particulate are evolved and where opacity from the high particle light reflectivity has dictated reduction in emissions. Numerous references to these ultra high efficiency mist eliminators are available. Those can be added on the tail end of the conventional wet scrubber.[16,17,18,19]

Materials of construction are one of the most important considerations in designing a wet scrubbing system for incinerator emissions. The incinerator gas streams frequently contain acid gases which are extremely corrosive to metals. Where metals are used, high nickel alloys must be used to resist corrosion by hydrogen chloride and some of the other hydrogen halides. Proprietary alloys such as Hastelloy Alloy C-276 and Hastelloy Alloy C-22 have proven to be most resistant to these gas streams. Attempts to use the 300 Series stainless steels have all resulted in disastrous failures. Use of some of the lower nickel alloys have also resulted in rapid equipment deterioration and failure. While the high nickel alloys are extremely expensive, they are basically the only materials which are capable of handling the corrosive conditions unless an acid resistant refractory is used. Some systems employ acid resistant refractories over mild steel shells where membranes are installed between the refractory and the shell to prevent acid condensate from slowly attacking the steel shell. In some very severe applications, pure carbon brick refractory has been used. Once the gas temperature has been reduced to less than 200°F (93°C), some of the nonmetallic materials can be employed. The most frequently used material is fiberglass reinforced vinylester with a high grade, chemically resistant resin. It is of utmost importance to incorporate a fire retardant material in the fiberglass resin so that should equipment failure occur and the fiberglass be exposed to elevated temperatures, it will be self-extinguishing and only minimal damage will result.

Polypropylene and PVC tower internals can be employed in some of the scrubbing systems where temperatures permit. Mist eliminators should normally be of one of the high nickel alloys, such as Alloy C or Inconel, since the plastic mist eliminators are inherently less efficient than metal mesh mist eliminators due to their inability to wet with the collected liquids. The diffusion controlled mist eliminators are best made of Teflon® or highly temperature resistant fibrous plastics.

Even after the scrubbed exhaust gas has been discharged from the scrubbing system, there is still substantial corrosion potential from the traces of hydrogen chloride and sulfur dioxide which are still present. Thus, the connecting ducts must be constructed of nonmetallic materials or rubber lined steel where the high nickel alloys must continue to be employed. If the system is operated with an induced draft fan, as shown in Figure 8, the fan must be built of one of these corrosion resistant materials. Because of the differential pressures which are required in these systems, fiberglass fan wheels do not survive. Andersen 2000 Inc uses Alloy C-276 or Hastelloy Alloy C-22 for the fan wheel and rubber lined mild steel as the housing material. Fiberglass reinforced vinylester fan housings are normally not employed because they do not provide as long a service life as rubber lined mild steel, and because the rubber lining also acts as a sound deadening material. The exhaust stack from the system is then normally fiberglass reinforced vinylester or a fiberglass lined steel stack. The liquid system components are normally fiberglass reinforced vinylester or CPVC. Polypropylene lined piping can also be used. All of these materials are expensive and all result in a high cost for the emission control device. However, useful lifetimes in excess of 40 years can be expected from these systems. This will certainly equal or exceed the life of the incinerator. There have been reports of systems installed with inferior

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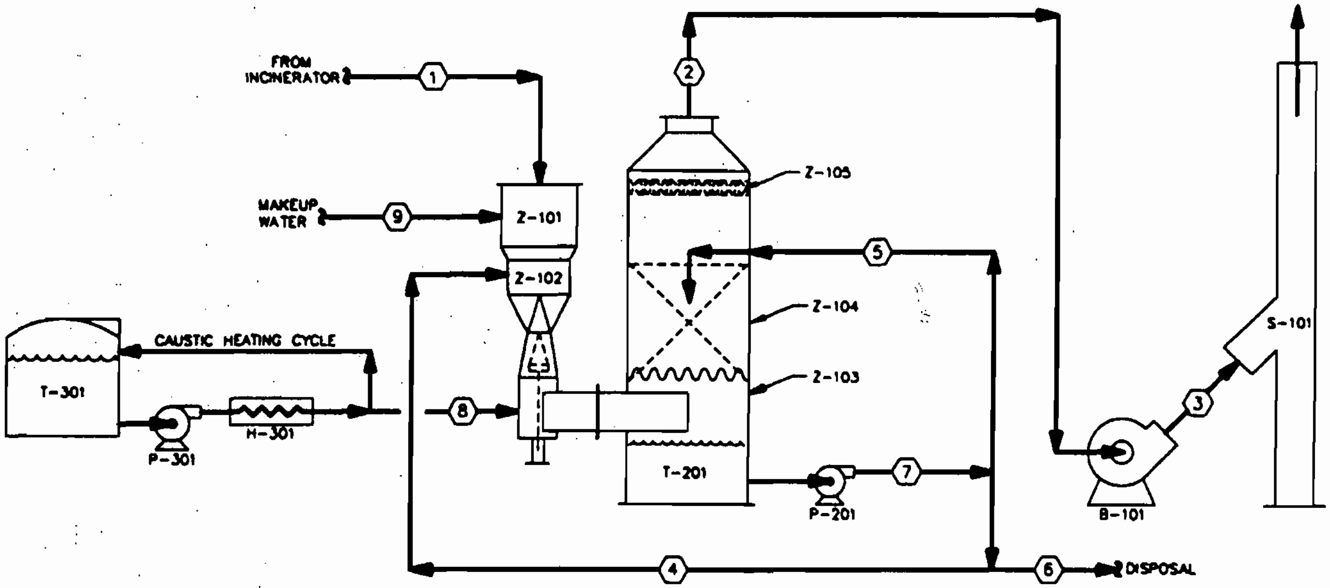
FIGURE 8
PROCESS FLOWSHEET FOR 1500#/HR (680kg/hr) HOSPITAL WASTE INCINERATOR SCRUBBER



EQUIPMENT LIST

Z-101	QUENCH SECTION
Z-102	VARIABLE VENTURI
Z-103	CYCLONIC SEPARATOR
Z-104	PACKED TOWER ABSORBER
Z-105	MESH MIST ELIMINATOR
T-201	SCRUBBER RECIRCULATION TANK
P-201	SCRUBBER RECIRCULATION PUMP
B-101	INDUCED DRAFT FAN
S-101	EXHAUST STACK
T-301	CAUSTIC STORAGE TANK
P-301	CAUSTIC FEED PUMP
H-301	CAUSTIC HEATER

STREAM NAME AND NUMBER / PROPERTY OR COMPONENT	1 INLET GAS (ENGLISH)	INLET GAS (METRIC)	2 SCRUBBER OUTLET GAS (ENGLISH)	SCRUBBER OUTLET GAS (METRIC)	3 FAN DISCHARGE GAS (ENGLISH)	FAN DISCHARGE GAS (METRIC)
H2O------------(#/HR)-------(Kg/HR)	1003.80	455.31	3374.90	1530.82	3374.90	1530.82
CO2	2606.60	1182.33	2606.60	1182.33	2606.60	1182.33
CO	.00	.00	.00	.00	.00	.00
O2	3479.60	1578.31	3479.60	1578.31	3479.60	1578.31
N2	18543.40	8411.10	18543.40	8411.10	18543.40	8411.10
HCl	17.00	7.71	.034	.02	.034	.02
NO	0	.00	0	.00	0	.00
SO2	6.60	2.99	.132	.06	.132	.06
HF	.25	.11	.0025	.00	.0025	.00
PARTICULATE	5.45	2.47	1.30	.59	1.3	.59
TOTALS---------(#/HR)-------(Kg/HR)	25662.70	11640.35	28005.97	12703.23	28005.97	12703.23
ACTUAL FLOW----(ACFM)------(AM3/HR)	10563.60	17947.05	8384.87	14247.57	7459.86	12675.79
STANDARD FLOW--(SCFM)------(NM3/HR)	5713.20	9010.99	6556.21	10346.46	6556.21	10346.46
STD. DRY FLOW-(SDCFM)-----(NM3D/HR)	5353.02	8444.84	5347.44	8434.33	5347.44	8434.33
DENSITY----(#/CU.FT.)------(Kg/AM3)	.0407	.6522	.0557	.8916	.0626	1.0022
PRESSURE-------(PSIA)------(Kg/cm2)	14.479	.9980	12.2536	.8660	14.6960	1.0130
STATIC PRESS.(in H2O)------(mm H2O)	-6.00	-152.4	-51	-1295.4	0	0
TEMPERATURE--(DEG. F)-------(DEG. C)	500	260.00	132.85	56.03	143.05	61.70
MOLECULAR WEIGHT	28.95	28.95	27.53	27.53	27.53	27.53
HCl CONCEN.----(PPMV)------(mg/NM3)	525.44	855.74	.92	1.49	.92	1.49
SO2 CONCEN.----(PPMV)------(mg/NM3)	116.34	332.83	2.03	5.79	2.03	5.79
HF CONCEN.-----(PPMV)------(mg/NM3)	14.16	12.50	.12	.11	.12	.11
PARTICULATE-(GR/SDCF)-----(mg/NM3D)	.1109	253.9893	.0294	69.9127	.0294	69.9127
PART.@12%CO2(GR/SDCF)-----(mg/NM3D)	.2080	492.9670	.0477	117.4960	.0477	117.4960
PART.@7%O2--(GR/SDCF)-----(mg/NM3D)	.2116	501.5193	.0526	124.6049	.0526	124.6049
PART.@6%O2--(GR/SDCF)-----(mg/NM3D)	.2268	539.6306	.0562	133.6530	.0562	133.6530
HCl @ 7% O2 DRY(PPMV)-----(mg/NM3D)	998.00	1625.47	2.00	3.26	2.00	3.26
HCl @ 6% O2 DRY(PPMV)-----(mg/NM3D)	1069.89	1742.42	2.15	3.50	2.15	3.50
SO2 @ 7% O2 DRY(PPMV)-----(mg/NM3D)	220.99	631.07	4.43	12.66	4.43	12.66
SO2 @ 6% O2 DRY(PPMV)-----(mg/NM3D)	236.09	674.47	4.75	13.57	4.75	13.57
HF @ 7% O2 DRY(PPMV)-----(mg/NM3D)	26.79	23.90	.27	.24	.27	.24
HF @ 6% O2 DRY(PPMV)-----(mg/NM3D)	28.71	25.62	.29	.26	.29	.26

SCF = 70 DEGREES F & 14.696 PSIA (1.0 ATMOSPHERE)
NM3 = 0 DEGREES C & 1013 MILLIBARS (1.0 ATMOSPHERE)

STREAM NAME AND NUMBER / PROPERTY OR COMPONENT	4 VENTURI OR QUENCH FEED (ENGLISH)	VENTURI OR QUENCH FEED (METRIC)	5 ABSORBER FEED (ENGLISH)	ABSORBER FEED (METRIC)	6 BLOWDOWN TO DISPOSAL (ENGLISH)	BLOWDOWN TO DISPOSAL (METRIC)	7 TOTAL PUMP FLOW (ENGLISH)	TOTAL PUMP FLOW (METRIC)	8 CHEMICAL MAKEUP (ENGLISH)	CHEMICAL MAKEUP (METRIC)	9 WATER MAKEUP (ENGLISH)	WATER MAKEUP (METRIC)
H2O------------(#/HR)-------(Kg/HR)	49473.50	22440.72	103894.51	47125.51	629.50	285.53	153997.98	69851.76	27.17	12.33	2963.01	1343.99
NaCl	2137.09	969.36	4487.90	2035.66	27.19	12.33	6652.10	3017.36	.00	.00	.00	.00
Na2SO3	1000.79	453.95	2101.65	953.29	12.73	5.78	3115.17	1413.01	.00	.00	.00	.00
NaF	40.85	18.53	85.78	38.91	.52	.24	127.15	57.67	.00	.00	.00	.00
NaOH	.00	.00	.00	.00	.00	.00	.00	.00	27.17	12.33	.00	.00
PARTICULATE	326.50	148.10	685.64	311.00	4.15	1.88	1016.29	460.98	.00	.00	.00	.00
TOTALS---------(#/HR)-------(Kg/HR)	52978.70	24030.65	111255.48	50464.37	674.10	305.76	164908.30	74800.79	54.35	24.65	2963.01	1343.99
FLOW---(U.S. GAL/MIN)-------(M3/HR)	100.00	22.71	210.00	47.69	1.27	.29	311.27	70.69	.07	.02	5.93	1.35
PRESSURE--------(PSIG)-----(Kg/cm2)	30.00	2.11	30.00	2.11	30.00	2.11	30.00	2.11	30.00	2.11	30.00	2.11
SPECIFIC GRAVITY	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.52	1.52	1.00	1.00
TEMPERATURE---(DEG F)-------(DEG C)	133	56.03	133	56.03	133	56.03	133	56.03	90.00	32.22	70.00	21.11
SUSPENDED SOLIDS (WT %)	.62	.62	.62	.62	.62	.62	.62	.62	.00	.00	.00	.00
DISSOLVED SOLIDS (WT %)	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	50.00	50.00	.00	.00
pH	6.95	6.95	6.95	6.95	6.95	6.95	6.95	6.95	>14.0	>14.00	7.00	7.00

materials which have experienced major equipment failures due to corrosion within two weeks of initial operation. Obviously, these systems were very poor investments.

Table VIII provides a capital cost estimate for a 1500 pound per hour (680 Kg/Hr) hospital waste incinerator scrubbing system. This is an Andersen 2000 Inc Model 540BSE scrubbing system, which includes all of the materials of construction and all of the scrubbing stages mentioned in this section. Operating costs for this unit are listed in Table IX.

Figure 9 shows a complete system for achieving outlet particulate emissions as low as 0.01gr/sdcf (23mg/Nm^{3}dry) corrected to 7% O_2. This system includes a fresh water quench system, a variable throat venturi scrubber, a packed tower absorber with mist eliminator, a CHEAF® aerosol filtration system, and a final mist eliminator. Because gas flow rates vary, it is necessary to install variable throat systems to control static pressure or "draft" in the incinerator primary chamber. The geometry in the throat area determines the energy required for a given collection efficiency. The wetted approach, adjustable insert throat venturi is used by Andersen 2000 Inc in all incinerator applications.

TABLE VIII
CAPITAL COST FOR SCRUBBING SYSTEM
ON 1500#/HR (680 Kg/H) HOSPITAL WASTE INCINERATOR
OPERATING WITH WASTE HEAT RECOVERY BOILER

(ANDERSEN 2000 INC MODEL 540BSE SCRUBBING SYSTEM)

	COMPONENT	DESCRIPTION	PRICE
1.	SCRUBBER	VENTURI & PACKED TOWER	$ 95,190
2.	I.D. FAN	100 HP, HASTELLOY WHEEL, RUBBER LINED HOUSING	$ 42,400
3.	EXHAUST STACK	40' TALL, FRP	$ 14,600
4.	LIQUID SYSTEM	ALL NON-METALLIC WITH TWO 15 HP PUMPS (ONE STANDBY)	$ 32,240
5.	CHEMICAL NEUTRALIZATION SYSTEM	CAUSTIC TANK, TWO PUMPS, SECONDARY CONTAINMENT	$ 12,600
6.	INSTRUMENTATION, CONTROLS, STARTERS	INCLUDES ALL SAFETIES AND INTERLOCKS	$ 61,500
7.	MISC. SKIDS, SUPPORTS, ETC.	PAINTED WITH CORROSION INHIBITOR PAINT	$ 12,480
8.	FREIGHT	AVERAGE HAUL	$ 5,000
9.	INSTALLATION	UTILITIES, DUCTS, FOUNDATIONS & ALL LABOR	$ 75,000
10.	STARTUP SERVICES	3 WEEKS INCLUDING TRAVEL	$ 12,230
		TOTAL 1994 U.S. DOLLARS	$363,240

TABLE IX
OPERATING COST FOR SCRUBBING SYSTEM
ON 1500#/HR (680Kg/h) HOSPITAL WASTE INCINERATOR

(ANDERSEN 200 INC MODEL 540BSE SCRUBBING SYSTEM)
SEE FIGURE 8 FOR OPERATING CONDITIONS

7500 HRS/YR

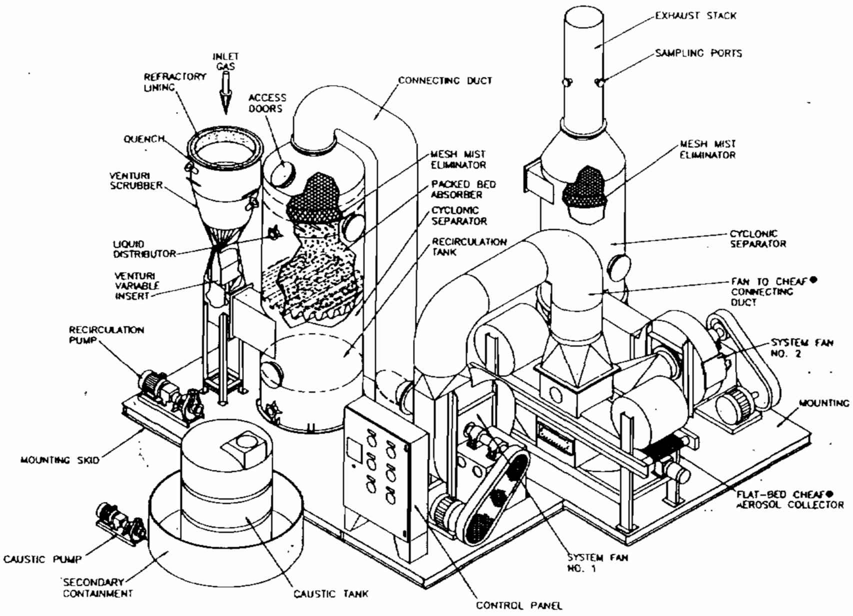
	COMPONENT	QUANTITY	ANNUAL COST
1.	ELECTRICAL POWER	133 KWH/H @ $0.06/KWH	$ 59,850
2.	MAKEUP WATER	356 GPH @ $0.03/A00 GAL	$ 800
3.	SEWER CHARGE	76.2 GPH @ $0.20/100 GAL	$ 1,143
4.	CHEMICALS (NaOH)	27.12#/HR @ $400/TON	$ 40,680
5.	MAINTENANCE	2% OF EQUIPMENT CAPITAL/YR	$ 5,665
6.	OPERATORS	1/2 HR/8 HR SHIFT @ $45/HR	$ 21,094
7.	TESTING & PERMITS	ONE TEST PER YEAR (PARTICULATE AND HCL ONLY)	$ 7,000
8.	AMORTIZE CAPITAL	5 YEAR STRAIGHT LINE	$ 72,648
		TOTAL	$208,880
		EQUALS $0.02/# OF WASTE OR $37.13/TON OF WASTE	

BASIS - 1994 U.S. DOLLARS

B. Ejector Scrubbers for Small Gas Flows

When gas flows exiting the incinerator total less than 1000 acfm (1700 am^3/h), it is often more economical to use an ejector scrubber for particulate and acid gas removal than it is to use a venturi scrubber and packed tower absorber. Figure 10 shows a simplified schematic drawing of an ejector scrubber with packed tower absorber. The ejector does not require an induced draft fan. It utilizes high pressure scrubbing liquid as the motive force for the gas through the scrubbing system. A properly designed ejector scrubber can create a negative pressure at its inlet of about 2" W.G. (5.1mm) while operating at design gas flow rate. Liquid recirculation rates are as much as 10 times as high as for an equivalent flow venturi scrubber because the liquid takes the place of the induced draft fan. The high pressure, high flow rate liquid is atomized into relatively small droplets which provide a large surface area for mass transfer, in addition to particulate collection. It is often necessary, however, to provide an additional packed tower absorber after the ejector scrubber to act as a final acid gas absorption section. The packed bed absorber is then normally followed with a mist eliminator. The mist eliminator can be additional packing which is not irrigated with the scrubbing solution, or it can be a conventional mesh-type mist eliminator. Materials of construction are the same as those required for venturi scrubber with packed tower absorbers in this application. Total system horsepower is not substantially different from that required for a venturi scrubber of equivalent performance. In general, the ejector scrubber is slightly less efficient and, as a result, requires slightly more horsepower than the venturi scrubber. At an inlet gas flow rate of 1000 acfm (1700 am^3/h) at a temperature of up to 2000°F (1093°C), however, the total system horsepower would be less than 15. Chemical addition is done exactly as in a venturi scrubbing system using a pH controller. Chemical consumption is calculated exactly as it would be for a venturi scrubber and as shown in Table VII.

FIGURE 9
INCINERATOR SCRUBBING SYSTEM



QUENCH CHAMBER AND VENTURI SCRUBBER

A QUENCH CHAMBER FOLLOWED BY A VARIABLE THROAT VENTURI SCRUBBER IS UTILIZED FOR PARTICULATE CONTROL. THE VARIABLE THROAT VENTURI SCRUBBER MAINTAINS CONSTANT DIFFERENTIAL PRESSURE WITH VARYING GAS FLOW RATES. THE QUENCH SECTION LOCATED DIRECTLY ABOVE THE VENTURI SCRUBBER IS WHERE THE GAS FROM THE INCINERATOR OR BOILER ENTERS VERTICALLY DOWNWARD. FRESH WATER IS INTRODUCED THROUGH SPRAY NOZZLES TO REDUCE THE GAS TEMPERATURE TO APPROXIMATELY 95°C (200°F). THESE COOLED GASES THEN ENTER THE VENTURI SCRUBBER WHERE THEY ARE CONTACTED WITH RECIRCULATED SCRUBBING LIQUID AND ARE FULLY QUENCHED TO THEIR ADIABATIC SATURATION TEMPERATURE. THE SCRUBBING LIQUID IS INTRODUCED THROUGH SPRAY NOZZLES AND TANGENTIAL LIQUID INLETS. THE TANGENTIAL INLETS ARE USED TO PROVIDE A WETTED WALL EFFECT, PREVENTING WET/DRY INTERFACE AT THE VENTURI THROAT ENTRANCE.

THE GASES ARE ACCELERATED TO VERY HIGH VELOCITIES IN THE VENTURI SCRUBBER THROAT. HERE, PARTICULATE IS REMOVED FROM THE FLUE GAS STREAM BY PARTICLE IMPACTION ON SCRUBBING LIQUID DROPLETS. THE GASES DECELERATE THROUGH AN EXPANDER SECTION AT THE VENTURI THROAT EXIT TO MINIMIZE OVERALL ENERGY CONSUMPTION. THE GASES AND LIQUID MAKE A 90° TURN INTO THE CYCLONIC ENTRANCE TO THE PACKED TOWER ABSORBER. A WETTED ELBOW IS PROVIDED BENEATH THE VENTURI SCRUBBER WHICH MINIMIZES THE ABRASIVE EFFECT OF THE PARTICULATE AND LIQUID MAKING THIS 90° TURN.

THE QUENCH SECTION INCLUDES A REFRACTORY LINED INLET WHEN INLET GAS TEMPERATURES EXCEED 1200°F (648°C). BELOW THIS REFRACTORY LINED INLET, ALLOY C-276 OR HASTELLOY® (REGISTERED TRADEMARK OF CABOT CORPORATION) C-22 IS USED TO RESIST THE CORROSIVE EFFECT OF ACID GASES, PRIMARILY HYDROGEN CHLORIDE, IN THE INCINERATOR FLUE GAS. THE ENTIRE VENTURI SCRUBBER AND WETTED ELBOW, AS WELL AS VENTURI SCRUBBER SPRAY NOZZLES, ARE ALSO CONSTRUCTED OF ALLOY C-276 OR HASTELLOY C-22. THESE ALLOYS CONTAIN A HIGH NICKEL CONTENT, CONTRIBUTING TO CORROSION RESISTANCE. ALLOYS OF STAINLESS STEEL DO NOT EXHIBIT ACCEPTABLE CORROSION RESISTANCE.

ACID GAS ABSORBER

THE GASES EXITING THE VENTURI SCRUBBER WETTED ELBOW PASS INTO A COMBINATION CYCLONIC ENTRAINMENT SEPARATOR AND COUNTERCURRENT PACKED TOWER ABSORBER WITH INTEGRAL RECIRCULATION TANK. THE LOWER SECTION OF THE PACKED TOWER INCLUDES A CYCLONIC ENTRAINMENT REMOVAL SECTION TO REDUCE ENTRAINED LIQUID IN THE GAS STREAM. THIS LIQUID FALLS BY GRAVITY INTO THE INTEGRAL, SLOPED BOTTOM RECIRCULATION TANK AT THE PACKED TOWER BASE. THE PACKED BE IS TYPICALLY 1.2 TO 1.8 METERS (4-6 FEET) DEEP. RECIRCULATED LIQUID IS INTRODUCED TO THE TOP OF THE PACKED SECTION BY A LADDER TYPE LIQUID DISTRIBUTOR. ABOVE THIS LIQUID DISTRIBUTOR, A MESH TYPE MIST ELIMINATOR IS INCLUDED FOR FURTHER LIQUID ENTRAINMENT REMOVAL. THE PACKED TOWER ABSORBER, IN CONJUNCTION WITH THE VENTURI SCRUBBER IS CAPABLE OF ACID GAS REMOVAL EFFICIENCIES IN EXCESS OF 99%. HOWEVER, IN SOME CASES, ACCEPTABLE LEVELS OF ACID GAS REMOVAL EFFICIENCY CAN BE ACHIEVED WITH A VENTURI SCRUBBER ONLY.

TYPICALLY, SODIUM HYDROXIDE ($NaOH$) IS FED TO THE SCRUBBER RECIRCULATION LIQUID FOR ACID GAS NEUTRALIZATION. THE pH OF THE RECIRCULATED SCRUBBING SOLUTION IS MAINTAINED AT APPROXIMATELY 7.0 SO THAT CHEMICAL UTILIZATION IS ESSENTIALLY 100%. LIME SLURRY ($Ca(OH)_2$) CAN ALSO BE FED WITH MINIMAL ABSORBER MODIFICATIONS.

THE PACKED TOWER SHELL IS CONSTRUCTED WITH A PREMIUM GRADE, FIBERGLASS REINFORCED VINYLESTER RESIN (FRP). THIS VINYLESTER RESIN IS SUPERIOR TO CONVENTIONAL POLYESTER RESINS. THIS RESIN IS LOADED THROUGHOUT WITH ANTIMONY OXIDE FIRE RETARDANT FOR INTERIOR AND EXTERIOR FIRE RETARDANCY. EXTERIOR SURFACES INCLUDE AN ULTRAVIOLET LIGHT GET INHIBITOR. INTERIOR SURFACES ARE LINED WITH A "C" VEIL TO PREVENT ANY EXPOSED GLASS FIBERS FROM DETERIORATION IN THE CORROSIVE GAS AND LIQUID ENVIRONMENT. THE PACKING SUPPORT IS TYPICALLY CONSTRUCTED OF THIS SAME RESIN OR OF POLYPROPYLENE MATERIAL. POLYPROPYLENE, CPVC, OR KYNAR® (REGISTERED TRADEMARK OF PENNWALT CORPORATION) PACKING IS USED IN THE PACKED BED SECTION. THE LADDER TYPE LIQUID DISTRIBUTOR IS CONSTRUCTED OF CPVC, FRP, KYNAR OR POLYPROPYLENE PIPE. THE MESH TYPE MIST ELIMINATOR IS CONSTRUCTED OF KYNAR, A HIGH TEMPERATURE PLASTIC MESH, OR ALLOY 625, A HIGH NICKEL ALLOY.

FLAT-BED CHEAF® AEROSOL COLLECTOR (TRADEMARK AND PATENT HELD BY ANDERSEN 2000 INC)

FOR APPLICATIONS WHERE THE REQUIRED OUTLET PARTICULATE EMISSION FROM THE SCRUBBING SYSTEM IS EQUAL TO OR LESS THAN 30 mg/Nm^{3}d (0.013 gr/sdcf) CORRECTED TO 7% O_2, AN AEROSOL COLLECTOR IS INSTALLED AFTER THE VENTURI SCRUBBER AND PACKED TOWER ABSORBER. AFTER THE PARTICULATE IS REMOVED IN THE VENTURI SCRUBBER DOWN TO A LEVEL OF 74 mg/Nm^{3}d (0.03 gr/sdcf) CORRECTED TO 7% O_2. THE REMAINING PARTICULATE IS PRIMARILY LESS THAN 0.5 MICRON IN DIAMETER. MOST OF THIS PARTICULATE IS SOLUBLE, CONDENSIBLE AEROSOLS FORMED IN THE INCINERATION CHAMBER. FILTER MEDIA IS USED IN THE AEROSOL COLLECTOR TO TRAP THE SUBMICRON AND AEROSOL PARTICULATE EMISSIONS. THE FILTER MEDIA IS A DENSE MAT OF POLYESTER, FIBERGLASS POLYPROPYLENE, OF TEFLON® (REGISTERED TRADEMARK OF E.I. DUPONT de MEMOURS & COMPANY INCORPORATED). THE AEROSOL COLLECTOR OPERATES AT A DIFFERENTIAL PRESSURE OF APPROXIMATELY 875-1000 mm W.G. (35-40" W.G.) AT A FILTER FACE VELOCITY OF 300-600 METERS/MIN (1000-2000 FT/MIN). THE FILTER MEDIA IS WASHED CONTINUOUSLY WITH RECIRCULATED WATER TO CLEAN THE MEDIA OF THESE SOLUBLE PARTICULATES. THE AEROSOL COLLECTOR IS HOUSED IN A NICKEL ALLOY ENCLOSURE WITH AN AUTOMATIC FILTER ADVANCE MECHANISM USING A PRESSURE CONTROLLER.

INDUCED DRAFT FANS

THE MOTIVE FORCE FOR THE GAS FLOW THROUGH THE SCRUBBING SYSTEM AND ASSOCIATED DUCTWORK, WASTE HEAT RECOVERY BOILER, ETC., IS PROVIDED BY TWO INDUCED DRAFT FANS DOWNSTREAM OF THE PACKED TOWER ABSORBER. THE PACKED TOWER ABSORBER AND I.D. FANS ARE CONNECTED WITH AN FRP DUCT. THE GAS FROM THE PACKED TOWER REMAINS SATURATED AND CONTAINS RESIDUAL (BUT VERY GREATLY REDUCED) CONCENTRATIONS A ACID GASES. AS THIS GAS IS COMPRESSED THROUGH THE FANS, SOME CONDENSATE FORMATION OCCURS. BECAUSE THERE IS NO RESIDUAL SODIUM HYDROXIDE IN THE SYSTEM AT THIS POINT, THE CONSENSATE FROM THE INDUCED DRAFT FANS AND ASSOCIATED INLET AND OUTLET DUCTWORK OR STACK, HAS MEASURED pH VALUES OF 1 TO 3. THIS, THE CORROSION PROBLEMS WHICH OCCUR IN THE SCRUBBING SYSTEM ARE NOT YET OVER IN THE INDUCED DRAFT FANS. FOR THIS REASON, THE INDUCED DRAFT FANS ARE CONSTRUCTED WITH AN ALLOY C-276 OR C-22 FAN WHEEL WITH TEFLON SHAFT SEALS AND A TEFLON LINED OR RUBBER LINED MILD STEEL FAN HOUSING. IT IS VERY IMPORTANT THAT DRAINS BE INSTALLED IN INLET AND OUTLET DUCTWORK, EXHAUST STACK, AND INDUCED DRAFT FANS SO THAT THIS CONDENSATE CAN BE DRAINED FROM THE SYSTEM AND NOT REENTRAINED IN THE GAS STREAM. TYPICALLY, AN FRP EXHAUST STACK IS INSTALLED DOWNSTREAM OF THE INDUCED DRAFT FANS WHERE THE SCRUBBED GASES ARE RELEASED TO THE ATMOSPHERE.

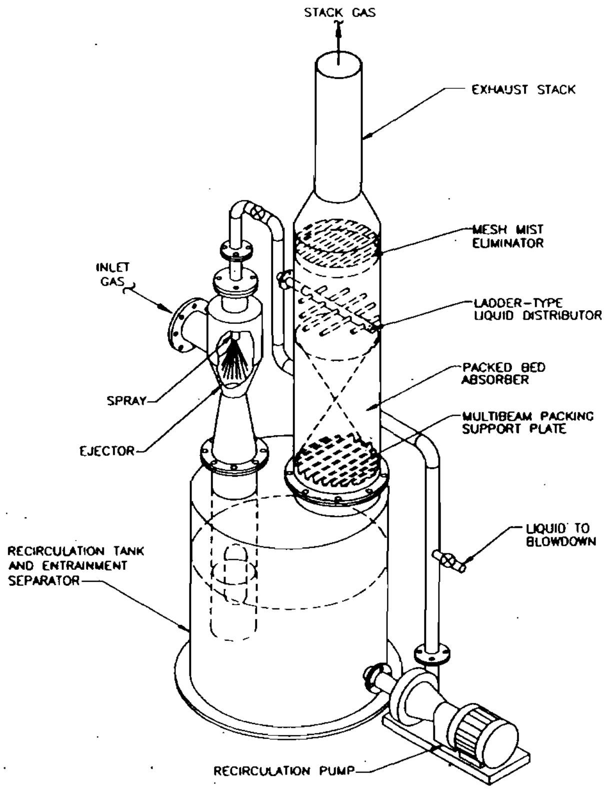
AUXILIARY COMPONENTS

A LIQUID RECIRCULATION SYSTEM FOR THE SCRUBBING SYSTEM TYPICALLY INCLUDES AN FRP OR TEFLON LINED RECIRCULATION PUMP, CPVC, FRP, OR POLYPROPYLENE LINED STEEL PIPE, AND CPVD, POLYPROPYLENE, OR POLYMER LINED VALVES AND CONTROL VALVES. THIS LIQUID RECIRCULATION SYSTEM DELIVERS THE SCRUBBING SOLUTION FROM THE INTEGRAL RECIRCULATION TANK AT THE PACKED TOWER BASE TO THE VENTURI AND PACKED TOWER LIQUID DISTRIBUTORS. IN ADDITION, A BLOWDOWN STREAM FROM THE RECIRCULATED LIQUID IS TAKEN TO MAINTAIN A CONSTANT LEVEL OF DISSOLVED SOLIDS ($NaCl$, Na_2SO_3, ETC.) AND LESS THAN 1.0% SUSPENDED SOLIDS (ASH OR PARTICULATE).

THE COMPREHENSIVE INSTRUMENTATION PACKAGE FOR THE SCRUBBING SYSTEM INCLUDES RECIRCULATION AND BLOWDOWN FLOW INDICATORS, GAS AND LIQUID PRESSURE AND DIFFERENTIAL PRESSURE INDICATORS, MAKE-UP WATER CONTROLLER (TO REPLENISH WATER LOST TO EVAPORATION AND BLOWDOWN), EMERGENCY QUENCH SYSTEM ACTIVATED BY HIGH INLET TEMPERATURE TO THE PACKED TOWER, LOW LIQUID LEVEL IN THE RECIRCULATION TANK, OR LOW RECIRCULATION LIQUID FLOW RATE, AND pH CONTROLLER FOR RECIRCULATED LIQUID pH MAINTENANCE.

THE pH OF THE RECIRCULATED LIQUID IS MAINTAINED AT APPROXIMATELY 7.0 BY THE INTERMITTENT ADDITION OF SODIUM HYDROXIDE SOLUTION. THIS SODIUM HYDROXIDE IS TYPICALLY 50% (WT) $NaOH$. BECAUSE THIS SOLUTION WILL BEGIN TO FREEZE AT APPROXIMATELY 10°C (50°F), A FREEZE PROTECTION PACKAGE MUST BE INCLUDED WITH THE CHEMICAL STORAGE AND FEEDING SYSTEM. A RECIRCULATION PUMP WITH AN IN-LINE ELECTRICALLY POWERED, RECIRCULATION TYPE HEATER IS PROVIDED WITH THE SODIUM HYDROXIDE STORAGE TANK. THE SODIUM HYDROXIDE SOLUTION IS CONSTANTLY RECIRCULATED IN THE STORAGE TANK TO MAINTAIN THIS TEMPERATURE ABOVE 20°C (68°F). A CONTROL VALVE IS INSTALLED AT THE DISCHARGE OF THIS CAUSTIC RECIRCULATION PUMP TO ADD CAUSTIC TO THE RECIRCULATION LIQUID IN THE SCRUBBING SYSTEM BASED ON DEMAND. IN ADDITION, THE UNITED STATES RESOURCE CONSERVATION AND RECOVERY ACT (RCRA) LISTS SODIUM HYDROXIDE AS A CONTROLLED CHEMICAL REQUIRING SECONDARY CONTAINMENT. THIS SECONDARY CONTAINMENT VESSEL FOR THE SODIUM HYDROXIDE TANK MUST BE 10% GREATER IN VOLUME THAN THE STORAGE TANK ITSELF. THE STORAGE TANK AND CONTAINMENT VESSEL CAN BE CONSTRUCTED OF HIGH DENSITY, CROSS-LINKED, ROTATIONALLY MOLDED POLYETHYLENE (HDPE), FIBERGLASS, MILD STEEL, OR STAINLESS STEEL MATERIALS. THE SODIUM HYDROXIDE RECIRCULATION AND FEED SYSTEM IS CONSTRUCTED WITH A SEALLESS RECIRCULATION PUMP, STAINLESS STEEL PIPING, VALVES, CONTROL VALVES AND INCONEL 625 WETTED PARTS FOR THE IN-LINE RECIRCULATION HEATER.

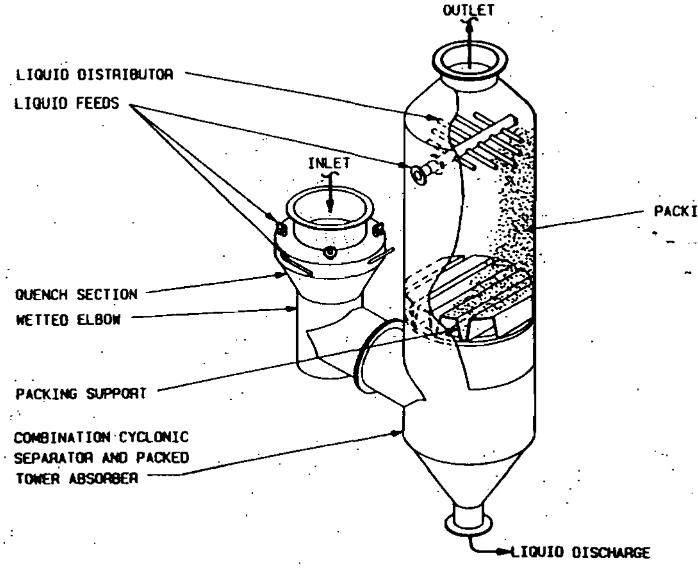
FIGURE 10
EJECTOR SCRUBBER



C. Acid Gas-Only Scrubbers

If an incinerator system has already been equipped with particulate removal equipment, or if the incinerator is burning a waste material which has no ash content, it is necessary to only use an acid gas absorption system to control emissions. Figure 11 shows such a system. The system differs very little from the venturi scrubber and packed tower absorber discussed in Section A. However, rather than a venturi throat, a quench section is substituted for the venturi section. The quench section is built of the same high nickel alloy or of a refractory lined steel, as would be the inlet section of the venturi. In the quench section, liquid is evaporated into the gas stream to bring the gas to adiabatic saturation temperature. Once this temperature has been achieved, the gas is discharged into the packed tower absorber where it is contacted coutercurrently with scrubbing solution in the packed section. Acid gas absorption efficiencies are equal to those for venturi and packed tower absorber systems. Particulate removal, however, is negligible. Differential pressures are typically less than 10" W.G. (254mm W.G.) and the systems require relatively low fan horsepower. Materials of construction are essentially the same as those used in the venturi scrubbing systems and all of the cautions regarding corrosion in Section A should be observed. It is also possible to use this same type of system but employ a baffle-type scrubber, as was described for lime neutralization in Section A.

FIGURE 11
HC1 ABSORPTION SYSTEM AFTER PARTICULATE REMOVAL USING SOLUBLE ALKALI FOR INCINERATOR EMISSIONS



D. Particulate-Only Collectors

As mentioned earlier in this brochure, some municipal waste incineration systems have only particulate collectors employed. The particulate collectors are either baghouse systems (fabric filters) or electrostatic precipitators. Baghouses are designed with tube sheets holding multiple cylindrical fabric tubes through which the gas passes and is exhausted to the outlet air plenum. The fabric filtration material intercepts and filters the particulate matter from the gas stream, accumulating a cake of the filtered particulate on the surface of the bag. Bags are intermittently cleaned by either mechanically shaking them, by reversing gas flow through them, or by pulsing them with a pulse of compressed air. The "pulse jet"-type collector is most frequently employed for incineration systems. Recent developments in high temperature fabrics have resulted in bag filter systems which can tolerate incoming gas temperatures of up to 600° F (316°C). Normal operating temperatures, however, are below 400°F (204°C). The gas stream normally must be cooled somewhat using evaporative cooling with very finely atomized water droplets before filtration. Very careful attention must be given to design of the cooling section since no liquid water droplets can be tolerated in the baghouse. Any moisture accumulated on the bags causes blinding of the bags and prevents the filtration system from functioning properly. In addition, any free water will absorb acid gases and will become extremely corrosive. Because of their extremely large size for a given gas flow rate, baghouses are not constructed of alloy steels in most installations and water droplets collecting acids will then attack the mild steel housings on the baghouse with disastrous consequences. The baghouses must be insulated so that the outer walls do not become cold enough to condense water on them from moisture in the gas stream. The compressed air which is used to pulse the bags and clean them must also be dried and heated so that it does not introduce any moisture into the bag filtration area and does not cause localized cooling of the gas.

The filter bags are supported on metal cages which are made of steel or stainless steel. These cages can normally be removed from the tube sheet with the bag on them so that bags can be replaced. The baghouse is normally divided into individual compartments so that cleaning of the bags can be done "off-line." Poppett valves are used to shut off flow to one section of the baghouse while flow continues through other sections of the baghouse. Once flow is stopped, the bags are pulsed with the compressed air pulses for cleaning, and are brought back on-line. Simultaneously, another section of the baghouse is taken off-line for cleaning.

The performance of the baghouse is dependent upon the type of filter material used, the so-called "air-to-cloth ratio," and the properties of the particulate matter being collected. In general, baghouses or fabric filters are extremely efficient particulate emission control devices and can control outlet particulate loadings from incinerators to concentrations of less than 0.01 gr/sdcf (23mg/Nm^{3}dry), corrected to 12% CO_2. Differential pressures across the baghouse vary from a low of about 6" W.G. (152mm W.G.) to a high of about 12" W.G. (305mm W.G.). Typical air-to-cloth ratios are four cubic feet of gas per square foot of filter material. This considered a rather low air-to-cloth ratio and results in a very large number of filter tubes and a very large enclosure for the bag filter. Because the baghouse is strictly a filtration device, it does not collect any acid gas emissions unless an alkaline absorbant is injected into the gas stream upstream of the baghouse.

Electrostatic precipitators do not depend upon filtration or impaction as their collection mechanism. They utilize an electrostatic charging mechanism to impart an electrostatic charge to the particle and then attract it to an oppositely charged collection plate in a high potential gradient. The potential difference between two plates in an electrostatic precipitator varies from a low of about 20,000 volts to a high of about 80,000 volts. Collection efficiency in an electrostatic precipitator is dependent upon the electrical characteristics of the particle (insulating or conducting), the potential gradient between the plates in the precipitator, the power input to the ionizer section, the size of the particle and its mass, the velocity of the gas stream through the collection plate section of the precipitator, and the characteristics of the gas itself. Mechanical design differences in the precipitator also have an impact on collection efficiency capabilities. Prior to the development of high quality fabric filter materials, electrostatic precipitators generally achieved the highest particulate removal efficiencies of any of the conventional pollution control devices. However, the new fabric filter materials have enabled baghouses to achieve higher particulate removal efficiencies than even the best electrostatic precipitators. Electrostatic precipitators are generally the most expensive capital cost items used for air pollution control. Gas velocities through these systems must be extremely low to achieve high collection efficiencies. Thus, the size of the housing around the precipitator elements is extremely large for a given gas flow rate. In addition, the system must be electrically insulated so that the high potential differences can be maintained between plates and in the ionizer system. If the electrical insulators become dirty and create conductive paths, the precipitator no longer functions properly. Thus, the insulators must be properly shielded, it is often necessary to bathe them in clean air, and the corrosion potential becomes high because of the very large size of the housing, the multiple penetrations through the housing for electrical conductors, and the frequent need for use of fresh air to prevent conductive dust buildup on insulators. Just as in the case with fabric filters, the precipitators cannot be built of alloy steels because of their extremely large size and the resultant prohibitive costs. Thus, they must be insulated, just as the baghouse, to prevent condensation of water or acids on inside surfaces exposed to the gas stream. Precipitators are finding less and less favor among designers in recent years because of the lower cost of fabric filters and the higher quality of filtration materials available. Precipitators, just as baghouses, do not collect acid gases. They can only serve in this capacity if an alkaline absorbant is injected upstream of the precipitator.

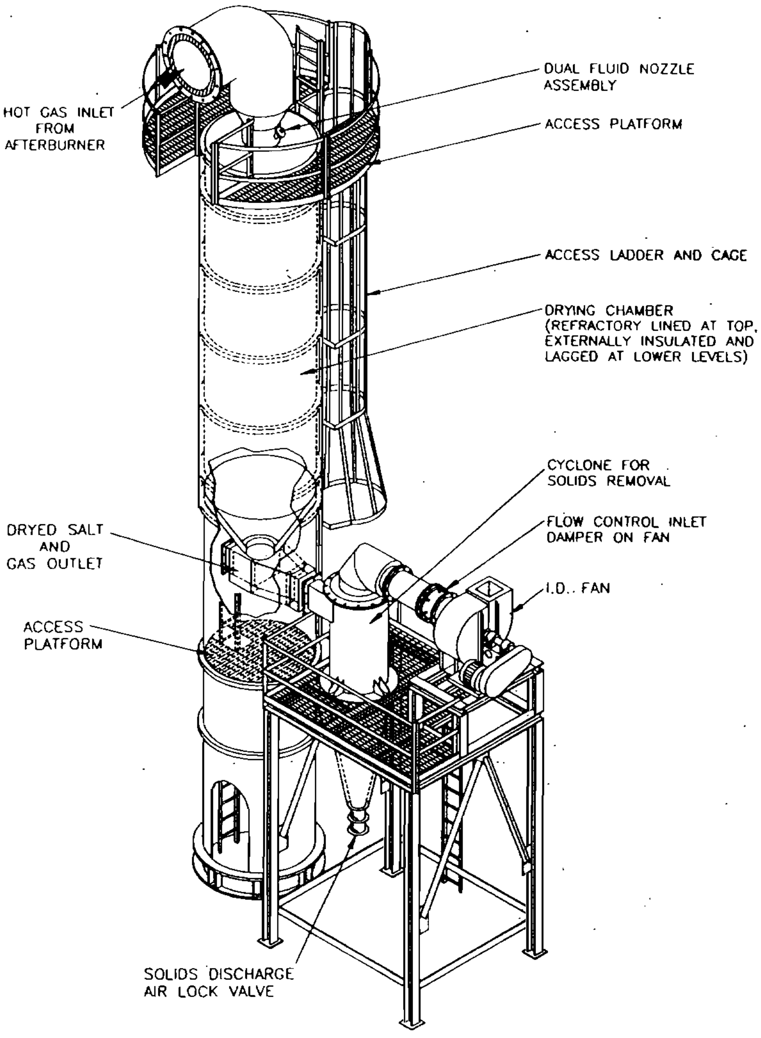
E. Spray Evaporators in Series with Wet Scrubbers

When wet scrubbers are employed for emission control in incineration applications, the primary disadvantage of their operation is production of a liquid waste material which must be disposed of. In a hazardous waste incineration application, the waste liquid may be classified under RCRA in the United States as being hazardous. This is true in many other countries, as well. In hospital waste incineration, it is normally possible to discharge the waste liquid directly to the sewer. However, there are some areas which do not have municipal sewage treatment systems and where septic tanks are used. When this is the case, the particulate content of the waste liquid is not desirable in septic systems. Furthermore, the dissolved salt content in the solution is not desirable in the soil where the septic leach field might be. In municipal waste incineration, where wet scrubbers are employed for acid gas removal after particulate collectors (as described in Section D. above), the same waste liquid problems exist as in the case of hospital waste incinerators.

In the United States, Andersen 2000 Inc was the first company in the pollution control field to employ a spray drying system, utilizing sensible heat from the incinerator exhaust gas, to evaporate the waste liquid from a wet scrubbing system. Andersen conducted extensive experimentation in its own pilot plants and then on commercial installations using actual exhaust gas streams from incinerators. The system is now being employed successfully in commercial applications not only in the United States, but in other locations throughout the world. Figure 12 shows a schematic diagram and material balance of an incinerator emission control system employing a spray dryer to evaporate scrubber waste liquid and a wet scrubbing system with aerosol filter (see Figure 9).

If elevated temperature gas is used as the feed to the spray dryer, special design considerations must be taken into account in the spray dryer itself. Figure 13 shows the Andersen 2000 Inc design for this application. This unit employs a refractory lined upper section where the hot gas is introduced. Liquid is introduced into the gas stream through spray nozzles which are mounted through either bayonet style fittings from the outer walls of the dryer, or in venturi throats through which the hot gas passes. The upper sections of the spray dryer are subjected to the same severely corrosive conditions that wet scrubbers are. Thus, any metal in contact with the gas stream must be of high nickel alloy. If high nickel alloys are not employed, it is necessary to refractory cover any surfaces exposed to the gas stream.

FIGURE 13
SPRAY DRYER FOR WASTE SCRUBBER LIQUID

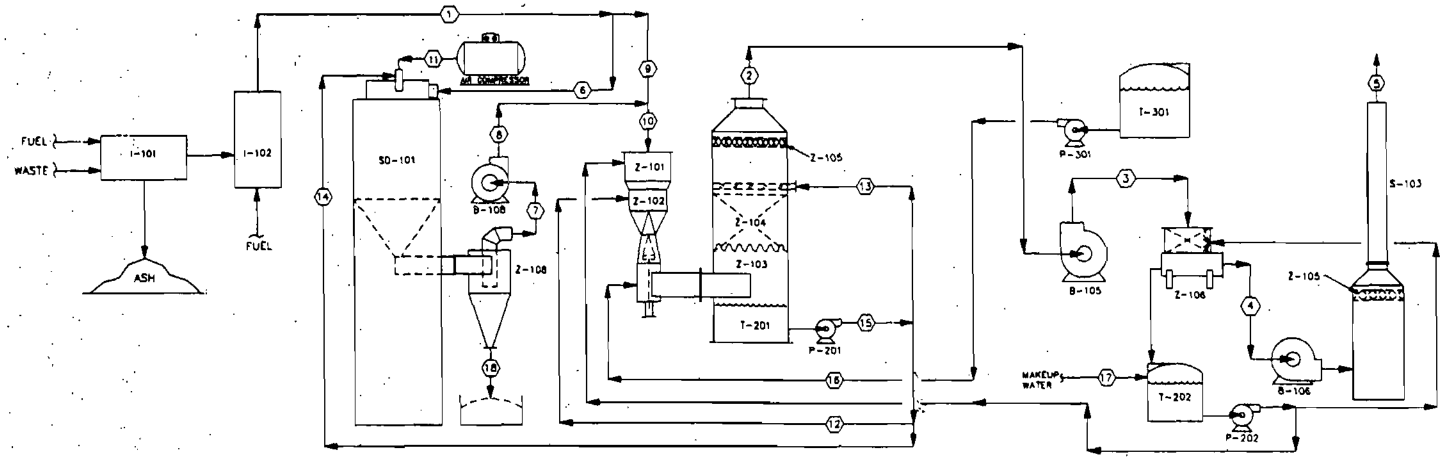


F. Sorbent Injection Dry Collectors

If the gas temperature from an incineration system is reduced to about 600°F (316°C) by evaporative cooling, finely powdered lime or other alkaline absorbant can be injected directly into the gas stream and will absorb acid gases. Many factors determine the removal efficiency which can be achieved. The efficiency is primarily dependent upon the particle size of the alkali injected into the gas stream and on the temperature and moisture content of the gas stream. The smaller the dust particle size injected into the gas stream, the lower the temperature, and the greater the residence time, the higher the removal efficiency and the higher the chemical utilization will be. Even in the best such systems, however, it is virtually impossible to achieve acid gas removal efficiencies in excess of 98% at lime consumptions of 200% or greater of stoichiometric and at temperatures as low as 400°F (204°C). Thus, if extremely high acid gas removal efficiencies are required, the dry injection system is simply not a reason-

FIGURE 12

SPRAY DRYER AND SCRUBBING SYSTEM FOR EMISSION CONTROL ON WASTE INCINERATOR



EQUIPMENT LIST

I-101	INCINERATOR
I-102	AFTERBURNER
Z-101	QUENCH SECTION
Z-102	VARIABLE VENTURI
Z-103	CYCLONIC SEPARATOR
Z-104	PACKED TOWER ABSORBER
Z-105	MESH MIST ELIMINATOR
Z-106	CHEAF® AEROSOL COLLECTOR
T-201	RECIRCULATION TANK
P-201	RECIRCULATION PUMP
B-105	INDUCED DRAFT FAN #1
S-103	EXHAUST STACK
T-301	CAUSTIC STORAGE TANK
P-301	CAUSTIC FEED PUMP
P-202	CHEAF PUMP
B-106	INDUCED DRAFT FAN #2
SD-101	SPRAY DRYER
Z-108	CYCLONE COLLECTOR

STREAM NAME AND NUMBER / PROPERTY OR COMPONENT	1 INCINERATOR DISCHARGE GAS (ENGLISH)	INCINERATOR DISCHARGE GAS (METRIC)	2 SCRUBBER OUTLET GAS (ENGLISH)	SCRUBBER OUTLET GAS (METRIC)	3 FAN #1 DISCHARGE GAS (ENGLISH)	FAN #1 DISCHARGE GAS (METRIC)	4 FAN #2 INLET GAS (ENGLISH)	FAN #2 INLET GAS (METRIC)	5 STACK GAS (ENGLISH)	STACK GAS (METRIC)
H2O-------------(#/HR)--------(Kg/HR)	1003.86	455.35	12564.00	5698.90	12564.00	5698.90	12564.00	5698.90	12564.00	5698.90
CO2	2606.60	1182.33	2606.60	1182.33	2606.60	1182.33	2606.60	1182.33	2606.60	1182.33
CO	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
O2	3479.60	1578.31	3547.81	1609.25	3547.81	1609.25	3547.81	1609.25	3547.81	1609.25
N2	18543.40	8411.10	18769.60	8513.70	18769.60	8513.70	18769.60	8513.70	18769.60	8513.70
HCl	17	7.71	.034	.02	.034	.02	.034	.02	.034	.02
NO	0	.00	0	.00	0	.00	0	.00	0	.00
SO2	6.6	2.99	.132	.06	.132	.06	.132	.06	.132	.06
HF	.25	.11	.0025	.00	.0025	.00	.0025	.00	.0025	.00
PARTICULATE	5.43	2.46	1.3	.59	1.3	.59	.1308	.06	.1308	.06
TOTALS----------(#/HR)--------(Kg/HR)	25662.60	11640.34	37489.40	17004.85	37489.40	17004.85	37488.31	17004.32	37488.31	17004.32
ACTUAL FLOW----(ACFM)------(AM3/HR)	24392.10	41447.10	13184.60	22403.27	11867.30	20165.04	13158.06	22358.10	12013.04	20412.56
STANDARD FLOW--(SCFM)------(NM3/HR)	5713.20	9012.13	9843.71	15527.47	9843.71	15527.47	9843.71	15527.47	9843.71	15527.47
STD. DRY FLOW-(SDCFM)-----(NM3D/HR)	5353.02	8445.12	5344.54	8430.48	5344.54	8430.48	5344.54	8430.48	5344.54	8430.48
DENSITY----(#/CU.FT.)-----(Kg/AM3)	.0175	.2808	.0474	.7590	.0526	.8433	.0475	.7605	.0520	.8330
PRESSURE-------(PSIA)------(Kg/cm2)	14.678	1.0319	13.0345	.8985	14.6924	1.0127	13.2512	.9134	14.6960	1.0130
STATIC PRESS.(in H2O)------(mm H2O)	-.5	-12.7	-46	-1168.4	-.1	-2.54	-40	-1016	0	0
TEMPERATURE--(DEG. F)------(DEG. C)	1800	982.30	169.82	76.46	178.8	81.56	178.8	81.56	186.00	84.91
MOLECULAR WEIGHT	28.95	28.95	24.55	24.55	24.55	24.55	24.55	24.55	24.55	24.55
HCl CONCEN ----(PPMV)-----(mg/NM3)	523.44	855.63	.61	.99	.61	.99	.61	.99	.61	.99
SO2 CONCEN.----(PPMV)-----(mg/NM3)	116.34	332.18	1.35	3.86	1.35	3.86	1.35	3.86	1.35	3.86
HF CONCEN.-----(PPMV)-----(mg/NM3)	14.10	12.58	.08	.07	.08	.07	.08	.07	.08	.07
PARTICULATE-(GR/SDCF)-----(mg/NM3D)	.1183	291.6470	.0284	69.9446	.0284	69.9446	.0029	7.0375	.0029	7.0375
PART.@12%CO2(GR/SDCF)-----(mg/NM3D)	.1991	490.7094	.0477	117.4811	.0477	117.4811	.0048	11.8204	.0048	11.8204
PART.@7%O2--(GR/SDCF)-----(mg/NM3D)	.2106	519.1294	.0524	129.1275	.0524	129.1275	.0053	12.9922	.0053	12.9922
PART.@6%O2--(GR/SDCF)-----(mg/NM3D)	.2258	556.4768	.0562	138.4173	.0562	138.4173	.0057	13.9269	.0057	13.9269
HCl @ 7% O2 DRY(PPMV)-----(mg/NM3D)	998.08	1625.27	2.07	3.38	2.07	3.38	2.07	3.38	2.07	3.38
HCl @ 6% O2 DRY(PPMV)-----(mg/NM3D)	1069.89	1742.19	2.22	3.62	2.22	3.62	2.22	3.62	2.22	3.62
SO2 @ 7% O2 DRY(PPMV)-----(mg/NM3D)	220.99	630.99	4.59	13.11	4.59	13.11	4.59	13.11	4.59	13.11
SO2 @ 6% O2 DRY(PPMV)-----(mg/NM3D)	236.89	676.28	4.92	14.05	4.92	14.05	4.92	14.05	4.92	14.05
HF @ 7% O2 DRY(PPMV)-----(mg/NM3D)	26.79	23.90	.28	.25	.28	.25	.28	.25	.28	.25
HF @ 6% O2 DRY(PPMV)-----(mg/NM3D)	28.71	25.62	.30	.27	.30	.27	.30	.27	.30	.27

STREAM NAME AND NUMBER / PROPERTY OR COMPONENT	6 SPRAY DRYER INLET GAS (ENGLISH)	SPRAY DRYER INLET GAS (METRIC)	7 SPRAY DRYER FAN INLET GAS (ENGLISH)	SPRAY DRYER FAN INLET GAS (METRIC)	8 SPRAY DRYER FAN OUTLET GAS (ENGLISH)	SPRAY DRYER FAN OUTLET GAS (METRIC)	9 SPRAY DRYER SYSTEM BYPASS GAS (ENGLISH)	SPRAY DRYER SYSTEM BYPASS GAS (METRIC)	10 SCRUBBER INLET GAS (ENGLISH)	SCRUBBER INLET GAS (METRIC)	11 SPRAY DRYER NOZZLE ATOMIZ. AIR (ENGLISH)	SPRAY DRYER NOZZLE ATOMIZ. AIR (METRIC)
H2O-------------(#/HR)--------(Kg/HR)	200.76	91.06	1829.30	829.75	1829.30	829.75	803.04	364.25	2632.34	1194.00	.00	.00
CO2	521.32	236.47	521.32	236.47	521.32	236.47	2085.28	945.86	2606.60	1182.33	.00	.00
CO	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
O2	695.92	315.66	764.13	346.60	764.13	346.60	2783.68	1262.65	3547.81	1609.25	68.21	30.94
N2	3708.68	1682.22	3934.88	1784.82	3934.88	1784.82	14834.72	6728.88	18769.60	8513.70	226.20	102.60
HCl	3.4	1.54	3.4	1.54	3.4	1.54	13.6	6.17	17	7.71	.00	.00
NO	0	.00	0	.00	0	.00	0	.00	0	.00	.00	.00
SO2	1.32	.60	1.32	.60	1.32	.60	5.28	2.39	6.6	2.99	.00	.00
HF	.05	.02	.05	.02	.05	.02	.2	.09	.25	.11	.00	.00
PARTICULATE	1.0860	.49	1.0860	.49	1.0860	.49	4.3440	1.97	5.4300	2.46	.00	.00
TOTALS----------(#/HR)--------(Kg/HR)	5132.34	2328.07	7055.49	3200.30	7055.49	3200.30	20530.14	9312.27	27585.63	12512.57	294.41	133.54
ACTUAL FLOW----(ACFM)------(AM3/HR)	4878.44	8289.44	3297.16	5602.54	3248.49	5519.84	19513.82	33157.08	22531.91	38284.23	10.34	17.58
STANDARD FLOW--(SCFM)------(NM3/HR)	1142.66	1808.43	1791.23	2825.49	1791.23	2825.49	4570.63	7209.71	6361.86	10033.20	65.48	103.20
STD. DRY FLOW-(SDCFM)-----(NM3D/HR)	1070.76	1689.02	1136.19	1792.22	1136.19	1792.22	4283.06	6756.09	5419.23	8548.32	65.48	103.20
DENSITY----(#/CU.FT.)-----(Kg/AM3)	.0175	.2808	.0357	.5712	.0362	.5798	.0175	.2808	.0204	.3268	.4833	7.5971
PRESSURE-------(PSIA)------(Kg/cm2)	14.6780	1.0118	14.4613	.9968	14.6779	1.0118	14.6779	1.0118	14.6779	1.0118	94.6960	6.5274
STATIC PRESS.(in H2O)------(mm H2O)	-.5	-12.7	-6.5	-165.1	-.5	-12.7	-.5	-12.7	-.5	-12.7	---	0
TEMPERATURE--(DEG. F)------(DEG. C)	1800	982.30	500	260.02	500	260.02	1800.00	982.30	1414.00	768.89	80	26.67
MOLECULAR WEIGHT	28.95	28.95	25.38	25.38	25.38	25.38	28.95	28.95	27.94	27.94	29.00	29.00
HCl CONCEN ----(PPMV)-----(mg/NM3)	523.44	855.63	335.19	545.82	335.19	545.82	523.44	855.63	471.88	768.40	.00	.00
SO2 CONCEN.----(PPMV)-----(mg/NM3)	116.34	332.18	74.22	211.91	74.22	211.91	116.34	332.18	104.48	298.32	.00	.00
HF CONCEN.-----(PPMV)-----(mg/NM3)	14.10	12.58	9.00	8.03	9.00	8.03	14.10	12.58	12.64	11.36	.00	.00
PARTICULATE-(GR/SDCF)-----(mg/NM3D)	.1183	291.6470	.1115	274.8533	.1115	274.8533	.1183	291.6470	.1169	288.1261	.00	.00
PART.@12%CO2(GR/SDCF)-----(mg/NM3D)	.1991	490.7094	.1991	490.7094	.1991	490.7094	.1991	490.7094	.1991	490.7094	.00	.00
PART.@7%O2--(GR/SDCF)-----(mg/NM3D)	.2106	519.1294	.2108	519.5359	.2108	519.5359	.2106	519.1294	.2107	519.2106	.00	.00
PART.@6%O2--(GR/SDCF)-----(mg/NM3D)	.2258	556.4768	.2259	556.9126	.2259	556.9126	.2258	556.4768	.2258	556.5639	.00	.00
HCl @ 7% O2 DRY(PPMV)-----(mg/NM3D)	998.08	1625.27	998.86	1626.54	998.86	1626.54	998.08	1625.27	998.24	1625.52	.00	.00
HCl @ 6% O2 DRY(PPMV)-----(mg/NM3D)	1069.89	1742.19	1070.73	1743.56	1070.73	1743.56	1069.89	1742.19	1070.06	1742.47	.00	.00
SO2 @ 7% O2 DRY(PPMV)-----(mg/NM3D)	220.99	630.99	221.16	631.48	221.16	631.48	220.99	630.99	221.03	631.08	.00	.00
SO2 @ 6% O2 DRY(PPMV)-----(mg/NM3D)	236.89	676.28	237.08	676.91	237.08	676.91	236.89	676.28	236.93	676.49	.06	.00
HF @ 7% O2 DRY(PPMV)-----(mg/NM3D)	26.79	23.90	26.81	23.92	26.81	23.92	26.79	23.90	26.79	23.90	.00	.00
HF @ 6% O2 DRY(PPMV)-----(mg/NM3D)	28.71	25.62	28.74	25.64	28.74	25.64	28.71	25.62	28.72	25.60	.00	.00

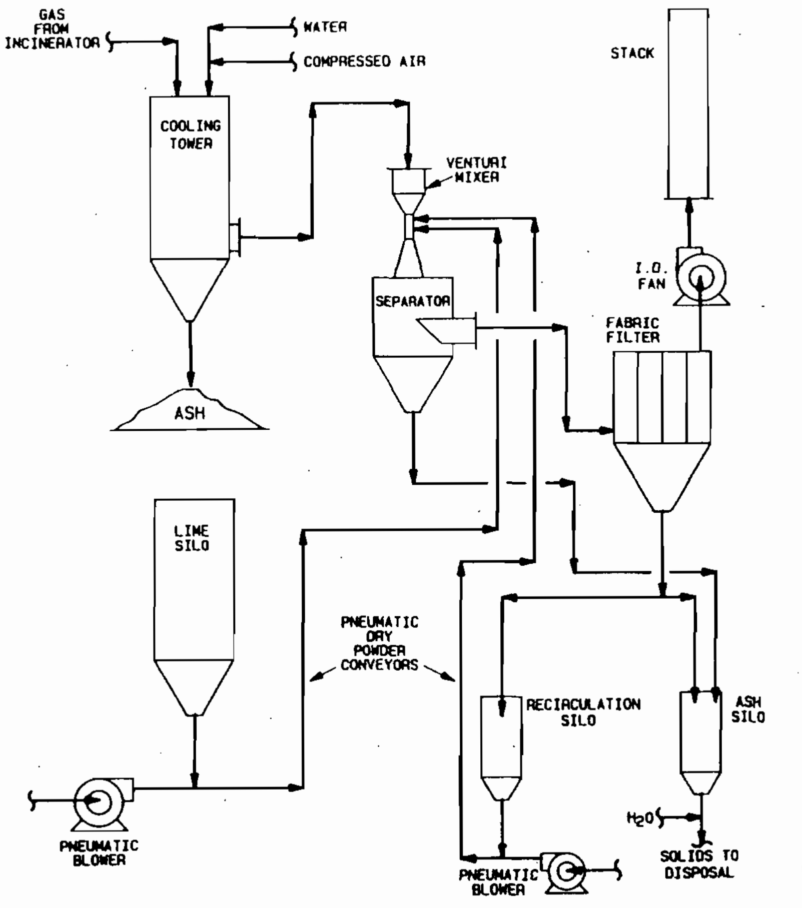
SCF = 70 DEGREES F & 14.696 PSIA (1.0 ATMOSPHERE)
NM3 = 0 DEGREES C & 1013 MILLIBARS (1.0 ATMOSPHERE)

STREAM NAME AND NUMBER / PROPERTY OR COMPONENT	12 VENTURI OR QUENCH FEED (ENGLISH)	VENTURI OR QUENCH FEED (METRIC)	13 ABSORBER FEED (ENGLISH)	ABSORBER FEED (METRIC)	14 BLOWDOWN TO SPRAY DRYER (ENGLISH)	BLOWDOWN TO SPRAY DRYER (METRIC)	15 TOTAL PUMP FLOW (ENGLISH)	TOTAL PUMP FLOW (METRIC)	16 CHEMICAL MAKEUP (ENGLISH)	CHEMICAL MAKEUP (METRIC)	17 WATER MAKEUP (ENGLISH)	WATER MAKEUP (METRIC)	18 SPRAY DRYER SOLIDS (ENGLISH)	SPRAY DRYER SOLIDS (METRIC)
H2O-------------(#/HR)--------(Kg/HR)	69754.42	31639.91	124561.47	56499.84	1629.88	739.30	195945.77	88879.04	27.17	12.33	11523.96	5227.15	1.34	.61
NaCl	1163.75	527.86	2078.12	942.62	27.19	12.33	3269.06	1482.62	.00	.00	.00	.00	27.19	12.33
Na2SO3	544.98	247.20	973.17	441.42	12.73	5.78	1530.88	694.39	.00	.00	.00	.00	12.73	5.78
NaF	22.24	10.09	39.72	18.02	.52	.24	62.48	28.34	.00	.00	.00	.00	.52	.24
NaOH	.00	.00	.00	.00	.00	.00	.00	.00	27.17	12.33	.00	.00	.00	.00
PARTICULATE	176.75	80.17	315.63	143.17	4.13	1.87	496.51	225.21	.00	.00	.00	.00	4.13	1.87
TOTALS----------(#/HR)--------(Kg/HR)	71662.14	32505.23	127968.12	58045.06	1674.45	759.52	201304.71	91309.80	54.35	24.65	11523.96	5227.15	45.91	20.83
FLOW---(U.S. GAL/MIN)--------(M3/HR)	140.00	31.79	250.00	56.76	3.27	.74	393.27	89.31	.07	.02	23.06	5.24	---	---
PRESSURE-------(PSIG)------(Kg/cm2)	40.00	2.81	40.00	2.81	40.00	2.81	40.00	2.81	30.00	2.11	30.00	2.11	GRAVITY	GRAVITY
SPECIFIC GRAVITY	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.52	1.52	1.00	1.00	---	---
TEMPERATURE---(DEG F)--------(DEG C)	170	76.46	170	76.46	170	76.46	170	76.46	90.00	32.22	70.00	21.11	300.00	148.90
SUSPENDED SOLIDS (WT %)	.25	.25	.25	.25	.25	.25	.25	.25	.00	.00	.00	.00	100.00	100.00
DISSOLVED SOLIDS (WT %)	2.42	2.42	2.42	2.42	2.42	2.42	2.42	2.42	50.00	50.00	.00	.00	.00	.00
pH	6.95	6.95	6.95	6.95	6.95	6.95	6.95	6.95	>14.00	>14.00	7.00	7.00	6.95	6.95

able system to be considered.

FIGURE 14

SORBENT INJECTION DRY COLLECTOR



As Figure 14 shows, a properly designed dry sorbent injection system is quite complex. Because the gas temperature from the incinerator is seldom cold enough for the absorption reactions to take place with any reasonable efficiency, it is first necessary to cool the gas stream in an evaporative cooling tower. The cooling tower is typically as large as the spray dryer described in Section E. above. Materials of construction concerns are equal to those discussed in Section E. Once the gas has been properly cooled, it is then introduced into a venturi mixing device where dry lime is pneumatically blown into the gas stream, mixed turbulently with the gas stream, allowed to remain in contact in the separator chamber, and is then separated from the gas stream by gravity. The exit gas is taken to a fabric filter collector as described in Section D. above, where fly ash and the residual lime and its reaction products are removed from the gas stream. Because chemical utilization is so poor in this system, it is necessary to recirculate part of the dust collected in the reactor section and part of the dust collected from the fabric filter. This recirculated material is fed in parallel to new lime into the venturi mixing section. Three separate solids storage silos are required. The largest is a lime silo for fresh lime. The second is a recirculation silo to hold the powdered material which is to be recirculated to the mixing section. Finally, an ash silo is provided to store the waste product until it can be hauled away. The waste material has a bulk density of less than 20#/ft^3 (257Kg/m^3). It is also extremely finely divided and produces dust when handled. To minimize the dust, water is added to this material before transportation and disposal.

To prevent corrosion in the baghouse (fabric filter), it is necessary to maintain the gas stream above the water and acid dew points. This requires precise temperature controls on the cooling tower and in the lime injection system. The introduction of ambient air through the pneumatic conveyors can create localized corrosion problems in the system. As a direct comparison, the venturi scrubber and packed tower absorption system, for which pricing was provided in Section A., would occupy a space approximately 20' long by 10' wide by 40' high (6.1 x 3.0 x 12.2 meters). The dry sorbent injection system shown in Figure 14 for the same gas stream would require an area approximately 60' long, 20' wide, and 40' high (18.3 x 6.1 x 12.2 meters). This does not include the silos which would have to be furnished for the lime, recirculation, and ash. Each of these silos would be approximately 6' (1.8m) in diameter by approximately 30' (9.1m) overall height. The capital cost of this system would be about two times that of the venturi scrubbing system and acid gas absorption system described in Section A above. This system, operating on the same gas stream as that described for the 1500#/hr (680 Kg/H) hospital waste incinerator, would produce about 6 cubic feet per hour (0.17m^3/h) of solid waste material. This compares with about 1.7 cubic feet per hour (0.48m^3/h) for the spray evaporator-scrubber system described in Section E. above. The waste material is highly alkaline rather neutral, as would be the case for the spray evaporator-scrubbing system described in Section E. above. Approximately half of the total weight of the waste solids from the sorbent injection system would be unreacted alkali. Operating costs for the system are estimated at about 20% greater than for the scrubbing system described in Section A. above. It is thus difficult to see how such a system can be considered economical for small incinerator applications. Where very large municipal waste incinerators are involved, it is quite probable that this type of system can become economically competitive.

G. Spray Reactor Semi-Dry Scrubbers

The only obvious difference between a spray reactor semi-dry scrubber system and the dry sorbent injection systems described in Section F. above is the method of introduction of the alkaline absorbant. In the spray reactor system, the lime is first fed to a slaker, where water is added to make a paste and to hydrate the lime to Ca $(OH)_2$. This paste is then fed into an agitated slurry tank where additional water is added and a lime slurry is prepared. This slurry will vary in suspended solids concentration from a low of about 5% (wt) to a high of about 30% (wt). The lime slurry is then fed into a spray reactor where it is contacted with moderate temperature gas from the incinerator, after the waste heat boiler or after gas pre-conditioning. The inlet temperature to the spray reactor is normally controlled at about 500°F (260°C) and the outlet gas temperature from the spray reactor is controlled at about 340°F (171°C). Lime slurry introduction can be done through dual fluid nozzles where air is used to atomize the slurry, or through rotary atomizers where high speed rotating wheels atomize the liquid by injecting it through small orifices which cause shear of the liquid when the liquid hits the gas stream in which the wheel is turning. While the liquid droplets still exist, acid gases are absorbed into them. The acid gases react with the slaked lime in the slurry droplet and water is then evaporated by sensible heat from the gas stream until only the solid reaction products and unreacted lime remain. Although chemical stoichiometry may be somewhat better than for the dry sorbent injection systems, these units are seldom operated at less than 150% of stiochiometric lime equivalent. These systems also suffer from relatively low removal efficiencies, typically less than 90% for HCl and typically less than 70% for sulfur dioxide. In general, the lower the exit gas temperature from the spray reactor, the higher the acid gas removal efficiency and the higher the chemical utilization. However, just as in any other fabric filter system, the closer the gas stream is operated to the water dew point or the acid dew points, the greater the chance of severe corrosion problems in the fabric filter. Thus, conditions which create ideal chemical utilization and ideal acid gas removal efficiency also create potentially severe maintenance problems.

Figure 15 shows a typical spray reactor semi-dry scrubbing system. With the exception of the recirculation silo for lime, the system occupies about the same space that the dry sorbent injection system does. The spray reactor is typically larger than the mixing section in the dry sorbent injection system. The cost of the system is also nearly equal to that of the dry sorbent injection system and is much more expensive than the wet collector for the same size gas stream. As mentioned above, chemical utilization is slightly better than for the dry sorbent injection system. Operating costs for this system are nearly equal to those required for the venturi scrubber and acid gas absorber system. Operating costs, however, are highly dependent upon how frequently the fabric filters must be replaced. It would be necessary to achieve a minimum two-year filter bag life in the fabric filter collector for operating costs to remain comparable to those for the venturi scrubber and acid gas absorber system.

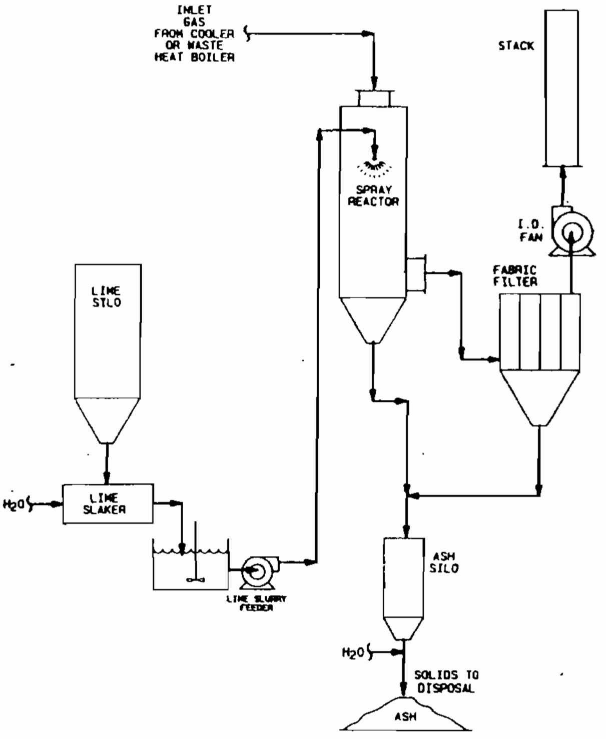
There are many publications available on dry collection systems for acid gases and particulate matter in incinerators. Two of these are referenced here.[20,21]

VI. AUXILIARY EQUIPMENT

When one installs an incinerator emission control system, there are a number of auxiliary items which must be installed to support the system. This section of this brochure describes some of those auxiliary items.

FIGURE 15

SPRAY REACTOR SEMI-DRY SCRUBBER



A. Chemical Storage and Feed Systems

In most incineration applications, sodium hydroxide (caustic soda) sodium carbonate (soda ash), calcium oxide (burned or pebble lime), or calcium hydroxide (slaked lime), is used as the chemical absorbant for acid gases. These chemical reactants must be stored at the use point in large enough quantities to minimize deliveries into the incineration facility. We recommend that a minimum 14-day storage be provided. Sodium hydroxide is delivered in either 50% (wt) solution or, in some areas, in 25% (wt) solution. Under RCRA regulations, storage tanks for caustic soda must have secondary containment basins. Andersen 2000 Inc. supplies high density, cross-linked polyethylene rotationally molded tanks and secondary containment basins for sodium hydroxide storage. These tanks are inexpensive, completely corrosion resistant, weather resistant, and suitable for outdoor storage. These are probably the most inexpensive storage tanks available for corrosive materials. Caustic soda can also be stored in mild steel tanks or in stainless steel tanks. Caustic soda requires heating to prevent crystal formation and freeze-up during cold winter temperatures. Andersen 2000 Inc. provides a recirculation heating system for sodium hydroxide to ensure against crystal formation or freeze-up.

Soda ash is normally delivered in a crystalline powder form in bulk trucks or in 100 pound (45Kg) bags. Soda ash is soluble in ambient temperature water up to about 30% (wt). It is normally dissolved in water and then fed to the scrubbing system as a liquid solution. Andersen can provide dry storage silos with automatic dissolving systems and feed systems for soda ash, or Andersen can supply a unique slurry storage system for soda ash which enables the direct hydration of the soda ash when a pneumatic truckload is unloaded into the tank. These systems are constructed of mild steel and are suitable for outdoor locations.

Both burned lime (CaO) and slaked lime ($Ca(OH)_2$) must be stored in weather protected silos where moisture cannot get to the materials. These are normally elevated storage bins of mild steel welded construction with conical bottoms. These must always be equipped with bin activators at the bottoms of the bins to prevent bridging inside the bin. Andersen can furnish such systems with conveyor filling mechanisms or with pneumatic filling mechanisms. Lime slakers are available from a number of suppliers in the United States and throughout the world. Because the reaction between burned lime and water is highly exothermic (gives off heat), it is absolutely essential that lime be stored in a completely moisture-free environment. Silo design is thus quite important.

The feed systems for these alkaline materials are subjected to rather severe operating conditions. In the case of sodium hydroxide or soda ash, the alkaline materials tend to attack normal elastomers. In concentrated form, both caustic soda and soda ash solutions can cause severe burns to the skin. Design of the feed system from a safety point of view is thus extremely important. Lime feed systems are subjected to severe abrasion. Lime slurries are quite abrasive. Rubber lined centrifugal pumps are frequently employed to convey this material.

B. Exhaust Stacks

One of the most common mistakes made in incinerator emission control system installations is the selection of the exhaust stack. Incinerators are normally equipped with refractory lined exhaust stacks. There are also a number of such systems which utilize brick stacks or masonry stacks. It is not uncommon for an incinerator operator to assume that after installation of a scrubbing system, the exhaust gas can then be routed back to the existing exhaust stack. Unfortunately, the wet gas streams from scrubbing systems are acidic and will attack most refractories and most masonry work. This attack can be quite rapid and the chemicals which are leached out of the masonry can become reentrained in the gas stream and show up as particulate emissions. Unless the exhaust gas from the scrubbing system is first reheated, it should not be routed back to a masonry or refractory lined exhaust stack. It should, instead, be exhausted through a fiberglass reinforced vinylester stack, a high nickel alloy stack, a rubber lined mild steel stack, or some other corrosion resistant stack. This same stack should not be used as the bypass stack in the event of scrubber failure. The high temperature gases from the incinerator would cause rapid deterioration and failure of such an exhaust stack.

C. Ducts and Dampers

The connecting duct between the incinerator system and the air pollution control device should be refractory lined. The lining should be exactly the same refractory as used in other ducting in the incinerator. Exhaust ducts from a scrubbing system or air pollution control device should be made of the same materials mentioned for exhaust stacks in Section B. above. Dampers should also be made of these same corrosion resistant materials unless they are on the incoming gas streams. If they are on the incoming gas streams, refractory covered dampers should be used.

D. Waste Storage Systems

If wet scrubbers are used for emission controls, and if liquid waste is produced, high density, cross-linked polyethylene rotationally molded tanks are the least expensive and most corrosion resistant tanks available for these waste liquids. These are available in capacities of up to about 10,000 gallons ($38m^3$). Multiple tanks can be used if capacity needs dictate it. For waste solids produced by spray evaporator-wet scrubber systems, open topped bins can be used, as long as they are protected from rain and snow. For the dry sorbent injection systems, or for spray reactor dry scrubber systems, the solid material is much too dusty to be stored in an open container. These materials need to be stored in silos, wetted before handling, and transported in closed containers. Again, we recommend minimum storage capacity of 14 days if the waste materials must be stored.

VII. SUMMARY

Thermal oxidation and incineration of waste materials is rapidly gaining favor worldwide for hospital wastes, municipal solid wastes, and hazardous wastes. Different incineration systems are used for each of these applications. Emission control systems are available to control particulate emissions and acid gases from each of the incinerator types used. The most commonly employed emission control systems are wet scrubbers. Fabric filters and electrostatic precipitators are also sometimes used, particularly for municipal waste incinerators. Regulatory requirements for air emissions are rapidly becoming much more restrictive in all locations throughout the world. The emission regulations are forcing the development of new and improved technologies for controlling exhaust gas emissions from incinerators. New control devices are available which bring exhaust gas emissions from incinerators to the lowest levels measured for any industrial source anywhere in the world. The trend toward more stringent emission controls and improved control equipment will continue. Incinerator emission control devices can be operated reliably and economically while achieving even the most stringent emission regulations. The systems are quite expensive in initial capital cost because of the materials of construction which are required to resist the high temperatures and corrosive conditions produced in most incinerator exhaust gases. Andersen 2000 Inc is a highly experienced supplier of all types of incinerator emission control systems and will be happy to work with you in selecting the technically correct and economically attractive emission control device for your incineration application.

REFERENCES

1. Brunner, C.R., "Hazardous Air Emissions from Incineration," Chapman and Hall, Second Edition, New York, 1986.
2. Midwest Research Institute, "Operation and Maintenance of Hospital Medical Waste Incinerators," EPA Contract No. 68-02-4395, Dec. 16, 1988.
3. Ontario Ministry of the Environment, "Incinerator Design and Operating Criteria," Volume II-Biomedical Waste Incineration, Oct. 1986.
4. Cross, Frank L., Jr., "Hospital Incinerator-The Case for Regional Incineration," 2nd National Symposium on Incineration of Infectious Wastes, San Francisco, CA, Sept. 21, 1988.
5. Allen, R.J., et al, "Incineration of Hospital Waste," Journal of the Air Pollution Control Association, vol. 36, #7, July 1986.
6. Tessitore, Joseph L., et al, "Incineration of Hospital Infectious Waste," Pollution Engineering, Nov. 1988.
7. Shuler, Steve, "Controlled Air Incineration for Biohazardous Waste," National Symposium on Incineration of Infectious Wastes, San Francisco, CA, Sept. 1988.
8. Lauber, Jack D., "The Incineration of Low Level Radioactive Wastes," Conference on Toxic Substances Sponsored by The Air Pollution Control Association, Montreal, Quebec, Canada, April 1988.
9. Koenig, R.A., et al, "The Los Alamos Controlled Air Incinerator for Radioactive Waste," Vols. I-III, United States DOE Hazardous Waste Remedial Actions Program, Oct. 1987.
10. U.S. EPA, "Technologies Approaches to the Cleanup of Radiologically Contaminated Superfund Sites," Office of Research and Development, August 1988.
11. Howes, J.E., Jr., et al, Battelle, Columbus Laboratories, "Characterization of Stack Emissions from Municipal Refuse-to-Energy Systems," United States Environmental Protection Agency Contract 68-02-3458, October 1986.
12. Brna, T.G., "Cleaning of Municipal Waste Incinerator Flue Gas in Europe," Air and Energy Engineering Research Laboratory, U.S. Environmental Protection Agency, Research Triangle Park, N.C., January 1988.
13. Siebert, Paul C., et al, "Effective Control Equipment and Operating Parameters on Municipal Solid Waste Incinerator Trace Emissions," Roy F. Weston, Inc., Air Pollution Control Association Annual Meeting, 1988, Paper #88-98.3.
14. Lee, Johannes W., "Distribution of Trace Element Emissions from the Liquid Injection Incinerator Combustion Research Facility," Acurex Corporation for United States Environmental Protection Agency, EPA Contract 68-03-3267, August 1987.
15. Lee, C.C., "A Model Analysis of Metal Partitioning in a Hazardous Waste Incineration System," Journal of the Air Pollution Control Association, vol. 38, #7, July 1988.
16. Brady, J.D., et al, "A Wet Collector of Fine Particles," Chemical Engineering Progress, August 1977, Pages 45-53.
17. Brady, Jack D., et al, "A New Wet Collector for Fine Particle Emission Control," American Institute of Chemical Engineers, 69th Annual Meeting, Chicago, IL, November 28 - December 2, 1976.
18. United States Environmental Protection Agency, Office of Air Quality Planning and Standards, "Urea Manufacturing Industry, Technical Document," US EPA Report #450/3-81-001, January 1981.
19. Brady, Jack D., "A Filtration Augmented Wet Collector for P2O5 Emission Control," Air Pollution Control Association, 70th Annual Meeting, Toronto, Ontario, Canada, June 20-24, 1977.
20. Schmal, D., et al, "Some Physico-Chemical Aspects of Dry Sorbent Injection for Removal of HCl and HF from Waste Incinerator Flue Gases," Journal of the Air Pollution Control Association, vol. 39, #1, January 1989.
21. Frame, Grant B., "A Comparison of Air Pollution Control Systems for Municipal Solid Waste Incinerators," Journal of the Air Pollution Control Association, Vol. 38, #8, August 1988.

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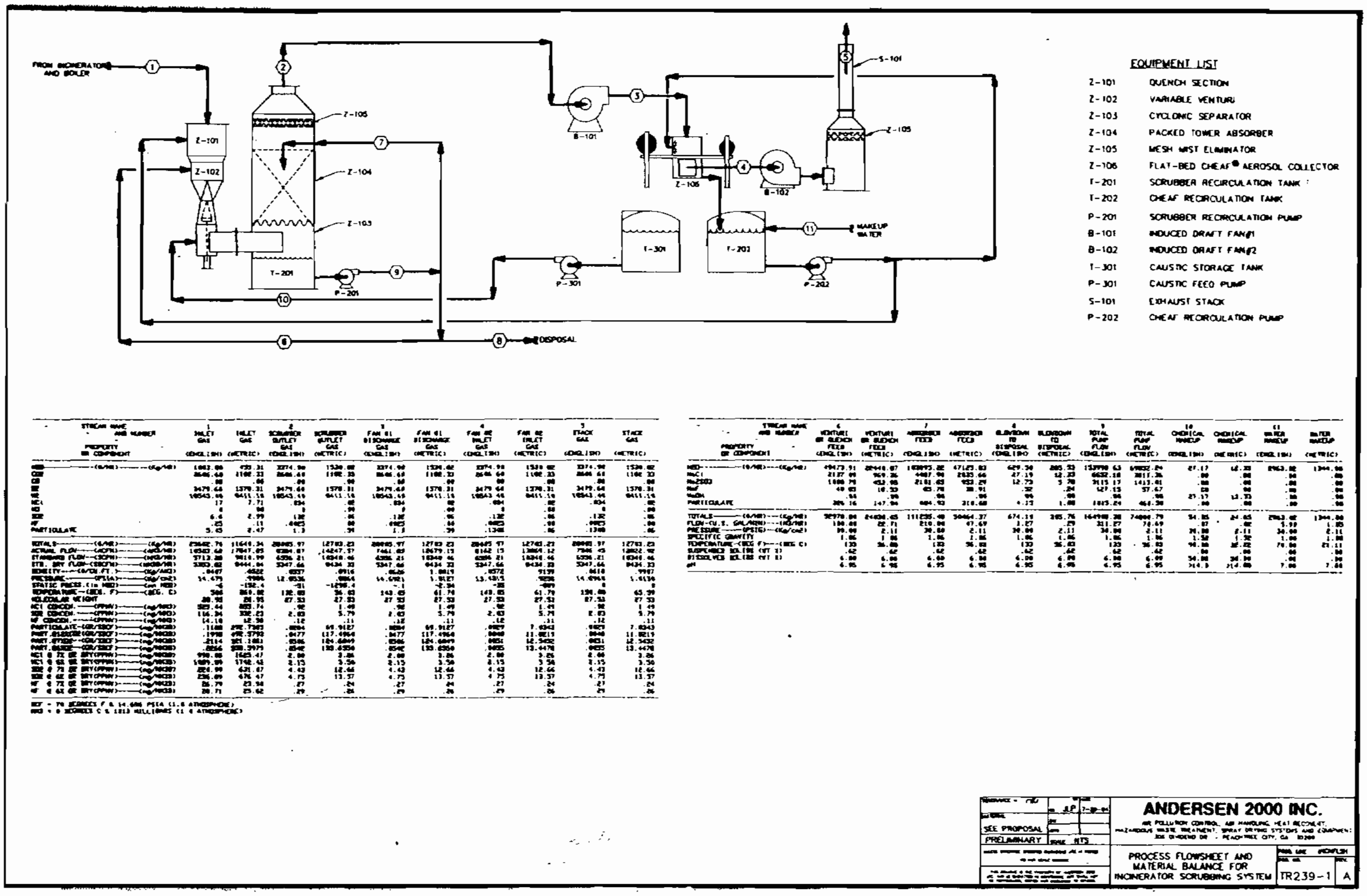
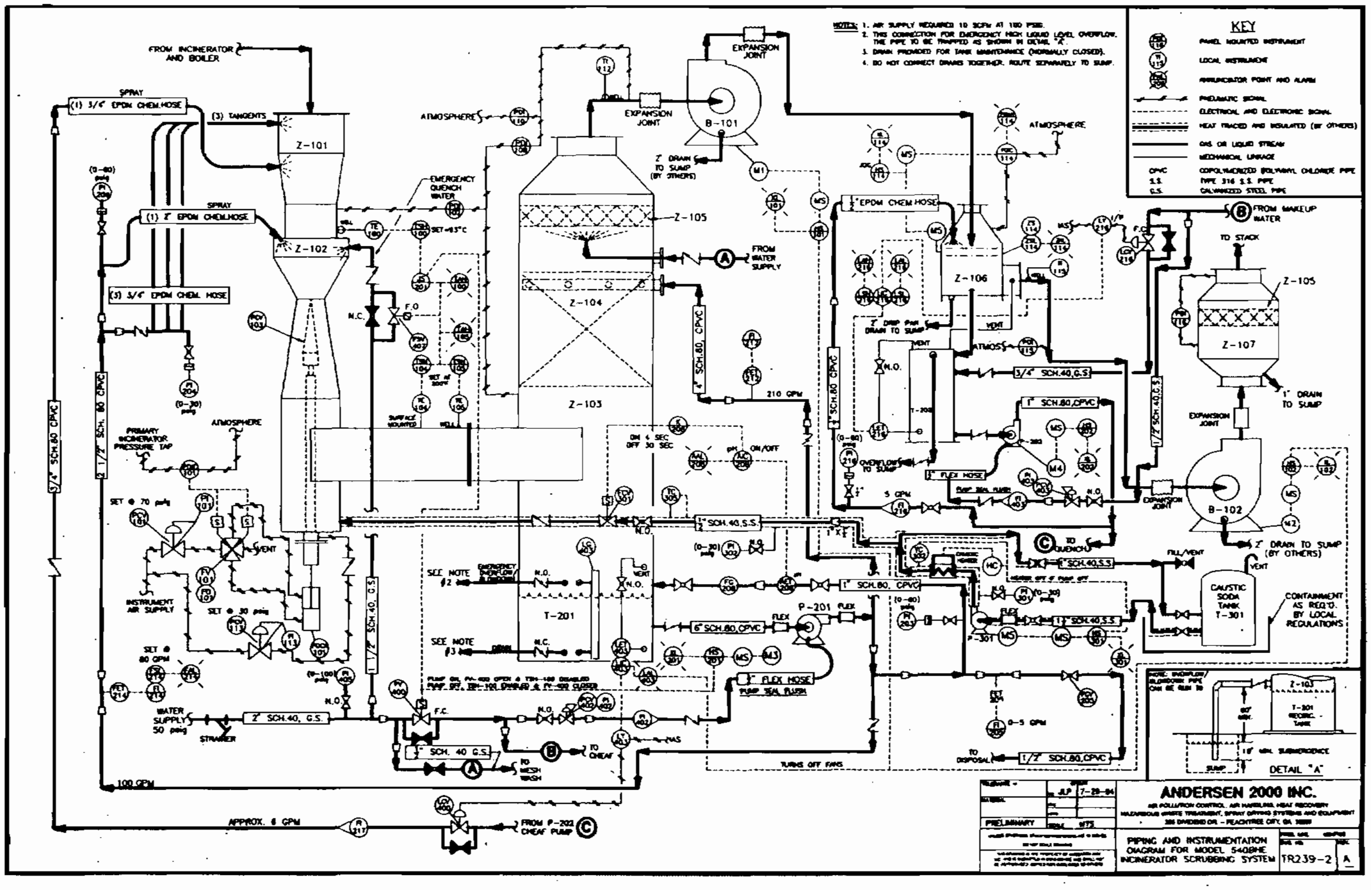


PROCESS FLOWSHEET & MATERIAL BALANCE FOR MEDICAL WASTE INCINERATOR SCRUBBING SYSTEM



PIPING & INSTRUMENTATION FOR MEDICAL WASTE INCINERATOR SCRUBBER

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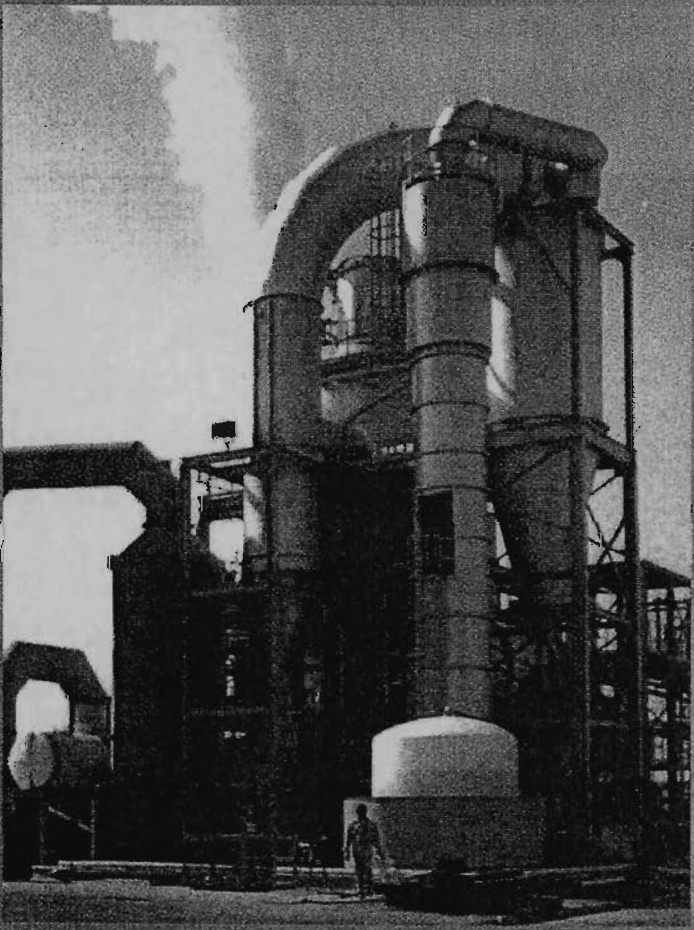

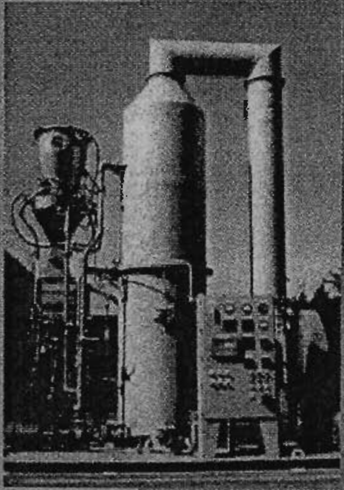

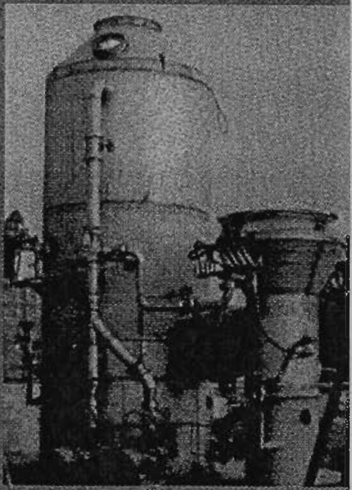

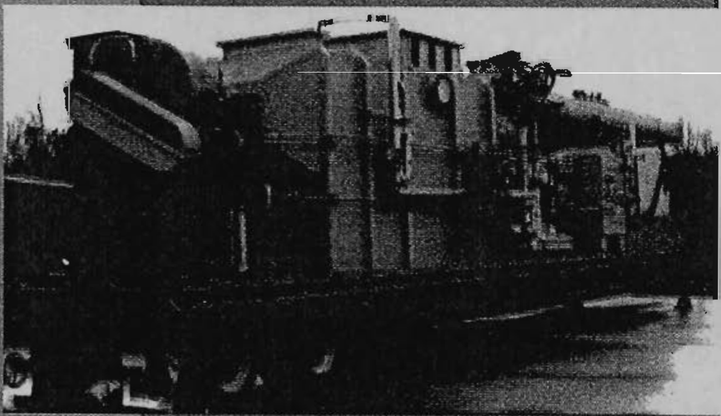

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ATTACHMENT A

DESCRIPTION OF PROPOSED CONSTRUCTION

ATTACHMENT A
DESCRIPTION OF PROPOSED CONSTRUCTION

1.0 INTRODUCTION

Dixie Waste Services LLC (DWS) is proposing to construct and operate a waste gasification/thermal oxidizer (WG/TO) plant on an 18.5-acre parcel adjacent to an existing solid waste transfer facility east of Rollinston Road in Dixie County, Florida. DWS is applying for a minor sources air construction permit from the Florida Department of Environmental Protection (FDEP) to construct the proposed facility that will be designed to burn 150 tons per day (TPD) of municipal solid waste (MSW), tire-derived fuel (TDF), and medical waste. Based on the maximum pollutant emissions estimated for the project, the project is considered a minor source under the New Sources Review (NSR) program, with annual emissions less than 250 tons per year (TPY) for applicable pollutants. A site plan indicating the location of the proposed facility is included as Attachment DWS-FI-C1 of the Air Construction Permit application.

The proposed WG/TO process consists of a batch operation. Incoming wastes delivered to the site by trucks are deposited in one of three insulated primary gasification chambers (combustors) each having a capacity of combusting 50 TPD of waste. Modular combustors, as proposed for this project, are not uncommon and are similar to mass burn combustors in that the waste is not pre-processed. The literature states that most facilities are in the range of 5 to 140 TPD [U.S. Environmental Protection Agency (EPA) Compilation of Air Pollutant Emission Factors (AP-42), 1996].

Starved-air modulars are one of the most common types of modular combustors. This system incorporates two chambers in which air is supplied to the primary chamber at sub-stoichiometric levels. The combustion in the primary chamber creates incomplete combustion products consisting of carbon monoxide (CO) and organic compounds. These gases pass into a secondary chamber where additional air is added and combustion is completed.

The proposed project has been designed utilizing similar concepts to a modular combustor with the exception that waste will be separated prior to combustion to ensure that hazardous materials with products containing lead and mercury, such as batteries and mercury-containing equipment, are removed from the waste stream prior to combustion. The proposed WG/TO will be subject to the New Source Performance Standards (NSPS) Subpart AAAA, codified in the Code of Federal Regulations (CFR), Title 40, Part 60, Subpart AAAA (40 CFR 60.1000), as described below in the applicable regulations section, that mandates a waste separation plan with a goal to minimize the introduction of the above-referenced materials into the combustion process.

The proposed WG/TO plant will be equipped with a wet scrubber to remove acids, sulfur dioxide (SO_2) and particulate matter (PM) not captured in the combustion process. Although the design and selection of the specific scrubber has not been completed, the emission control information from the proposed vendor is included in this application to demonstrate the control efficiencies anticipated for the proposed control equipment. The FDEP will receive more specific information once the design of the control equipment has been completed.

The proposed project provides the state of Florida with a technology that provides an alternative for disposing of MSW, tires, and certain levels of medical waste instead of using conventional land filling techniques. Although conservative emission factors were used in estimating the emissions for this facility, based on AP-42 factors or source testing data (see attached permit application), the emissions estimated for this project will be able to meet the NSPS emission limits and will be at or below the emission thresholds requested in this application. This project has been fully accepted by the Dixie County Board of County Commissioners, as described in the documentation attached to this application.

The purpose of this application is to provide the FDEP with the information to issue the necessary Air Construction Permit to construct the WG/TO plant. Additionally, DWS is requesting that the facility be allowed to conduct trial burns on the proposed and various other waste streams to establish emission factors and to determine if additional cells (beyond the 3 cells initially proposed) can be constructed while maintaining minor source status under the NSR program (i.e., less than 250 TPY for applicable pollutants). The proposed facility is designed with a finished floor slab several feet above existing grade to facilitate the construction of the cells and tipping of the waste into the cells. To facilitate the addition of future cells, DWS will construct a pad and floor slab that will allow for future cells if the facility can demonstrate through compliance testing that additional combustors can be added while maintaining minor source status. DWS will apply for a modification to their existing permit if any additional capacity is requested.

This attachment contains two additional sections. A description of the proposed project, including air emission estimates, is presented in Section 2.0. The air quality review requirements and source applicability of the proposed project, in relation to regulatory requirements, are discussed in Section 3.0.

2.0 PROJECT DESCRIPTION

2.1 Modular air-starved waste combustors

The proposed WG/TO plant will consist of three primary chambers connected to a common thermal oxidizer (i.e., the secondary chamber). The MSW, TDF, and medical waste material received at the proposed facility will be placed into one of the three gasification chambers or cells through a load access door. The collection vehicles discharge their waste loads directly into the cells. Once each cell has received the required mix of waste, the doors to the cell are closed and the combustion process is initiated.

The waste in the primary chamber is combusted in an oxygen-depleted environment at temperatures below 900 degrees Fahrenheit (°F). Retention times in the primary chamber are long, lasting up to 12 hours. Gases generated in this primary chamber are vented to a secondary gas processor where the gases are mixed with ambient air and channeled through a turbulence device and pilot light, igniting the gas and air mixture. The combustion of gases in the secondary chamber is conducted in an environment with temperatures between 1,600 and 2,000°F for a period of not less than 4 seconds. The exhaust gases will exit to the atmosphere through a wet scrubber, providing additional pollutant emission control.

The proposed WG/TO units will have auxiliary fuel burners located in both the primary and secondary combustion chambers. The combustion process is self-sustaining so that continuous use of auxiliary fuel is not required other than at start-up and to sustain the desired temperature in the secondary chamber. Propane will be utilized as the start-up and sustaining fuel. Diesel fuel oil may be used as an alternative start-up fuel in the primary chamber.

The high combustion temperatures and the proper mixing of the flue gas with air in the secondary chamber provide good combustion, resulting in relatively low CO and traces of organic emissions. The introduction of limited amounts of air in the primary chamber results in low velocities and low entrained PM. Most existing modular systems do not have air pollution controls, but newer units have acid gas and PM controls.

MSW currently delivered to the adjacent Dixie County transfer facility will be the sole source of MSW. The MSW will undergo an inspection and separation in accordance with the existing segregation plan for the adjacent transfer station. The segregation plan will be modified to incorporate the proposed project and will be presented to the FDEP under a separate report after soliciting input from two public meetings. MSW, if received from other service areas, will undergo similar inspection and segregation prior to the waste being directed to the WG/TO cells.

2.2 Waste Description

2.2.1 MSW Description

The EPA defines MSW to include durable goods, containers and packaging, food waste, yard waste, and miscellaneous organic waste from residential, commercial, institutional, and industrial sources. MSW excludes industrial waste, agricultural waste, sewage sludge, and all categories of hazardous waste including batteries and medical waste. MSW has a useful energy heat input of 4,500 British thermal units per pound (Btu/lb) with an ash residue of about 2 percent.

2.2.2 TDF Description

The disposal of used tires has been a significant environmental issue due to their resistance to degradation and poor compatibility with landfilling. In 1989, Florida implemented a waste tire management program resulting in the FDEP promulgating Chapter 62-711 to regulate the disposal of tires in Florida. Since 1990, significant progress has been made toward this environmental issue. However, Florida generates 19.5 million waste tires per year and disposal/recycling is still an ongoing issue. This is summarized in the FDEP's publication *Waste Tires in Florida*, State of the State Report, March 24, 2004. Although recycling opportunities are available, the market is currently insufficient to handle the large number of stockpiled tires. TDF has useful energy with a higher heating value of 15,500 Btu/lb as compared with the heating value of MSW of 4,500 Btu/lb and lower ash than MSW.

2.2.3 Medical Waste

Medical waste disposal will be limited to the class of waste generated in physician offices. Medical waste has useful energy with a heating value of 8,500 Btu/lb but a higher ash content of about 6 percent.

2.3 Air Emissions

Various sources of emission factors were evaluated and used to determine maximum emissions for this project. Stack test data from the vendor, International Environmental Technology, as well as data from a similar facility in Barrow, Alaska, and emission factors from EPA's Compilation of Air Pollutant Emission Factors, AP-42 were evaluated, with supporting information presented in Attachment B. The emission data obtained from the vendor and source testing performed for similar facilities did not include the use of control equipment, such as the wet scrubber proposed for this project.

A summary of the number of emission tests available from trial burns and stack tests for the various pollutants is presented in Table 2-1. A summary of the selected emission factors for this project is presented in Table 2-2.

The emission factors from the test and source data provided were normalized to the units of pounds per million British thermal units (lb/MMBtu). The vendor-provided data and source testing were compared with published emission factors for starved-air modular combustors as reported by EPA in AP-42.

For MSW and medical waste, the maximum emission factors used were the maximum emissions reported from either AP-42 or the source testing data. The maximum emission factor from the source test data was used to establish TDF emission factors. In the absence of source test data, emission factors from AP-42 were utilized.

Source test data for MSW were used for mercury emissions instead of the AP-42 emission factor since the source test data included the separation of material containing mercury from the waste stream. The emission factors from these tests better represent mercury emission factors for the proposed project. For CO emissions from medical waste, the AP-42 emission factor was used since the highest stack test value for CO was not consistent with the values for the other stack tests or the AP-42 emission factor.

The applicant, as previously stated, will conduct trial burns to confirm the emission factors proposed for this project and/or to adjust the emission factors if the test indicate that lower factors are justified.

As previously discussed, the proposed project will have two emissions controls. First, a thermal oxidizer, which makes up the secondary chamber of the WG/TO, will control the emissions of organics. Second, the exhaust gas from the thermal oxidizer will flow to a wet scrubber to control SO_2, PM and acid gases. The proposed scrubber control technology provided by Andersen 2000 Inc is presented in Attachment DWS-EU1-I3. The vendor information for a similar incinerator scrubber indicates control efficiencies for several pollutants as follows:

- HCl- 99.8 percent (Inlet to outlet concentration of 998 to 2 ppmvd, at 7 percent oxygen)
- SO_2- 97.9 percent (Inlet to outlet concentration of 998 to 2 ppmvd, at 7 percent oxygen)

Based on this information, a control efficiency of 98 percent was used in estimating SO_2 and hydrochloric acid emissions. A control efficiency of 95 percent was utilized in estimating PM and metal emissions

The MSW can also be combusted with varying amounts of TDF and medical waste. Various combinations of waste mixes were evaluated to estimate the hourly and annual emissions associated for various pollutants under the worst-case combination of waste mix while maintaining the minor source status for NSR permitting purposes. The maximum hourly emissions are based on the highest emission factor for each fuel as presented on Table 2-3.

When burning medical waste, the maximum hourly emissions are based on the waste containing 8 percent medical waste with the remainder either MSW or TDF, whichever produced the higher emission rate. The maximum estimated annual emissions were based on the fuel mix which produced the highest annual emission for each pollutant. The applicant under normal conditions seeks to maximize the combustion of medical waste, up to 8 percent by weight, on an annual basis, flowed by the combustion of TDF and the MSW. The ideal fuel mix on an annual basis consists of 45 percent MSW, 47 percent TDF and 8 percent medical waste.

Summaries of the annual emission rates for the project for the range of waste mixes that the project can burn is presented in Tables 2-4 a through 2-4 e. A summary of the maximum overall annual emission rates for the project is presented in Table 2-4f. Table 2-4f highlights the maximum annual emissions for various waste mixes for each pollutant while combusting 150 TPD of waste.

For each pollutant, the maximum hourly emissions were used to compare with the NSPS emission limits. A summary of the pollutant emission limits for New Small Municipal Waste Combustion Units (NSPS, Subpart AAAA) is presented in Table 2-5. As demonstrated in the application, all of the hourly emission rates for each pollutant are below the NSPS limit as presented in Table 2-6.

2.4 Good Engineering Practice Stack Height

The 1977 Clean Air Act (CAA) Amendments require that the degree of emission limitation required for control of any pollutant not be affected by a stack height that exceeds good engineering practice (GEP) or any other dispersion technique. On July 8, 1985, The EPA promulgated final stack height regulations (EPA, 1985a). The FDEP has adopted identical regulations (Rule 62-210.550, F.A.C.). GEP stack height is defined as the highest of:

1. 65 meters (m); or
2. A height established by applying the formula:

$Hg = H + 1.5L$

where:

Hg = GEP stack height;

H = Height of the structure or nearby structure; and

L = Lesser dimension (height or projected width) of nearby structure(s); or

3. A height demonstrated by a fluid model or field study.

The proposed facility will have a stack of 30 feet high and will comply with GEP.

3.0 RULE APPLICABILITY

3.1 PSD Source Review

Dixie County and adjacent counties, as well as the entire state of Florida, are classified as attainment or maintenance areas for all criteria pollutants [SO_2, nitrogen dioxide (NO_2), PM_{10}, CO, ozone (O_3), and lead]. Therefore, the air permitting would follow the NSR requirements for major sources under the Prevention of Significant Deterioration (PSD) regulations or for minor sources under minor source review requirements.

Because the proposed project is not one of the 28 named major source categories under PSD regulations, the major source threshold is 250 TPY for any of the criteria pollutants. The proposed facility intends to remain as a minor source under PSD regulations, and therefore, the project's maximum criteria pollutant emissions will remain below 250 TPY.

3.2 NSPS Subpart AAAA Requirements

The project is subject to the EPA's NSPS promulgated on December 6, 2000, for small municipal waste combustion units codified in 40 CFR 60.1000, Subpart AAAA. The NSPS establish emission limits and monitoring and reporting requirements for categories of sources determined to cause or contribute significantly to air pollution that may reasonably be anticipated to endanger public health or welfare.

Subpart AAAA establishes emission standards and requirements for monitoring, performance tests, recordkeeping, and reporting for MSW combustors with a capacity of between 35 TPD and 250 TPD. Each primary cell for the proposed WG/TO facility will be a 50-TPD combustor and, therefore, must comply with Subpart AAAA (presented below). The facility can combust up to 8 percent by weight of medical waste commingled with MSW.

The proposed facility will have to comply with the NSPS, which include the following five major components, which are discussed in greater detailed below:

- Preconstruction requirements
    - Materials separation plan
    - Siting analysis
- Good engineering combustion practices
    - Operator training
    - Operator certification
    - Operating requirements
- Emission limits
- Monitoring limits
- Recordkeeping and reporting

The materials separation plan and siting analysis are preconstruction requirements. The post-construction requirements in Subpart AAAA will be met during the commencement of operation. The two preconstruction and three post-construction requirements are discussed below.

3.2.1 Preconstruction Requirements

The preconstruction requirements in Subpart AAAA will be met prior to the commencement of construction. These preconstruction requirements will be submitted to FDEP under separate reports. These two requirements are discussed in the following sections.

Materials Separation Plan – A materials separation plan will be prepared that addresses a goal and an approach for separating certain components of MSW from a given service area prior to combustion and making them available for recycling. A draft materials separation plan will be prepared and made available to the public for review. DSW will also publish a notice of the public meeting in a local newspaper. The final segregation plan will be submitted to the FDEP as part of the notice of construction. Once the draft separation plan is prepared, a public meeting will be held to present the draft plan to the public. Comments received from the public will be incorporated into a revised plan that will be presented to the public during a second meeting. A response to public comments received during the second public meeting will be incorporated into the final plan and submitted to the FDEP.

Siting Analysis – A siting analysis, reported under a separate report will address the WG/TO plant's potential effects on ambient air quality, visibility, soils, vegetation, and other relevant factors, such as an analysis of alternatives for controlling air pollution to minimize potential risk to the public health.

The analysis will be made available to the public and will be presented in a public meeting. Responses will be prepared addressing comments received during the public meeting. The analysis will be distributed to the main public library in the area of the proposed project. A public notice of a meeting to present the siting analysis will be published in a local newspaper and a public meeting will be held to respond to public comments. The public meeting to review the siting analysis will be combined with the second meeting to discuss the responses of the separation plan. Responses to public comments will be summarized in a document to be made available to the public. A transcript of the public meeting of the siting study will also be prepared.

3.2.2 Good Engineering and Combustion Practices

Good engineering and combustion practices will be conducted during the operation of the facility. The components of this requirement consist of operator training using an EPA or state-approved training course, operator certification, and operating requirements.

3.2.3 Emission Limits

Subpart AAAA establishes emission standards and requirements for monitoring, performance tests, recordkeeping, and reporting for all affected sources. These requirements are discussed in the following sections.

Pollutants regulated by Subpart AAAA include organics (dioxins/furans), metals (cadmium, lead, and mercury), opacity, PM, acid gases (hydrogen chloride), NO_x, SO_2, CO, and fugitive ash.

Subpart AAAA establishes two classes of units depending on the aggregate plant combustion. The Class I category applies to plants with combustion capacity greater than 250 TPD, while the Class II category applies to plants with combustion capacity of less than or equal to 250 TPD. The Class I and II categories have identical requirements, except that the Class I category has a NO_x emission limit of 150 parts per million by volume dry (ppmvd) and requires a continuous monitoring system that can be used to determine and record compliance. The proposed project will be classified as a Class II unit and, therefore, would not be required to perform monitoring, testing, recordkeeping, or reporting to demonstrate compliance with the NO_x emission limit.

Subpart AAAA establishes emission standards for various regulated pollutants. Emission limits for these regulated pollutants are summarized in Table 2-5. A comparison of the project's maximum emissions to the NSPS limits is presented in Table 2-6.

In addition to maintaining records of continuous emissions monitoring, (CEM) data and stack emission data, the facility will maintain daily logs of the weight and type of waste combusted.

3.2.4 Monitoring Limit

The monitoring requirements under Subpart AAAA are presented in Table 2-5 along with the proposed method of compliance. CEM will be required for SO_2 and CO. Although a CEM is not required for NO_x for Class II units, the applicant is requesting using a CEM to monitor compliance.

3.2.5 Recordkeeping and Reporting

The following five items must be submitted by the submittal date of the construction permit application:

- A draft materials separation plan;
- A revised materials separation plan;
- The notice if the initial public meeting of the draft separation plan;
- The transcript of the initial public meeting; and
- A document that summarizes the responses to the public comments.

A notice of construction must be submitted that includes the following items:

- A statement of intent to construct a MSW combustion unit;
- Planned initial startup;
- Types of fuels that are planned to be combusted;
- The capacity of the MSW combustors including supporting documentation;
- Siting analysis;
- Initial material separation plan;
- Notice of the second public meeting;
- Transcript of the second public meeting;
- The document summarizing the comments received during the second public comment period; and
- The final siting analysis.

3.3 NESHAPs Requirements

The 1990 CAA Amendments established a complex program to regulate emissions of 188 hazardous air pollutants (HAPs) from particular industrial sources. The CAA requires the EPA to regulate emissions of these HAPs by developing and promulgating technology-based standards based on the best-performing similar facilities in operation. The National Emission Standards for Hazardous Air Pollutants (NESHAPs) established by the EPA are commonly called maximum achievable control technology (MACT) standards. MACT standards are designed to reduce HAP emissions to a maximum achievable degree, taking into consideration the cost of reductions and other factors.

A source having the potential to emit more that 10 TPY of a single pollutant and/or 25 TPY from combined HAPs is considered a major source and is; therefore, subject to MACT standards. The combustion of the waste streams at the proposed facility has the potential to emit HAPs (i.e., hydrochloric acid, chromium, mercury, lead, etc.); however, the facility proposes to establish federally enforceable limits on the throughput of waste to maintain the potential to emit HAPs below the 10 and 25 TPY thresholds for individual and cumulative HAPs, respectively.

3.4 Title V Operating Permit

Once the facility has been constructed and compliance testing completed, a Title V operating permit application must be submitted. Under these rules, because the facility has the potential to emit criteria pollutants (NO_x, PM, and SO_2) in amounts exceeding 100 TPY, the proposed facility will be classified as a Title V source. The submittal of the air operating permit application will also require a compliance assurance monitoring (CAM) plan.

3.5 Other Regulatory Requirements

Under Subpart AAAA, and Title V Operating Permit program, DSW is required to develop and implement a startup, shutdown, and malfunction (SSM) plan. This plan will contain the specific procedures to be followed for operating and maintaining the sources during periods of startup, shutdown, and malfunction. The plan also needs to include a program for corrective action for malfunctioning control systems used to comply with the standards of Subpart AAAA. The plan must also include procedures for responding to any process parameter that is inconsistent with previously established operating ranges, including procedures to determine and record the cause of the exceedance, the times that the exceedance began and ended, and the corrective actions to be taken. Maintenance and inspection schedules must also be included in the SSM plan.

Following the compliance date, owners or operators of all affected sources are required to implement corrective action as specified in the SSM plan when any 3-hour average parameter value is outside the established operating range. Records must be maintained of any occurrence when corrective action is required.

ATTACHMENT A

TABLES

Table 2-1
Summary of Number of Emission Tests Available from Trial Burns for Various Pollutants, Dixie Waste Gasification/Thermal Oxidizer

Pollutant	No. of Tests		
	MSW	TDF	Medical Waste
Carbon Monoxide (CO)	1	1	4
Nitrogen Oxides (NO_x)	1	1	2
Particulate Matter (PM)	2	3	4
PM < 10 microns (PM10)	0	0	0
Sulfur Dioxide (SO_2)	1	2	2
Volatile Organic Compounds (VOC)			
Lead (Pb)	1	2	5
Hydrochloric Acid	2	3	5
Metals			
Antimony (Sb)	2	2	5
Arsenic (As)	2	3	5
Beryllium (Be)	2	2	5
Cadmium (Cd)	2	3	5
Chromium, total (Cr)	2	3	5
Cobalt (Co)	1	2	4
Manganese (Mn)	2	3	5
Mercury (Hg)	0	1	1
Nickel (Ni)	2	2	5
Selenium (Se)	1	2	4
Zinc (Zn)	2	3	5

TABLE 2-2
SUMMARY OF ESTIMATED EMISSION FACTORS FOR THE WASTE GASIFICATION/THERMAL OXIDIZER PLANT
DIXIE WASTE SERVICES LLC

Pollutant	Emission Factors (lb/MMBtu)											
	MSW			TDF		MW			MSW	Overall Maximum		
		Source Tests		Source Tests			Source Tests		Barrows			
	AP-42	Max	Min	Max	Min	AP-42	Max	Min	Stack Test	MSW	TDF	MW
Carbon Monoxide (CO)	3.32E-02	3.51E-02	3.51E-02	2.93E-02	2.93E-02	1.74E-01	1.76E+00	5.02E-02	3.00E-03	3.51E-02	2.93E-02	1.74E-01 [a]
Nitrogen Oxides (NO_x)	3.51E-01	1.79E-01	1.79E-01	2.41E-01	2.41E-01	2.09E-01	2.85E-01	4.38E-01	1.24E+00	1.24E+00	2.41E-01	4.38E-01
Particulate Matter (PM)	3.81E-01	7.14E-01	4.61E-03	9.56E-02	3.02E-02	2.75E-01	1.19E-01	3.29E-02	4.50E-01	7.14E-01	9.56E-02	2.75E-01
PM < 10 microns (PM_{10})	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00		0.00E+00	0.00E+00	0.00E+00
Sulfur Dioxide (SO_2)	3.59E-01	8.91E-03	8.91E-03	2.45E+00	6.29E-01	1.28E-01	6.60E-03	1.03E-02	6.10E-01	6.10E-01	2.45E+00	1.28E-01
Volatile Organic Compounds (VOC)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.76E-02	0.00E+00	0.00E+00		0.00E+00	0.00E+00	1.76E-02
Lead (Pb)	0.00E+00	1.21E-04	1.21E-04	5.70E-05	7.54E-06	4.28E-03	1.41E-03	1.33E-04		1.21E-04	5.70E-05	4.28E-03
Hydrochloric Acid	2.39E-01	1.35E-01	8.79E-02	2.59E-02	8.65E-03	1.97E+00	1.63E+00	3.65E-01		2.39E-01	2.59E-02	1.97E+00
Metals												
Antimony (Sb)	0.00E+00	1.48E-05	6.05E-07	5.39E-06	2.31E-06	7.53E-04	1.46E-03	1.58E-05		1.48E-05	5.39E-06	1.46E-03
Arsenic (As)	7.43E-05	2.22E-04	6.05E-06	1.08E-05	2.31E-06	1.42E-05	9.09E-04	3.65E-06		2.22E-04	1.08E-05	9.09E-04
Beryllium (Be)	0.00E+00	4.44E-07	1.21E-07	1.88E-07	7.70E-08	3.68E-07	1.52E-06	1.22E-07		4.44E-07	1.88E-07	1.52E-06
Cadmium (Cd)	2.68E-04	1.78E-05	3.70E-06	1.99E-06	1.36E-06	3.22E-04	8.30E-05	2.30E-05		2.68E-04	1.99E-06	3.22E-04
Chromium, total (Cr)	3.68E-04	7.40E-07	9.07E-07	1.94E-05	4.08E-06	4.56E-05	2.71E-04	5.67E-07		3.68E-04	1.94E-05	2.71E-04
Cobalt (Co)	0.00E+00	4.53E-07	4.53E-07	1.54E-06	2.72E-07	0.00E+00	1.08E-05	2.61E-07		4.53E-07	1.54E-06	1.08E-05
Manganese (Mn)	0.00E+00	7.40E-06	3.02E-06	1.11E-04	4.62E-05	3.34E-05	2.98E-04	3.89E-06		7.40E-06	1.11E-04	2.98E-04
Mercury (Hg)	6.22E-04	0.00E+00	0.00E+00	2.69E-07	2.69E-07	6.29E-03	3.03E-06	3.03E-06		5.72E-04	2.69E-07	3.03E-06 [b]
Nickel (Ni)	6.13E-04	2.07E-05	1.21E-06	3.23E-04	5.08E-05	3.47E-05	3.33E-03	7.30E-06		6.13E-04	3.23E-04	3.33E-03
Selenium (Se)	0.00E+00	6.05E-06	6.05E-06	4.08E-06	2.31E-06	0.00E+00	4.60E-03	5.67E-07		6.05E-06	4.08E-06	4.60E-03
Zinc (Zn)	0.00E+00	1.48E-03	3.33E-04	8.57E-04	2.20E-04	0.00E+00	4.59E-03	1.43E-04		1.48E-03	8.57E-04	4.59E-03
Other HAPs	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00		0.00E+00	0.00E+00	0.00E+00
Dioxins/Furans (CDD/CDF)	3.27E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00		3.27E-07	0.00E+00	0.00E+00
Dioxins (2, 3, 7, 8-TCDD)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.22E-09	0.00E+00	0.00E+00		0.00E+00	0.00E+00	3.22E-09
Furans (CDF)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.21E-06	0.00E+00	0.00E+00		0.00E+00	0.00E+00	4.21E-06

[a] For CO emissions for medical waste, AP-42 factor used since highest stack test value was not coinsistent with the values for the other stack tests and AP-42 factor.

[b] For mercury for MSW, because waste separation plan will remove mercury containing products, NSPS limit used for emission factor.

NSPS limit =	0.08 mg/dscm	at 7% oxygen
	3.03E-06 lb/MMBtu	

TABLE 2-3
MAXIMUM HOURLY EMISSIONS FOR THE WASTE GASIFICATION/THERMAL OXIDIZER PLANT
DIXIE WASTE SERVICES LLC

Pollutant	Control %	Emissions (lb/hr) [a]			
		MSW	TDF	MW	Maximum
Carbon Monoxide (CO)	0	2.0	5.7	6.7	6.7
Nitrogen Oxides (NOx)	0	69.8	46.6	67.9	69.8
Particulate Matter (PM)	95	2.0	0.93	2.0	2.0
PM < 10 microns (PM10)	90	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Sulfur Dioxide (SO2)	98	0.69	9.5	8.8	9.5
Volatile Organic Compounds (VOC)	98	0.00E+00	0.00E+00	0.0030	0.003
Lead (Pb)	95	0.00034	0.00055	0.0023	0.002
Hydrochloric Acid	98	0.27	0.10	0.58	0.58
Metals					
Antimony (Sb)	95	4.16E-05	5.22E-05	6.69E-04	6.69E-04
Arsenic (As)	95	6.25E-04	1.04E-04	9.61E-04	9.61E-04
Beryllium (Be)	95	1.25E-06	1.83E-06	2.32E-06	2.32E-06
Cadmium (Cd)	95	7.53E-04	1.93E-05	8.30E-04	8.30E-04
Chromium, total (Cr)	95	1.03E-03	1.88E-04	1.07E-03	1.07E-03
Cobalt (Co)	95	1.28E-06	1.49E-05	1.83E-05	1.83E-05
Manganese (Mn)	95	2.08E-05	1.07E-03	1.12E-03	1.12E-03
Mercury (Hg)	0	3.22E-02	5.22E-05	2.96E-02	3.22E-02
Nickel (Ni)	95	1.73E-03	3.13E-03	4.30E-03	4.30E-03
Selenium (Se)	95	1.70E-05	3.95E-05	1.99E-03	1.99E-03
Zinc (Zn)	95	4.16E-03	8.30E-03	9.59E-03	9.59E-03
Other HAPs	95	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Dioxins/Furans (CDD/CDF)	98	3.68E-07	0.00E+00	3.38E-07	3.68E-07
Dioxins (2, 3, 7, 8-TCDD)	98	0.00E+00	0.00E+00	5.47E-10	5.47E-10
Furans (CDF)	98	0.00E+00	0.00E+00	7.15E-07	7.15E-07
Total HAPs					6.28E-01
Individual HAP					3.22E-02

[a] Basis of Emissions 150 TPD INPUT
6.25 TPH

Overall Max Emission Factor
Total Heat Input MMBtu/hr

	MSW	TDF	MW
Heat Content (Btu/lb)	4,500	15,500	8,500
Max HIR (MMBtu/hr)	56.25	193.75	106.25
%	100	100	8
HIR (MMBtu/hr)	56.3	193.8	8.50
TPH	6.25	6.25	0.50
			Remainder Max. MSW or TDF

TABLE 2-4a
MAXIMUM ANNUAL EMISSIONS FOR THE WASTE GASIFICATION/THERMAL OXIDIZER PLANT
DIXIE WASTE SERVICES LLC

Pollutant	Control %	Emissions (TPY)[a]				Major Source Threshold (TPY)	Major Source?	Annual Fuel Mix (%)			
		MSW	TDF	MW	Total			MSW	TDF	MW	Total
Carbon Monoxide (CO)	0	3.9	11.7	6.5	22.0	250	No	45	47	8	100
Nitrogen Oxides (NO_x)	0	137.5	95.9	16.3	249.7	250	No	45	47	8	100
Particulate Matter (PM)	95	4.0	1.9	0.5	6.4	250	No	45	47	8	100
PM < 10 microns (PM_{10})	90	0.0	0.0	0.0	0.0	250	No	45	47	8	100
Sulfur Dioxide (SO_2)	98	1.4	19.6	0.1	21.0	250	No	45	47	8	100
Volatile Organic Compounds (VOC)	98	0.000	0.000	0.013	0.013	250	No	45	47	8	100
Lead (Pb)	95	0.0007	0.0011	0.0080	0.0098	10	No	45	47	8	100
Hydrochloric Acid	98	0.5	0.2	1.5	2.2	10	No	45	47	8	100
Metals											
Antimony (Sb)	95	8.21E-05	1.07E-04	2.72E-03	2.91E-03	10	No	45	47	8	100
Arsenic (As)	95	1.23E-03	2.15E-04	1.69E-03	3.14E-03	10	No	45	47	8	100
Beryllium (Be)	95	2.46E-06	3.76E-06	2.82E-06	9.04E-06	10	No	45	47	8	100
Cadmium (Cd)	95	1.48E-03	3.97E-05	6.00E-04	2.12E-03	10	No	45	47	8	100
Chromium, total (Cr)	95	2.04E-03	3.87E-04	5.04E-04	2.93E-03	10	No	45	47	8	100
Cobalt (Co)	95	2.51E-06	3.07E-05	2.02E-05	5.34E-05	10	No	45	47	8	100
Manganese (Mn)	95	4.10E-05	2.21E-03	5.54E-04	2.81E-03	10	No	45	47	8	100
Mercury (Hg)	0	6.34E-02	1.07E-04	1.13E-04	6.37E-02	10	No	45	47	8	100
Nickel (Ni)	95	3.40E-03	6.44E-03	6.21E-03	1.60E-02	10	No	45	47	8	100
Selenium (Se)	95	3.35E-05	8.14E-05	8.57E-03	8.68E-03	10	No	45	47	8	100
Zinc (Zn)	95	8.21E-03	1.71E-02	8.54E-03	3.38E-02	10	No	45	47	8	100
Other HAPs											
Dioxins/Furans (CDD/CDF)	98	7.24E-07	0.00E+00	0.00E+00	7.24E-07	10	No	45	47	8	100
Dioxins (2, 3, 7, 8-TCDD)	98	0.00E+00	0.00E+00	2.40E-09	2.40E-09	10	No	45	47	8	100
Furans (CDF)	98	0.00E+00	0.00E+00	3.13E-06	3.13E-06	10	No	45	47	8	100
Total HAPs					2.3	25.0	No				
Individual HAP					2.2	10.0	No				

[a] Basis of Emissions

150 TPD	INPUT	
6.25 TPH		

Overall Max Emission Factor
Total Heat Input MMBtu/hr

	MSW	TDF	MW	Total
Heat Content (Btu/lb)	4,500	15,500	8,500	
Max HIR (MMBtu/hr)	56.25	193.75	106.25	

TABLE 2-4b
MAXIMUM ANNUAL EMISSIONS FOR THE WASTE GASIFICATION/THERMAL OXIDIZER PLANT
DIXIE WASTE SERVICES LLC

Pollutant	Control %	Emissions (TPY) [a]				Major Source Threshold (TPY)	Major Source?	Annual Fuel Mix (%)			
		MSW	TDF	MW	Total			MSW	TDF	MW	Total
Carbon Monoxide (CO)	0	0.0	22.9	6.5	29.3	250	No	0	92	8	100
Nitrogen Oxides (NO_x)	0	0.0	187.8	16.3	204.1	250	No	0	92	8	100
Particulate Matter (PM)	95	0.0	3.7	0.5	4.2	250	No	0	92	8	100
PM < 10 microns (PM_{10})	90	0.0	0.0	0.0	0.0	250	No	0	92	8	100
Sulfur Dioxide (SO_2)	98	0.0	38.3	0.1	38.4	250	No	0	92	8	100
Volatile Organic Compounds (VOC)	98	0.000	0.000	0.013	0.013	250	No	0	92	8	100
Lead (Pb)	95	0.0000	0.0022	0.0080	0.0102	10	No	0	92	8	100
Hydrochloric Acid	98	0.0	0.4	1.5	1.9	10	No	0	92	8	100
Metals											
Antimony (Sb)	95	0.00E+00	2.10E-04	2.72E-03	2.93E-03	10	No	0	92	8	100
Arsenic (As)	95	0.00E+00	4.20E-04	1.69E-03	2.11E-03	10	No	0	92	8	100
Beryllium (Be)	95	0.00E+00	7.36E-06	2.82E-06	1.02E-05	10	No	0	92	8	100
Cadmium (Cd)	95	0.00E+00	7.78E-05	6.00E-04	6.78E-04	10	No	0	92	8	100
Chromium, total (Cr)	95	0.00E+00	7.57E-04	5.04E-04	1.26E-03	10	No	0	92	8	100
Cobalt (Co)	95	0.00E+00	6.01E-05	2.02E-05	8.03E-05	10	No	0	92	8	100
Manganese (Mn)	95	0.00E+00	4.33E-03	5.54E-04	4.88E-03	10	No	0	92	8	100
Mercury (Hg)	0	0.00E+00	2.10E-04	1.13E-04	3.23E-04	10	No	0	92	8	100
Nickel (Ni)	95	0.00E+00	1.26E-02	6.21E-03	1.88E-02	10	No	0	92	8	100
Selenium (Se)	95	0.00E+00	1.59E-04	8.57E-03	8.73E-03	10	No	0	92	8	100
Zinc (Zn)	95	0.00E+00	3.35E-02	8.54E-03	4.20E-02	10	No	0	92	8	100
Other HAPs											
Dioxins/Furans (CDD/CDF)	98	0.00E+00	0.00E+00	0.00E+00	0.00E+00	10	No	0	92	8	100
Dioxins (2, 3, 7, 8-TCDD)	98	0.00E+00	0.00E+00	2.40E-09	2.40E-09	10	No	0	92	8	100
Furans (CDF)	98	0.00E+00	0.00E+00	3.13E-06	3.13E-06	10	No	0	92	8	100
Total HAPs					1.9	25.0	No				
Individual HAP					1.9	10.0	No				

[a] Basis of Emissions 150 TPD INPUT
6.25 TPH

Overall Max Emission Factor
Total Heat Input MMBtu/hr

	MSW	TDF	MW	Total
Heat Content (Btu/lb)	4,500	15,500	8,500	
Max HIR (MMBtu/hr)	56.25	193.75	106.25	

TABLE 2-4c
MAXIMUM ANNUAL EMISSIONS FOR THE WASTE GASIFICATION/THERMAL OXIDIZER PLANT
DIXIE WASTE SERVICES LLC

Pollutant	Control %	Emissions (TPY) [a] MSW	TDF	MW	Total	Major Source Threshold (TPY)	Major Source?	Annual Fuel Mix (%) MSW	TDF	MW	Total
Carbon Monoxide (CO)	0	3.9	13.7	0.0	17.6	250	No	45	55	0	100
Nitrogen Oxides (NO_x)	0	137.5	112.3	0.0	249.7	250	No	45	55	0	100
Particulate Matter (PM)	95	4.0	2.2	0.0	6.2	250	No	45	55	0	100
PM < 10 microns (PM_{10})	90	0.0	0.0	0.0	0.0	250	No	45	55	0	100
Sulfur Dioxide (SO_2)	98	1.4	22.9	0.0	24.2	250	No	45	55	0	100
Volatile Organic Compounds (VOC)	98	0.000	0.000	0.000	0.000	250	No	45	55	0	100
Lead (Pb)	95	0.0007	0.0013	0.0000	0.0020	10	No	45	55	0	100
Hydrochloric Acid	98	0.5	0.2	0.0	0.8	10	No	45	55	0	100
Metals											
Antimony (Sb)	95	8.21E-05	1.26E-04	0.00E+00	2.08E-04	10	No	45	55	0	100
Arsenic (As)	95	1.23E-03	2.51E-04	0.00E+00	1.48E-03	10	No	45	55	0	100
Beryllium (Be)	95	2.46E-06	4.40E-06	0.00E+00	6.86E-06	10	No	45	55	0	100
Cadmium (Cd)	95	1.48E-03	4.65E-05	0.00E+00	1.53E-03	10	No	45	55	0	100
Chromium, total (Cr)	95	2.04E-03	4.52E-04	0.00E+00	2.49E-03	10	No	45	55	0	100
Cobalt (Co)	95	2.51E-06	3.59E-05	0.00E+00	3.85E-05	10	No	45	55	0	100
Manganese (Mn)	95	4.10E-05	2.59E-03	0.00E+00	2.63E-03	10	No	45	55	0	100
Mercury (Hg)	0	6.34E-02	1.26E-04	0.00E+00	6.36E-02	10	No	45	55	0	100
Nickel (Ni)	95	3.40E-03	7.54E-03	0.00E+00	1.09E-02	10	No	45	55	0	100
Selenium (Se)	95	3.35E-05	9.53E-05	0.00E+00	1.29E-04	10	No	45	55	0	100
Zinc (Zn)	95	8.21E-03	2.00E-02	0.00E+00	2.82E-02	10	No	45	55	0	100
Other HAPs											
Dioxins/Furans (CDD/CDF)	98	7.24E-07	0.00E+00	0.00E+00	7.24E-07	10	No	45	55	0	100
Dioxins (2, 3, 7, 8-TCDD)	98	0.00E+00	0.00E+00	0.00E+00	0.00E+00	10	No	45	55	0	100
Furans (CDF)	98	0.00E+00	0.00E+00	0.00E+00	0.00E+00	10	No	45	55	0	100
Total HAPs					0.9	25.0	No				
Individual HAP					0.8	10.0	No				

[a] Basis of Emissions 150 TPD INPUT
6.25 TPH

Overall Max Emission Factor
Total Heat Input MMBtu/hr

	MSW	TDF	MW	Total
Heat Content (Btu/lb)	4,500	15,500	8,500	
Max HIR (MMBtu/hr)	56.25	193.75	106.25	

TABLE 2-4d
MAXIMUM ANNUAL EMISSIONS FOR THE WASTE GASIFICATION/THERMAL OXIDIZER PLANT
DIXIE WASTE SERVICES LLC

Pollutant	Control %	Emissions (TPY) [a]				Major Source Threshold (TPY)	Major Source?	Annual Fuel Mix (%)			
		MSW	TDF	MW	Total			MSW	TDF	MW	Total
Carbon Monoxide (CO)	0	0.0	24.8	0.0	24.8	250	No	0	100	0	100
Nitrogen Oxides (NO_x)	0	0.0	204.1	0.0	204.1	250	No	0	100	0	100
Particulate Matter (PM)	95	0.0	4.1	0.0	4.1	250	No	0	100	0	100
PM < 10 microns (PM_{10})	90	0.0	0.0	0.0	0.0	250	No	0	100	0	100
Sulfur Dioxide (SO_2)	98	0.0	41.6	0.0	41.6	250	No	0	100	0	100
Volatile Organic Compounds (VOC)	98	0.000	0.000	0.000	0.000	250	No	0	100	0	100
Lead (Pb)	95	0.0000	0.0024	0.0000	0.0024	10	No	0	100	0	100
Hydrochloric Acid	98	0.0	0.4	0.0	0.4	10	No	0	100	0	100
Metals											
Antimony (Sb)	95	0.00E+00	2.29E-04	0.00E+00	2.29E-04	10	No	0	100	0	100
Arsenic (As)	95	0.00E+00	4.57E-04	0.00E+00	4.57E-04	10	No	0	100	0	100
Beryllium (Be)	95	0.00E+00	8.00E-06	0.00E+00	8.00E-06	10	No	0	100	0	100
Cadmium (Cd)	95	0.00E+00	8.45E-05	0.00E+00	8.45E-05	10	No	0	100	0	100
Chromium, total (Cr)	95	0.00E+00	8.23E-04	0.00E+00	8.23E-04	10	No	0	100	0	100
Cobalt (Co)	95	0.00E+00	6.53E-05	0.00E+00	6.53E-05	10	No	0	100	0	100
Manganese (Mn)	95	0.00E+00	4.71E-03	0.00E+00	4.71E-03	10	No	0	100	0	100
Mercury (Hg)	0	0.00E+00	2.29E-04	0.00E+00	2.29E-04	10	No	0	100	0	100
Nickel (Ni)	95	0.00E+00	1.37E-02	0.00E+00	1.37E-02	10	No	0	100	0	100
Selenium (Se)	95	0.00E+00	1.73E-04	0.00E+00	1.73E-04	10	No	0	100	0	100
Zinc (Zn)	95	0.00E+00	3.64E-02	0.00E+00	3.64E-02	10	No	0	100	0	100
Other HAPs											
Dioxins/Furans (CDD/CDF)	98	0.00E+00	0.00E+00	0.00E+00	0.00E+00	10	No	0	100	0	100
Dioxins (2, 3, 7, 8-TCDD)	98	0.00E+00	0.00E+00	0.00E+00	0.00E+00	10	No	0	100	0	100
Furans (CDF)	98	0.00E+00	0.00E+00	0.00E+00	0.00E+00	10	No	0	100	0	100
Total HAPs					0.5	25.0	No				
Individual HAP					0.4	10.0	No				

[a] Basis of Emissions 150 TPD INPUT
6.25 TPH

Overall Max Emission Factor
Total Heat Input MMBtu/hr

	MSW	TDF	MW	Total
Heat Content (Btu/lb)	4,500	15,500	8,500	
Max HIR (MMBtu/hr)	56.25	193.75	106.25	

TABLE 2-4e
MAXIMUM ANNUAL EMISSIONS FOR THE WASTE GASIFICATION/THERMAL OXIDIZER PLANT
DIXIE WASTE SERVICES LLC

Pollutant	**Control %**	**Emissions (TPY) [a]**				**Major Source Threshold (TPY)**	**Major Source?**	**Annual Fuel Mix (%)**			
		MSW	**TDF**	**MW**	**Total**			**MSW**	**TDF**	**MW**	**Total**
Carbon Monoxide (CO)	0	7.0	0.0	0.0	7.0	250	No	81	0	0	100
Nitrogen Oxides (NO_x)	0	247.5	0.0	0.0	247.5	250	No	81	0	0	100
Particulate Matter (PM)	95	7.1	0.0	0.0	7.1	250	No	81	0	0	100
PM < 10 microns (PM_{10})	90	0.0	0.0	0.0	0.0	250	No	81	0	0	100
Sulfur Dioxide (SO_2)	98	2.4	0.0	0.0	2.4	250	No	81	0	0	100
Volatile Organic Compounds (VOC)	98	0.000	0.000	0.000	0.000	250	No	81	0	0	100
Lead (Pb)	95	0.0012	0.0000	0.0000	0.0012	10	No	81	0	0	100
Hydrochloric Acid	98	1.0	0.0	0.0	1.0	10	No	81	0	0	100
Metals											
Antimony (Sb)	95	1.48E-04	0.00E+00	0.00E+00	1.48E-04	10	No	81	0	0	100
Arsenic (As)	95	2.22E-03	0.00E+00	0.00E+00	2.22E-03	10	No	81	0	0	100
Beryllium (Be)	95	4.43E-06	0.00E+00	0.00E+00	4.43E-06	10	No	81	0	0	100
Cadmium (Cd)	95	2.67E-03	0.00E+00	0.00E+00	2.67E-03	10	No	81	0	0	100
Chromium, total (Cr)	95	3.67E-03	0.00E+00	0.00E+00	3.67E-03	10	No	81	0	0	100
Cobalt (Co)	95	4.52E-06	0.00E+00	0.00E+00	4.52E-06	10	No	81	0	0	100
Manganese (Mn)	95	7.39E-05	0.00E+00	0.00E+00	7.39E-05	10	No	81	0	0	100
Mercury (Hg)	0	1.14E-01	0.00E+00	0.00E+00	1.14E-01	10	No	81	0	0	100
Nickel (Ni)	95	6.12E-03	0.00E+00	0.00E+00	6.12E-03	10	No	81	0	0	100
Selenium (Se)	95	6.03E-05	0.00E+00	0.00E+00	6.03E-05	10	No	81	0	0	100
Zinc (Zn)	95	1.48E-02	0.00E+00	0.00E+00	1.48E-02	10	No	81	0	0	100
Other HAPs											
Dioxins/Furans (CDD/CDF)	98	1.30E-06	0.00E+00	0.00E+00	1.30E-06	10	No	81	0	0	100
Dioxins (2, 3, 7, 8-TCDD)	98	0.00E+00	0.00E+00	0.00E+00	0.00E+00	10	No	81	0	0	100
Furans (CDF)	98	0.00E+00	0.00E+00	0.00E+00	0.00E+00	10	No	81	0	0	100
Total HAPs					1.1	25.0	No				
Individual HAP					1.0	10.0	No				

247.6 tpy

[a] Basis of Emissions 150 TPD INPUT
6.25 TPH

Overall Max Emission Factor
Total Heat Input MMBtu/hr

	MSW	TDF	MW	Total
Heat Content (Btu/lb)	4,500	15,500	8,500	
Max HIR (MMBtu/hr)	56.25	193.75	106.25	

TABLE 2-4f
SUMMARY OF MAXIMUM ANNUAL EMISSIONS FOR THE WG/TO PLANT FOR VARIOUS WASTE MIXES
DIXIE WASTE SERVICES LLC

		Emissions (TPY) ^{a} for %Waste of 150 TPD				@ 100% = 305.7			
Pollutant	**MSW** **TDF** **MW**	**45** **47** **8**	**0** **92** **8**	**45** **55** **0**	**0** **100** **0**	**81** **0** **0**	**Maximum**	**Major Source Threshold (TPY)**	**Major Source?**
Carbon Monoxide (CO)		22.0	29.3	17.6	24.8	7.0	29.3	250	No
Nitrogen Oxides (NO_x)		249.7	204.1	249.7	204.1	247.5 305	249.7	250	No
Particulate Matter (PM)		6.4	4.2	6.2	4.1	7.1	7.1	250	No
PM < 10 microns (PM_{10})		0.0	0.0	0.0	0.0	0.0	0.0	250	No
Sulfur Dioxide (SO_2)		21.0	38.4	24.2	41.6	2.4	41.6	250	No
Volatile Organic Compounds (VOC)		0.013	0.013	0.000	0.000	0.0	0.013	250	No
Lead (Pb)		0.010	0.010	0.002	0.002	0.0	0.010	10	No
Hydrochloric Acid		2.2	1.9	0.8	0.4	1.0	2.2	10	No
Metals									
Antimony (Sb)		2.91E-03	2.93E-03	2.08E-04	2.29E-04	1.48E-04	2.93E-03	10	No
Arsenic (As)		3.14E-03	2.11E-03	1.48E-03	4.57E-04	2.22E-03	3.14E-03	10	No
Beryllium (Be)		9.04E-06	1.02E-05	6.86E-06	8.00E-06	4.43E-06	1.02E-05	10	No
Cadmium (Cd)		2.12E-03	6.78E-04	1.53E-03	8.45E-05	2.67E-03	2.67E-03	10	No
Chromium, total (Cr)		2.93E-03	1.26E-03	2.49E-03	8.23E-04	3.67E-03	3.67E-03	10	No
Cobalt (Co)		5.34E-05	8.03E-05	3.85E-05	6.53E-05	4.52E-06	8.03E-05	10	No
Manganese (Mn)		2.81E-03	4.88E-03	2.63E-03	4.71E-03	7.39E-05	4.88E-03	10	No
Mercury (Hg)		6.37E-02	3.23E-04	6.36E-02	2.29E-04	1.14E-01	1.14E-01	10	No
Nickel (Ni)		1.60E-02	1.88E-02	1.09E-02	1.37E-02	6.12E-03	1.88E-02	10	No
Selenium (Se)		8.68E-03	8.73E-03	1.29E-04	1.73E-04	6.03E-05	8.73E-03	10	No
Zinc (Zn)		3.38E-02	4.20E-02	2.82E-02	3.64E-02	1.48E-02	4.20E-02	10	No
Other HAPs									
Dioxins/Furans (CDD/CDF)		7.24E-07	0.00E+00	7.24E-07	0.00E+00	1.30E-06	1.30E-06	10	No
Dioxins (2, 3, 7, 8-TCDD)		2.40E-09	2.40E-09	0.00E+00	0.00E+00	0.00E+00	2.40E-09	10	No
Furans (CDF)		3.13E-06	3.13E-06	0.00E+00	0.00E+00	0.00E+00	3.13E-06	10	No
Total HAPs		2.3	1.9	0.9	0.5	1.1	2.3	25.0	No
Individual HAP		2.2	1.9	0.8	0.4	1.0	2.2	10.0	No

Table 2-5
Summary of Pollutant Emission Limits for New Small Municipal Waste Combustion Units (NSPS, Subpart AAAA, 40 CFR 60.1000)

Pollutant	Emission Limits	Units	Compliance Method
Acid Gases			
Hydrochloric Acid [b]	25	mg/dscm	Stack test
Nitrogen Oxides (NO_x)	500	ppmvd	None required [d]
Sulfur Dioxide (SO_2) [a]	30	ppmvd	Continuous emission monitoring
Metals			
Cadmium (Cd)	0.02	mg/dscm	Stack test
Lead (Pb)	0.2	mg/dscm	Stack test
Mercury (Hg) [c]	0.08	mg/dscm	Stack test
Opacity	10	percent	Stack test
Particulate Matter (PM)	24	mg/dscm	Stack test
Organics			
Dioxins/Furans	13	ng/dscm	Stack test
Carbon Monoxide	50	ppmvd	Continuous emission monitoring

Note:
ppmvd: parts per million by volume dry corrected to 7 percent oxygen
mg/dscm: milligrams per dry standard cubic feet per minute corrected to 7% oxygen
ng/dscm: nanograms per dry standard cubic feet per minute corrected to 7% oxygen

[a] Or 80 percent reduction of potential sulfur dioxide emissions
[b] Or 95 percent reduction of potential hydrogen chloride emissions
[c] Or 85 percent reduction of potential mercury emissions
[d] For Class II units, no monitoring, testing, recordkeeping, or reporting is required to demonstrate compliance.

TABLE 2-6
COMPARISON OF MAXIMUM HOURLY EMISSION RATES TO NSPS EMISSION LIMITS

Pollutant	Emissions (lb/hr) MSW	TDF	MW	Maximum	Project Emissions at 7% O2 [a]	NSPS Limit at 7% O2	Units	Compliance Averaging Time
Acid Gases								
Hydrochloric Acid	0.27	0.10	0.58	0.58	0.7	25	ppmv	Initial and annual stack test
Nitrogen Oxides (NO_x)	69.8	46.6	67.9	69.8	102	500	ppmv	CEM-24 hours[4]
Sulfur Dioxide (SO_2)	0.69	9.50	8.76	9.50	6.5	30	ppmv	CEM-24 hours.
Metals								
Cadmium (Cd)	7.53E-04	1.93E-05	8.30E-04	8.30E-04	0.002	0.02	mg/dscm	Initial and annual stack test
Lead (Pb)	3.40E-04	5.52E-04	2.33E-03	2.33E-03	0.006	0.2	mg/dscm	Initial and annual stack test
Mercury (Hg)	3.22E-02	5.22E-05	2.96E-02	3.22E-02	0.080	0.08	mg/dscm	Initial and annual stack test
Opacity [b]	10	10	10	10	10	10	percent	Initial and annual stack test
Particulate Matter (PM)	2.01	0.93	1.97	2.01	5.02	24	mg/dscm	Initial and annual stack test
Organics								
Dioxins/Furans (CDD/CDF)	3.68E-07	0.00E+00	3.38E-07	3.68E-07	0.92	13	ng/dscm	Initial and annual stack test
Dioxins (2, 3, 7, 8-TCDD)	0.00E+00	0.00E+00	5.47E-10	5.47E-10	0.001	NA	ng/dscm	Initial and annual stack test
Furans (CDF)	0.00E+00	0.00E+00	7.15E-07	7.15E-07	1.8	NA	ng/dscm	Initial and annual stack test
Carbon Monoxide	1.97	5.67	6.7	6.7	11	50	ppmv	CEM-24 hours.

Note:
ppmvd: parts per million by volume dry corrected to 7 percent oxygen
mg/dscm: milligrams per dry standard cubic feet per minute corrected to 7% oxygen
ng/dscm: nanograms per dry standard cubic feet per minute corrected to 7% oxygen

[a] Operating data used to calculate project emissions

Temperature	100 °F	311 K
Oxygen	8 %	
Moisture	20 %	
Temperature, standard	60 °F	289 K
Flowrate	155,000 acfm	
	143,922 scfm	
	4,392 m^3/min	
	4,079 std m^3/min (scm/min)	
	3,263 dscm/min	

Pollutant	Molecular Weight
SO2	64
HCL	36.5
NOx	30
CO	28

[b] Units are in percent

ATTACHMENT B

SUMMARY OF EMISSION DATA

TABLE A-1
SUMMARY OF SOURCE TEST DATA FOR THE WASTE GASIFICATION/THERMAL OXIDIZER PLANT, DIXIE WASTE SERVICES LLC

	Municipal Solid Waste					Tire Derived Fuel					Medical Waste				
Pollutant	**Max**	**Min**	**Mean**	**Units**	**# of Tests**	**Max**	**Min**	**Mean**	**Units**	**# of Tests**	**Max**	**Min**	**Mean**	**Units**	**# of Tests**
Carbon Monoxide (CO)	9	9	9	ppm CO	1	15	15	15	ppm CO	1	437.2	15.0	138.5	ppmv (7% O2)	4
Nitrogen Oxides (NOx)	28	28	28	ppm NOx	1	75	75	75	ppm NOx	1	69.3	66.1	34.4	ppmv (7% O2)	2
Particulate Matter (PM)	0.200	0.00063	0.100	gr/dscf (7% O2)	2	0.0291	0.0081	0.0201	gr/dscf (7% O2)	3	0.8	0.3	0.5	lbs/test	4
PM < 10 microns (PM10)															
Sulfur Dioxide (SO2)	1	1	1	ppm SO2 (1/2 DL)	1	0.0380	0.010	0.0240	lb/lb tires	2	1.2	1.1	1.1	ppmv (7% O2)	2
Volatile Organic Compounds (VOC)															
Hydrochloric Acid	54.5	17.3	35.9	ppmvd	2	29.6	3.4	14.3	ppmvd	3	372.3	32.2	272.7	ppmv (7% O2)	5
Metals															
Lead (Pb)	4.00E-02	4.00E-02	4.00E-02	mg/dscm (7% O2)	1	3.70E-02	1.40E-02	2.55E-02	mg/dscm (7% O2)	2	5.20E-01	2.20E-02	2.41E-01	mg/dscm (7% O2)	5
Antimony (Sb)	1.00E-02	2.00E-04	5.10E-03	mg/dscm (7% O2)	2	1.00E-02	1.50E-03	5.75E-03	mg/dscm (7% O2)	2	5.40E-01	6.50E-03	1.63E-01	mg/dscm (7% O2)	5
Arsenic (As)	1.50E-01	2.00E-03	7.60E-02	mg/dscm (7% O2)	2	2.00E-02	1.50E-03	8.83E-03	mg/dscm (7% O2)	3	1.50E-01	1.50E-03	6.40E-03	mg/dscm (7% O2)	5
Beryllium (Be)	3.00E-04	4.00E-05	1.70E-04	mg/dscm (7% O2)	2	3.50E-04	5.00E-05	2.00E-04	mg/dscm (7% O2)	2	2.50E-04	5.00E-05	7.54E-05	mg/dscm (7% O2)	5
Cadmium (Cd)	5.90E-03	2.50E-03	4.20E-03	mg/dscm (7% O2)	2	3.70E-03	1.00E-03	2.23E-03	mg/dscm (7% O2)	3	2.93E-02	3.80E-03	1.48E-02	mg/dscm (7% O2)	5
Chromium, total (Cr)	5.00E-04	3.00E-04	4.00E-04	mg/dscm (7% O2)	2	3.60E-02	3.00E-03	1.44E-02	mg/dscm (7% O2)	3	1.00E-01	2.00E-04	2.88E-02	mg/dscm (7% O2)	5
Cobalt (Co)	1.50E-04	1.50E-04	1.50E-04	mg/dscm (7% O2)	1	1.00E-03	2.00E-04	6.00E-04	mg/dscm (7% O2)	2	4.00E-03	1.50E-04	1.35E-03	mg/dscm (7% O2)	4
Manganese (Mn)	5.00E-03	1.00E-03	3.00E-03	mg/dscm (7% O2)	2	2.06E-01	3.00E-02	8.87E-02	mg/dscm (7% O2)	3	1.10E-01	1.60E-03	1.83E-02	mg/dscm (7% O2)	5
Mercury (Hg)						5.00E-04	5.00E-04	5.00E-04	mg/dscm (7% O2)	1	5.00E-04	5.00E-04	0.00E+00	mg/dscm (7% O2)	1
Nickel (Ni)	1.40E-02	4.00E-04	7.20E-03	mg/dscm (7% O2)	2	6.00E-01	3.30E-02	3.17E-01	mg/dscm (7% O2)	2	5.50E-01	3.00E-03	3.91E-02	mg/dscm (7% O2)	5
Selenium (Se)	2.00E-03	2.00E-03	2.00E-03	mg/dscm (7% O2)	1	3.00E-03	1.50E-03	2.25E-03	mg/dscm (7% O2)	2	1.70E+00	2.00E-04	5.56E-01	mg/dscm (7% O2)	4
Zinc (Zn)	1.00E+00	1.10E-01	5.55E-01	mg/dscm (7% O2)	2	6.30E-01	1.43E-01	3.42E-01	mg/dscm (7% O2)	3	1.62E+00	5.30E-02	5.80E-01	mg/dscm (7% O2)	5

TABLE A-2
EMISSION TEST DATA FOR MUNICIPAL SOLID WASTE

Waste	Municipal Solid Waste			**Waste**	Municipal Solid Waste		
Waste Amount	1739 lbs			**Waste Amount**	6600 lbs		
	226.8 lb/hr				825.0 lb/hr		
Test Date	3-Dec-90			**Test Date**	20-Apr-93		
Source	Entech Thermal Oxidation Test			**Source**	Entech, Inc. TOS-80 incinerator		
Flue Gas Flow Rate	899 scfm (3.15% H_2O)				1599 scfm (~3% O2)		
Pollutant	**Value**	**Units**		**Pollutant**	**Value**	**Units**	
Carbon Monoxide (CO)	9	ppm CO	9.06% O_2	Carbon Monoxide (CO)		lbs/test	
Nitrogen Oxides (NO_x)	28	ppm NO_x	9.06% O_2	Nitrogen Oxides (NO_x)		lbs/test	
Particulate Matter (PM)	0.00063	gr/dscf (7% O_2)		Particulate Matter (PM)	0.1995	gr/dscf (7% O_2)	front half
PM < 10 microns (PM_{10})				PM < 10 microns (PM_{10})			
Sulfur Dioxide (SO_2)	1	ppm SO_2 (1/2 DL)	9.06% O2	Sulfur Dioxide (SO_2)		ppm SO_2	
Volatile Organic Compounds (VOC)				Volatile Organic Compounds (VOC)			
Hydrochloric Acid	17.3	ppmvd		Hydrochloric Acid	54.5	ppm HCl (7% O_2)	
Metals				**Metals**			
Lead (Pb)	4.00E-02	mg/dscm (7% O_2)		Lead (Pb)		mg/dscm (7% O_2)	
Antimony (Sb)	2.00E-04	mg/dscm (7% O_2)	1/2 DL	Antimony (Sb)	1.00E-02	mg/dscm (7% O_2)	1/2 DL
Arsenic (As)	2.00E-03	mg/dscm (7% O_2)	1/2 DL	Arsenic (As)	1.50E-01	mg/dscm (7% O_2)	1/2 DL
Beryllium (Be)	4.00E-05	mg/dscm (7% O_2)	1/2 DL	Beryllium (Be)	3.00E-04	mg/dscm (7% O_2)	1/2 DL
Cadmium (Cd)	5.90E-03	mg/dscm (7% O_2)		Cadmium (Cd)	2.50E-03	mg/dscm (7% O_2)	
Chromium, total (Cr)	3.00E-04	mg/dscm (7% O_2)		Chromium, total (Cr)	5.00E-04	mg/dscm (7% O_2)	1/2 DL
Cobalt (Co)	1.50E-04	mg/dscm (7% O_2)	1/2 DL	Cobalt (Co)			
Manganese (Mn)	1.00E-03	mg/dscm (7% O_2)		Manganese (Mn)	5.00E-03	mg/dscm (7% O_2)	1/2 DL
Mercury (Hg)		mg/dscm (7% O_2)		Mercury (Hg)	1.40E-02	mg/dscm (7% O_2)	
Nickel (Ni)	4.00E-04	mg/dscm (7% O_2)	1/2 DL	Nickel (Ni)	1.40E-02	mg/dscm (7% O_2)	
Selenium (Se)	2.00E-03	mg/dscm (7% O_2)	1/2 DL	Selenium (Se)			
Zinc (Zn)	1.10E-01	mg/dscm (7% O_2)		Zinc (Zn)	1.00E+00	mg/dscm (7% O_2)	
<u>Other Notes</u>				<u>Other Notes</u>			
Duration of Test	7.67	hours		Dioxins and Furans were detected. PAHs were detected.			
				Duration of test	8.0 hours (appx.)		

TABLE A-3
EMISSION TEST DATA FOR TIRE DERIVED FUEL

Waste	Tires	
Waste Amount	1000 lbs 127.7 lb/hr	
Test Date	5-Dec-90	7.83 hours
Source	Entech Thermal Oxidation Test	
Flue Gas Flow Rate	873 scfm (1.5% H_2O)	

Pollutant	**Value**	**Units**	
Carbon Monoxide (CO)	15	ppm CO	6.2% O_2
Nitrogen Oxides (NO_x)	75	ppm NO_x	6.2% O_2
Particulate Matter (PM)	0.0081	gr/dscf (7% O_2)	
PM < 10 microns (PM_{10})			
Sulfur Dioxide (SO_2)	0.01	lb/lb tires	6.2% O_2
Volatile Organic Compounds (VOC)			
Hydrochloric Acid	3.4	ppmvd	
Metals			
Lead (Pb)	3.70E-02	mg/dscm (7% O_2)	
Antimony (Sb)	1.50E-03	mg/dscm (7% O_2)	1/2 DL
Arsenic (As)	1.50E-03	mg/dscm (7% O_2)	1/2 DL
Beryllium (Be)	5.00E-05	mg/dscm (7% O_2)	1/2 DL
Cadmium (Cd)	2.00E-03	mg/dscm (7% O_2)	
Chromium, total (Cr)	4.30E-03	mg/dscm (7% O_2)	1/2 DL
Cobalt (Co)	1.00E-03	mg/dscm (7% O_2)	
Manganese (Mn)	3.00E-02	mg/dscm (7% O_2)	
Mercury (Hg)			
Nickel (Ni)	3.30E-02	mg/dscm (7% O_2)	
Selenium (Se)	1.50E-03	mg/dscm (7% O_2)	1/2 DL
Zinc (Zn)	1.43E-01	mg/dscm (7% O_2)	

Other Notes

Test Duration 7.83 hours

Waste	Tires	
Waste Amount	1400 lbs 124.4 lb/hr	
Test Date	7-Dec-90	11.25 hours
Source	Entech Thermal Oxidation Test	
	798 scfm (7.2% H_2O)	

Pollutant	**Value**	**Units**	
Carbon Monoxide (CO)			7.3% O_2
Nitrogen Oxides (NO_x)			7.3% O_2
Particulate Matter (PM)	0.02905	gr/dscf (7% O_2)	
PM < 10 microns (PM_{10})			
Sulfur Dioxide (SO_2)	0.038	lb/lb tires	7.3% O_2
Volatile Organic Compounds (VOC)			
Hydrochloric Acid	10	ppmvd	
Metals			
Lead (Pb)		mg/dscm (7% O_2)	
Antimony (Sb)		mg/dscm (7% O_2)	
Arsenic (As)	5.00E-03	mg/dscm (7% O_2)	
Beryllium (Be)			
Cadmium (Cd)	1.00E-03	mg/dscm (7% O_2)	
Chromium, total (Cr)	3.00E-03	mg/dscm (7% O_2)	
Cobalt (Co)	2.00E-04	mg/dscm (7% O_2)	1/2 DL
Manganese (Mn)	3.00E-02	mg/dscm (7% O_2)	
Mercury (Hg)			
Nickel (Ni)			
Selenium (Se)	3.00E-03	mg/dscm (7% O_2)	
Zinc (Zn)	6.30E-01	mg/dscm (7% O_2)	

Other Notes

Test Duration 11.25 hours

Waste	Tires	
Waste Amount	461 lbs 57.6 lb/hr	
Test Date	26-Apr-93	
Source	Entech Model TOS-80 Anchorage, AK	
Flue Gas Flow Rate	1143 scfm (assume 5% H_2O)	

Pollutant	**Value**	**Units**	
Carbon Monoxide (CO)		ppmv (7% O_2)	
Nitrogen Oxides (NO_x)			
Particulate Matter (PM)	0.023	gr/dscf (7% O_2)	front half
PM < 10 microns (PM_{10})			
Sulfur Dioxide (SO_2)			
Volatile Organic Compounds (VOC)			
Hydrochloric Acid	29.6	ppm HCl (7% O_2)	
Metals			
Lead (Pb)	1.40E-02	mg/dscm (7% O_2)	
Antimony (Sb)	1.00E-02	mg/dscm (7% O_2)	1/2 DL
Arsenic (As)	2.00E-02	mg/dscm (7% O_2)	1/2 DL
Beryllium (Be)	3.50E-04	mg/dscm (7% O_2)	1/2 DL
Cadmium (Cd)	3.70E-03	mg/dscm (7% O_2)	
Chromium, total (Cr)	3.60E-02	mg/dscm (7% O_2)	
Cobalt (Co)		mg/dscm (7% O_2)	
Manganese (Mn)	2.06E-01	mg/dscm (7% O_2)	
Mercury (Hg)	5.00E-04	mg/dscm (7% O_2)	1/2 DL
Nickel (Ni)	6.00E-01	mg/dscm (7% O_2)	
Selenium (Se)		mg/dscm (7% O_2)	
Zinc (Zn)	2.52E-01	mg/dscm (7% O_2)	

Other Notes

Dioxins, furans were detected, no worthwhile CO, Nox and SO2 data

Test Duration 8.00 hours

Waste		
Waste Amount	lbs	
Test Date		
Source		
	scfm	

Pollutant	**Value**	**Units**	
Carbon Monoxide (CO)			
Nitrogen Oxides (NO_x)			
Particulate Matter (PM)			
PM < 10 microns (PM_{10})			
Sulfur Dioxide (SO_2)			
Volatile Organic Compounds (VOC)			
Hydrochloric Acid			
Metals			
Lead (Pb)			
Antimony (Sb)			
Arsenic (As)			
Beryllium (Be)			
Cadmium (Cd)			
Chromium, total (Cr)			
Cobalt (Co)			
Manganese (Mn)			
Mercury (Hg)			
Nickel (Ni)			
Selenium (Se)			
Zinc (Zn)			

Other Notes

No worthwhile CO, NOx and SO2 data

Test Duration hours

TABLE A-4
EMISSION TEST DATA FOR MEDICAL WASTES

Waste	Medical Waste		
Waste Amount	1036 lbs		
	129.5 lb/hr		
Test Date	21-May-90		
Source	Entech Thermal Oxidation Test		
Flue Gas Flow Rate	622 scfm (8.87% O_2)		13.05% H_2O
Pollutant	**Value**		
Carbon Monoxide (CO)	27.7	ppmv (7% O_2)	
Nitrogen Oxides (NO_x)	69.3	ppmv (7% O_2)	
Particulate Matter (PM)	0.29	lbs/test	
PM < 10 microns (PM_{10})			
Sulfur Dioxide (SO_2)	1.2	ppmv (7% O_2)	75 lbs Lime
Volatile Organic Compounds (VOC)			
Hydrochloric Acid	182.6	ppmv (7% O_2)	75 lbs Lime
Metals			
Lead (Pb)	8.80E-02	mg/dscm (7% O_2)	
Antimony (Sb)	8.00E-03	mg/dscm (7% O_2)	
Arsenic (As)	1.20E-02	mg/dscm (7% O_2)	
Beryllium (Be)	1.00E-04	mg/dscm (7% O_2)	1/2 DL
Cadmium (Cd)	4.20E-03	mg/dscm (7% O_2)	
Chromium, total (Cr)	3.50E-04	mg/dscm (7% O_2)	1/2 DL
Cobalt (Co)	1.50E-04	mg/dscm (7% O_2)	1/2 DL
Manganese (Mn)	4.00E-03	mg/dscm (7% O_2)	
Mercury (Hg)		mg/dscm (7% O_2)	
Nickel (Ni)	1.50E-01	mg/dscm (7% O_2)	
Selenium (Se)	3.00E-01	mg/dscm (7% O_2)	
Zinc (Zn)	8.20E-02	mg/dscm (7% O_2)	
Other Notes			
Test Duration	8.00 hours		

Waste	Medical Waste		
Waste Amount	824 lbs		
	103 lb/hr		
Test Date	29-Jun-90		
Source	Entech Thermal Oxidation Test		
	798 scfm (8.5% O_2)		16.2% H_2O
Pollutant	**Value**	**Units**	
Carbon Monoxide (CO)	437.2	ppmv (7% O_2)	
Nitrogen Oxides (NO_x)	66.1	ppmv (7% O_2)	
Particulate Matter (PM)	0.5	lbs/test	
PM < 10 microns (PM_{10})			
Sulfur Dioxide (SO_2)	1.1	ppmv (7% O_2)	100 lbs NaOH
Volatile Organic Compounds (VOC)			
Hydrochloric Acid	338.5	ppmv (7% O_2)	100 lbs NaOH
Metals			
Lead (Pb)	5.20E-01	mg/dscm (7% O_2)	
Antimony (Sb)	5.40E-01	mg/dscm (7% O_2)	
Arsenic (As)	1.00E-02	mg/dscm (7% O_2)	
Beryllium (Be)	1.00E-04	mg/dscm (7% O_2)	1/2 DL
Cadmium (Cd)	1.36E-02	mg/dscm (7% O_2)	
Chromium, total (Cr)	1.00E-01	mg/dscm (7% O_2)	
Cobalt (Co)	4.00E-03	mg/dscm (7% O_2)	1/2 DL
Manganese (Mn)	5.70E-02	mg/dscm (7% O_2)	
Mercury (Hg)		mg/dscm (7% O_2)	
Nickel (Ni)	1.00E-02	mg/dscm (7% O_2)	1/2 DL
Selenium (Se)	1.70E+00	mg/dscm (7% O_2)	
Zinc (Zn)	5.30E-02	mg/dscm (7% O_2)	
Other Notes			
Test Duration	8.00 hours		

Waste	Medical Waste		
Waste Amount	752 lbs		
	94.0 lb/hr		
Test Date	11-Dec-90		
Source	Entech TO Test at WRI North Site		
Flue Gas Flow Rate	742 scfm (10.12% O_2)		13.90% H_2O
Pollutant	**Value**	**Units**	
Carbon Monoxide (CO)	15	ppmv (7% O_2)	1/2 DL
Nitrogen Oxides (NO_x)			no data
Particulate Matter (PM)	0.52	lbs/test	
PM < 10 microns (PM_{10})			
Sulfur Dioxide (SO_2)			minimal
Volatile Organic Compounds (VOC)			
Hydrochloric Acid	193.2	ppmv (7% O_2)	(13.9% H_2O)
Metals			
Lead (Pb)	1.84E-01	mg/dscm (7% O_2)	
Antimony (Sb)	2.00E-02	mg/dscm (7% O_2)	
Arsenic (As)	2.00E-03	mg/dscm (7% O_2)	1/2 DL
Beryllium (Be)	5.00E-05	mg/dscm (7% O_2)	1/2 DL
Cadmium (Cd)	2.93E-02	mg/dscm (7% O_2)	
Chromium, total (Cr)	2.00E-04	mg/dscm (7% O_2)	1/2 DL
Cobalt (Co)	4.00E-04	mg/dscm (7% O_2)	
Manganese (Mn)	3.00E-03	mg/dscm (7% O_2)	
Mercury (Hg)		mg/dscm (7% O_2)	
Nickel (Ni)	8.00E-03	mg/dscm (7% O_2)	
Selenium (Se)	2.00E-04	mg/dscm (7% O_2)	1/2 DL
Zinc (Zn)	1.62E+00	mg/dscm (7% O_2)	
Other Notes			
Dioxins, furans were detected, no worthwhile CO, NO_x and SO_2 data			
Test Duration	8.00 hours		

Waste	Medical Waste		
Waste Amount	782 lbs		
	97.8 lb/hr		
Test Date	13-Dec-90		
Source	Entech TO Test at WRI North Site		
	629 scfm (7.25% O_2)		9.28% H_2O
Pollutant	**Value**	**Units**	
Carbon Monoxide (CO)	15	ppmv (7% O_2)	1/2 DL
Nitrogen Oxides (NO_x)			no data
Particulate Matter (PM)	0.79	lbs/test	
PM < 10 microns (PM_{10})			
Sulfur Dioxide (SO_2)			minimal
Volatile Organic Compounds (VOC)			
Hydrochloric Acid	372.3	ppmv (7% O_2)	(9.28% H_2O)
Metals			
Lead (Pb)	1.06E-01	mg/dscm (7% O_2)	
Antimony (Sb)	6.50E-03	mg/dscm (7% O_2)	
Arsenic (As)	1.50E-03	mg/dscm (7% O_2)	1/2 DL
Beryllium (Be)	5.00E-05	mg/dscm (7% O_2)	1/2 DL
Cadmium (Cd)	9.90E-03	mg/dscm (7% O_2)	
Chromium, total (Cr)	3.00E-04	mg/dscm (7% O_2)	
Cobalt (Co)	3.00E-04	mg/dscm (7% O_2)	
Manganese (Mn)	1.60E-03	mg/dscm (7% O_2)	
Mercury (Hg)		mg/dscm (7% O_2)	
Nickel (Ni)	3.00E-03	mg/dscm (7% O_2)	
Selenium (Se)	1.50E-02	mg/dscm (7% O_2)	1/2 DL
Zinc (Zn)	5.13E-01	mg/dscm (7% O_2)	
Other Notes			
No worthwhile CO, NO_x and SO_2 data			
Test Duration	8.00 hours		

Waste	Medical Waste		
Waste Amount	629 lbs		
	78.6 lb/hr		
Test Date	24-Apr-93		
Source	Entech Model TOS-80 Anchorage, AK		
Flue Gas Flow Rate	1314 scfm		13% H_2O est.
Pollutant	**Value**	**Units**	
Carbon Monoxide (CO)			
Nitrogen Oxides (NO_x)			
Particulate Matter (PM)			
PM < 10 microns (PM_{10})			
Sulfur Dioxide (SO_2)			
Volatile Organic Compounds (VOC)			
Hydrochloric Acid	32.2	ppm HCl (7% O_2)	
Metals			
Lead (Pb)	2.20E-02	mg/dscm (7% O_2)	
Antimony (Sb)	1.00E-02	mg/dscm (7% O_2)	1/2 DL
Arsenic (As)	1.50E-01	mg/dscm (7% O_2)	1/2 DL
Beryllium (Be)	2.50E-04	mg/dscm (7% O_2)	1/2 DL
Cadmium (Cd)	3.80E-03	mg/dscm (7% O_2)	
Chromium, total (Cr)	2.30E-02	mg/dscm (7% O_2)	1/2 DL
Cobalt (Co)		mg/dscm (7% O_2)	
Manganese (Mn)	1.10E-01	mg/dscm (7% O_2)	
Mercury (Hg)	5.00E-04	mg/dscm (7% O_2)	
Nickel (Ni)	5.50E-01	mg/dscm (7% O_2)	
Selenium (Se)		mg/dscm (7% O_2)	1/2 DL
Zinc (Zn)	1.15E-01	mg/dscm (7% O_2)	
Other Notes			
Dioxins, furans were detected, PAHs were not detected			
Test Duration	8.00 hours		

Waste	Medical Waste		
Waste Amount	lbs		
Test Date			
Source			
	scfm		
Pollutant	**Value**	**Units**	
Carbon Monoxide (CO)			
Nitrogen Oxides (NO_x)			
Particulate Matter (PM)			
PM < 10 microns (PM_{10})			
Sulfur Dioxide (SO_2)			
Volatile Organic Compounds (VOC)			
Hydrochloric Acid			
Metals			
Lead (Pb)			
Antimony (Sb)			
Arsenic (As)			
Beryllium (Be)			
Cadmium (Cd)			
Chromium, total (Cr)			
Cobalt (Co)			
Manganese (Mn)			
Mercury (Hg)			
Nickel (Ni)			
Selenium (Se)			
Zinc (Zn)			
Other Notes			

ATTACHMENT C

SUPPORTING DOCUMENTATION

Commission Approves Zoning Change For Waste Gasification Plant

Above is an artist rendition of the proposed gasification plant.

By Terri Langford – Staff Writer

At the last Board of County Commission Meeting, Commissioners voted unanimously for the re-zoning of a 19-acre parcel of land located off the Rollison Road, next to the County's Transfer Station. The property was bought by a newly formed company, Dixie Waste Services, who will be using gasification/thermal oxidation technology, developed by International Environmental Technologies, Inc. (IET) out of Danville, Kentucky

IET, acting as a technical representative for Dixie Waste Services first approached the Board several months ago, asking for the re-zoning of property in the Old Town area, off US 19. However, upon further investigation, IET found that the property was prone to flooding and withdrew their request. The Commission and local realtors worked to find another, more suitable site, a task which they completed in less than a week.

Once again, the re-zoning was advertised and then brought before the Board. Several residents who live by the proposed site were on hand at the meeting, asking questions. Representatives from IET were on hand to answer any and all questions. Commissioners, already satisfied with the research they had reviewed on the operation of the proposed plant, had only one issue to discuss and that was working out the details on how the county could benefit from the plant being located in Dixie. Dixie Waste Services assured the Commissioners that they would be pleased with their "tipping" fee proposal, which will be worked out once the plant receives permitting from the DEP and Suwannee River Water Management District.

Dixie's Solid Waste Coordinator, Joe Ruth, has also been working with the company, learning more about the gasification process itself and how it will benefit our community. "I can't tell you how excited I am about Dixie Waste Services coming to our county," stated Ruth. "This is a top-notch company and we are lucky to have them," he added.

The technology of gasification and thermal oxidation has been around for over fifty years. Aircraft carriers have used it for years as a way to dispose of waste safely at sea. The process is simple, reverting any manmade or organic waste product back to its natural state, inert ash or breathable air. Any emissions are captured and used as a non-fossil fuel source for on-site processes.

There is no smoke or harmful emissions, it is quiet, and there is no odor. Sound too good to be true? According to recent phone interviews with several state Department of Regulation departments in both Wyoming and Alaska, the gasification/thermal oxidation process has been found to be the most environmentally safe solution to landfills.

Landfills require mass amounts of land and once filled to capacity, require the shutting down of the property and years of monitoring at an enormous cost to the taxpayer. Landfills are not only dangerous to humans, but to wildlife as well. The gasification/thermal oxidation system eliminates all these problems. It was noted that while DWS purchased 19-acres of land only 10-acres will be needed for the plant, the additional land will be used as a buffer.

Simply put, waste is brought to the plant and directly dumped into sealed vaults. There is no pre-sorting. This eliminates odor, animal scavenging, and even allows the disposal of tires and medical waste. Once sealed the waste is digested for 8-12 hours. When completed the waste will be reduced down to an ash that can be sold to cement companies.

Traffic to the plant will be approximately 12-15 trucks per day. Dixie Waste Services stated that they would help secure a grant for funding to build a new access road to be built between Rollison Road and the transfer station. It was noted at the meeting that funding for such projects is available at the state level now.

"You will find that we are good cooperate citizens," stated Larry Crow, IET Representative. "We will be spending a great deal of money here in your community and providing jobs for 30-50 people." The plant will cost around 20 million to build and then put into operation.

"It is a win-win proposition," stated Ruth. "The environment wins and the county wins with the savings this plant will provide," added Ruth.

Once permitting from the DEP and SRWMD is secured, it will take approximately 10-12 months for construction of the plant.

North Slope Borough
Barrow Thermal Oxidation System
Summary Report
Total Particulate, SO_2, NO_x, CO Emissions & CEMS RATA

Prepared for:

ASCG, Incorporated
P.O. Box 650
Barrow, AK 99723-0650

On Behalf of:
North Slope Borough
Department of Municipal Services
P.O. Box 69
Barrow, AK 99723

Prepared by:

Alaska Source Testing, LLC
520 W 58th, Unit A
Anchorage, Alaska 99518

October 3, 2003

1. INTRODUCTION

The North Slope Borough (NSB) operates an Entech Model 100 Thermal Oxidation System (TOS) in Barrow, Alaska for the oxidation of municipal solid waste. To comply with conditions in the Alaska Department of Environmental Conservation (ADEC) Compliance Evaluation dated April 23, 2003 (Certified Mail No. 7099-3400-0015-5441-3735) and Air Quality Construction Permit No. 9771-AC012, Arctic Slope Consulting Group, Incorporated (ASCG), on behalf of the NSB, engaged Alaska Source Testing, LLC (AST) to perform a source test.

The testing consisted of measuring total particulate (PM), sulfur dioxide (SO_2), nitrogen oxides (NO_x) and carbon monoxide (CO) in the exhaust gases of the unit; and a relative accuracy test audit (RATA) of the unit's continuous emission monitoring system (CEMS). AST performed the PM/SO_2/NO_x/CO test in accordance with USEPA Reference Methods 1-5, 6C, 7E and 10 as prescribed in 40 *CFR* 60, Appendix A. The RATA was performed in accordance with 40 CFR 60, Appendix B-Performance Specifications 3 and 4A. In addition to the testing, a visual emission observation was performed in accordance with USEPA Reference Method 9. AST performed the emission testing on August 20 and August 25, 2003.

Bill Hudson was project manager and on-site team leader. Danny Kost was the project technician. They were assisted during the on-site testing by Scott Barr and Ben Fletes. Matt Wilkinson, ADEC, was on-site during the August 20, 2003 testing.

Particulate testing consisted of one, 60-minute run and two, 80-minute runs for both sides of the TOS; six total particulate runs. The SO_2, NO_x and CO testing consisted of three, 60-minute runs. The CO RATA consisted of ten, twenty-two-minute runs. This document provides a summary report of the emission testing results.

2. SUMMARY OF RESULTS

2.1. Particulate Matter Emissions

The results of sample runs are presented in Table 2-1.

Table 2-1 Summary of Particulate Emissions

Run/Side	PM gr/scf*	CO_2 %	$PM_{corrected}$** gr/scf	PM lb/hr	PM lb/MMBtu ***
1 – 2	0.026	11.1	0.029	0.576	0.288
2 – 2	0.034	11.1	0.037	0.672	0.336
3 – 2	0.035	10.4	0.040	0.710	0.355
Average	**0.032**		**0.035**	**0.653**	**0.326**
8 – 1	0.055	9.4	0.070	1.326	0.663
9 – 1	0.033	10.6	0.038	0.681	0.340
10 – 1	0.036	9.9	0.044	0.695	0.348
Average	**0.041**		**0.051**	**0.901**	**0.450**

* gr/scf = grains per standard cubic foot of exhaust gas
** corrected to 12% CO_2
*** lb/MMBtu = pounds per million BTUs of fuel fired

Please note that lb/hr and lb/MMBtu are not corrected to 12% CO_2 because the units are mass per unit time.

The batch poundage burned during particulate testing was 40,740 pounds for Side #2 and 36,100 pounds for Side #1. The TOS is a batch operation. Please refer to Appendix E for a complete summary of operational parameters.

Visual surveillance observations were performed in accordance with USEPA Method 9 and were conducted by Bill Hudson. The one-hour observation was conducted on August 20, 2003 from 1600 – 1700 hrs; no visible emissions were observed. The field data sheet is included in Appendix C.

2.2. SO_2, NO_x, and CO Results

The results of sample runs are presented in Table 2-2.

Table 2-2 Summary of O_2/CO_2 Concentrations; SO2, NO_x, and CO Emissions

	Run 1	Run 2	Run 3	Average
M-3A Oxygen (%)	6.94	6.66	7.23	**6.94**
M3-A Carbon Dioxide (%)	11.1	11.1	10.4	**10.9**
Method 6-C Sulfur Dioxide				
dppmv	47.7	47.9	58.7	**51.4**
lb/hr	1.21	1.08	1.39	**1.23**
lb/MMBtu	0.60	0.54	0.69	**0.61**
Method 7-E Nitrogen Oxides				
dppmv	181.5	147.6	102.0	**143.7**
lb/hr	3.30	2.40	1.73	**2.48**
lb/MMBtu	1.65	1.20	0.87	**1.24**
Method 10 Carbon Monoxide				
dppmv	0.2	0.4	1.4	**0.7**
lb/hr	0.002	0.004	0.014	**0.007**
lb/MMBtu	0.001	0.002	0.007	**0.003**

2.3. RATA Results

The RATA evaluates system performance by comparing emission test results derived from EPA Reference Methods to monitoring results derived from the unit's CEMS. The acceptance criterion for relative accuracy for the CEMS monitor is referenced back to Performance Specifications prescribed in 40 CFR 60, Appendix B, Performance Specification 4A (PS4A).

Relative Accuracy (RA) is the absolute mean difference between the values measured by the CEMS and the value measured by the Reference Methods (RM) plus the percent error confidence coefficient of the series of tests divided by the mean of the RM tests or the applicable emission limit.

The RA acceptance criteria for a CO monitor is specified in PS 4A as no greater than 10% of the mean value of the RM test data in terms of the units of the emission standard or 5 ppm, whichever is greater.

The RA acceptance criterion for a CO_2 monitor is specified in PS 3 as no greater than 1.0 percent CO_2.

Table 2-2 Summary of RATA Results

Performance Specifications for Relative Accuracy	**CO <5 ppm**	**CO2 <1.0 %**
Absolute Value of the mean differences	0.74	0.1
Confidence Coefficient	0.08	0.1
CEMS Monitor Relative Accuracy	0.83 ppm	0.18 %

The RATA results for each test run are presented in tabular form in Appendix A along with example calculations. The batch load for the RATA was 31,600 pounds. The RM and CEMS field data are presented in Appendices B and E, respectively.

3. SOURCE DESCRIPTION

The TOS incinerator facility is located near the NSB landfill, 3490 Stevenson Road, Barrow, Alaska. The TOS is a modular, batch load, starved air unit with a manufacturer's rated capacity of thirty-tons per day of municipal solid waste (MSW).

The TOS incinerator is designed with two primary chambers and a shared secondary chamber fired with auxiliary natural gas burners. Primary chamber #1 (North Unit) is equipped with an oil burner that has the ability to burn on-spec used oil. Each chamber has a maximum practical operating capacity of 80 cubic yards of MSW.

The secondary chamber is 68-foot horizontal refractory lined tunnel that incorporates a turbulent air mixing manifold and four natural gas burners to complete the combustion of the off-gases from the primary. The secondary exits into a vertical refractory lined stack. The stack is equipped with a continuous opacity monitoring system (COMS) and CEMS.

In normal operation, the MSW is loaded as a batch into one of the primary chambers through two loading doors located on the top of primary. Once the secondary chamber is preheated to 1650 degrees Fahrenheit with auxiliary fuel, the primary chambers can be ignited; this is the start of the combustion process. A batch is typically processed with approximately an eight-hour gasification period followed a five-hour burn down. The burn-down cycle may last longer than five hours, depending upon the nature of the waste. The cycle ends when combustion is complete, the unit is cooled, ash is conveyed from the chamber. The next cycle commences when the primary is loaded again.

In each of the successful test series, the chamber that was in Cool Down Mode was isolated from the chamber being fired.

4. SAMPLE LOCATION AND TRAVERSE METHODOLOGY

Sample access was through two existing three-inch sample ports oriented 90 degrees apart on the 36-inch internal diameter circular stack. The ports are approximately ten stack diameters downstream and more than one stack diameter upstream from the nearest disturbance. Bill Hudson, AST, verified that the sample ports are positioned in accordance with USEPA Reference Method 1 prior to testing.

Figure 4-1 shows the cross-sectional area of stack at the sample location. The measurements for the traverse points are provided on the figure.

5. OPERATIONS AND TESTING CONDITIONS

Table 5-1 Operational Data

Test Date/Series	Batch Process (pounds/day)	Average Fuel Consumption (scfh)	Primary Chamber Temperature (°F)	Secondary Chamber Temperature (°F)
8/20/03 PM, SO_2/ NO_x/CO Side #2	40740	2000	63-1693	1642-1725
8/21/03 RATA	31360	2000	61-1394	1642-2087
8/25/03 PM Side #1	36100	2000	69-1693	1642-1777

Note: The Chamber temperatures reported are the ranges recorded on the TOS temperature log. The Primary Chamber has nine thermocouple reporting temperatures. The range for the Secondary Chamber is from the 'Sec180' column; this burner control is a 180-degree sweep of the chamber and regulated to a minimum 1600 degrees by the TOS Air Permit.

Daily operational data, including the process rate, fuel consumption and process temperatures for primary and secondary combustion chambers is included in Appendix E. Copies of the applicable CEMS strip charts and a summary of the data values used for the RATA are also included in Appendix E. The complete, original strip charts will remain on file at the TOS facility.

SGS

200 W. Potter Drive
Anchorage, AK 99518-1605
Tel: (907) 562-2343
Fax: (907) 561-5301
Web: http://www.sgsenvironmental.com

Laboratory Analysis Report

Scott Barr
North Slope Borough/Barrow
PO Box 69
Barrow, AK 99723

Work Order: 1044362
Thermal Oxidation System
Client: North Slope Borough/Barrow
Report Date: August 02, 2004

Enclosed are the analytical results associated with the above workorder.

As required by the state of Alaska and the USEPA, a formal Quality Assurance/Quality Control Program is maintained by SGS. A copy of our Quality Control Manual that outlines this program is available at your request. The laboratory ADEC certification numbers are AK08-03 (DW), UST-005 (CS) and AK00971 (Micro).

Except as specifically noted, all statements and data in this report are in conformance to the provisions set forth by the SGS Quality Assurance Program Plan and the National Environmental Laboratory Accreditation Conference.

If you have any questions regarding this report or if we can be of any other assistance, please call your SGS Project Manager at (907) 562-2343.

The following descriptors may be found on your report which will serve to further qualify the data.

PQL	Practical Quantitation Limit (reporting limit).
U	Indicates the analyte was analyzed for but not detected.
F	Indicates an estimated value that falls below PQL, but is greater than the MDL.
J	The quantitation is an estimation.
B	Indicates the analyte is found in a blank associated with the sample.
*	The analyte has exceeded allowable regulatory or control limits.
GT	Greater Than
D	The analyte concentration is the result of a dilution.
LT	Less Than
!	Surrogate out of control limits.
Q	QC parameter out of acceptance range.
M	A matrix effect was present.
JL	The analyte was positively identified, but the quantitation is a low estimation.
E	The analyte result is high outside of calibrated range.

Note: Soil samples are reported on a dry weight basis unless otherwise specified

1044362

CT&E Environmental Services Inc.
200 W. Potter Drive
Anchorage, AK 99518-1605
Fax # 907-561-5301

July 16, 2004

① A-B

To whom it may concern,
Enclosed you will find an amalgamated ash sample from the Thermal Oxidation System Facility. The sample is in two sample jars to ensure that you have a sufficient amount for the "RCRA 8" TLCP, EPA Method 1311. Please indicate in your final analysis report the dates of the sample are from 07/19/03 through 07/16/04 for continuity of our records. Upon completion of the test please call Raymond Atos at (907) 852-0349 with the results. The written report should be sent to:

North Slope Borough
Thermal Oxidation System Facility
P.O. Box 69
Barrow, Alaska 99723

Best regards,

Scott Barr
Thermal Oxidation System System Operator

Received:
7/20/04 0815

SGS

SGS Ref.#	1044362001
Client Name	North Slope Borough/Barrow
Project Name/#	Thermal Oxidation System
Client Sample ID	Amalgamated Ash
Matrix	Other Solids (Wet Weight)

All Dates/Times are Alaska Standard Time

Printed Date/Time	08/02/2004 18:08
Collected Date/Time	07/16/2004 0:00
Received Date/Time	07/20/2004 8:15
Technical Director	Stephen C. Ede
Released By	

Sample Remarks:

Parameter	Results	PQL	Units	Method	Container ID	Allowable Limits	Prep Date	Analysis Date	Init
Characterization									
Aqueous Phase, Total	0.0		%	TCLP	A			07/20/04	JMP
Oil Phase, Total	0.0		%	TCLP	A			07/20/04	JMP
Solid Phase, Total	100		%	TCLP	A			07/20/04	JMP
TCLP Metals									
Arsenic	0.500 U	0.500	mg/L	SW6010B TCLP	A	(<=5)	07/30/04	08/02/04	BAG
Barium	0.476	0.100	mg/L	SW6010B TCLP	A	(<=100)	07/30/04	08/02/04	BAG
Cadmium	0.0500 U	0.0500	mg/L	SW6010B TCLP	A	(<=1)	07/30/04	08/02/04	BAG
Chromium	0.200 U	0.200	mg/L	SW6010B TCLP	A	(<=5)	07/30/04	08/02/04	BAG
Lead	0.500 U	0.500	mg/L	SW6010B TCLP	A	(<=5)	07/30/04	08/02/04	BAG
Selenium	1.00 U	1.00	mg/L	SW6010B TCLP	A	(<=1)	07/30/04	08/02/04	BAG
Silver	0.200 U	0.200	mg/L	SW6010B TCLP	A	(<=5)	07/30/04	08/02/04	BAG
Mercury by Cold Vapor	0.00200 U	0.00200	mg/L	SW7470A TCLP	A	(<=0.2)	07/30/04	07/30/04	TK

North Slope Borough
Barrow Thermal Oxidation System
Summary Report
Cylinder Gas Audit

Prepared for:

ASCG, Incorporated
P.O. Box 650
Barrow, AK 99723-0650

On Behalf of:
North Slope Borough
Department of Municipal Services
P.O. Box 69
Barrow, AK 99723

Prepared by:

Alaska Source Testing, LLC
520 W 58th, Unit A
Anchorage, Alaska 99518

October 3, 2003

Introduction

The North Slope Borough (NSB) operates an Entech Model 100 Thermal Oxidation System (TOS) in Barrow, Alaska for the oxidation of municipal solid waste. The TOS is equipped with a continuous emissions monitoring system (CEMS) that was manufactured and installed by the Rosemount Corporation.

Arctic Slope Consulting Group, Incorporated (ASCG), on behalf of the NSB, engaged Alaska Source Testing, LLC (AST) to perform a cylinder gas audit (CGA) on the CEMS.

The CGA was performed by Bill Hudson of Alaska Source Testing (AST) on August 21, 2003. Scott Barr and Ben Fletes from the Barrow TOS witnessed the CGA.

I. Summary of Results

The criteria for excessive audit inaccuracy (40 CFR Part 60, App. F, 5.2.3 (2)) are ±15 percent of the averages audit value or ± 5 ppm, whichever is greater. Please refer to Appendix A for detailed calculations.

Audit Gas	Difference (C-M)*	CGA Accuracy
CO Low (23.25 ppm)	1.25 ppm	5.05 %
CO Mid (48.9 ppm)	-1.17 ppm	-1.54 %
CO High (96.7 ppm)	0.75 ppm	-0.20 %
CO Zero	1.25 ppm	-
CO_2 Low (3.98 %)	-0.19 %	4.69 %
CO_2 Mid (7.96 %)	0.30 %	3.81 %
CO_2 High (13.0 %)	0.12%	0.92 %
CO_2 Zero	-0.09%	-

* Calibration gas value less CEMS value.

II. Field Procedures

Prior to the cylinder gas audit, the TOS CEMS response times were checked. At 237 parts per million (ppm) carbon monoxide (CO), the TOS CEMS upscale response time was *1 minute (m) 12 seconds(s)* and the downscale response time was *1 m 11s*. Carbon dioxide (CO_2) was checked at 13% with up- and downscale response times of *1m 4s* and *1m 13s*, respectively.

The CEMS unit was challenged an EPA Protocol I audit gas of known concentration at three points. The span values of the CO and CO2 analyzers were 100 ppm and 25%, respectively. The CO concentrations were 23.25 ppm, 48.9 ppm and 96.7 ppm respectively. Concentrations were 3.98%, 7.96% and 13.0% respectively.

The monitor was challenged at each audit point for three to five minutes to assure adsorption-desorption of the CEMS sample transport surfaces to stabilize. The monitor was operated in its normal sampling mode. Copies of the monitor stripchart are included in Appendix C.

IV. Calculations for CEMS Data Accuracy

The monitor response at each audit point was recorded. The difference between the actual concentration of the audit gas and the concentration indicated by the monitor is used to assess the accuracy of the CEMS.

Equation 1-1 from 40 CFR 60, Appendix F, 6.2 was used to calculate the accuracy for the CGA, in units of the appropriate concentration (ppm for CO and % for CO_2). Each component of the CEMS must meet the acceptable accuracy requirement. For the CGA, the criteria for excessive inaccuracy are, +/- 15 percent of the average audit value or +/- 5 ppm, whichever is greater.

Please refer to Appendix A for the spreadsheet and a sample calculation.

V. Quality Control

The TOS CO Calibration gases used include:
96.7 ppm Cylinder no CA 05438, PO 20031435-000 OP, CC USBA01
48.9 ppm Cylinder no. CA05442
23.25 ppm Cylinder no. CA05439

The AST CO_2 calibration gases were EPA Protocol 1 with values of 3.98%, 7.96% and 13.0%. Calibration gas certificates are provided in Appendix D.

Barrow TOS
Cylinder Gas Audit

August 21, 2003

	Time	Span Value	Calibration Value (C)	Monitor Value (M)	Difference (C-M)	Percent of span value (C-M)/Span	CGA Accuracy
CO Zero	16:35	100ppm	0	-1.25			
CO Zero		100ppm	0				
CO Zero		100ppm	0				
	Average	100	**0**	**-1.25**	**1.25**	**1.25**	
CO Low	14:55	100ppm	23.25	23.33			
CO Low	15:26	100ppm	23.25	26.83			
CO Low	15:56	100ppm	23.25	23.11			
	Average	100	**23.25**	**24.42**	**-1.17**	**-1.17**	**5.0**
CO Mid	15:03	100ppm	48.9	48.85			
CO Mid	15:35	100ppm	48.9	46.84			
CO Mid	16:04	100ppm	48.9	48.75			
	Average	100	**48.9**	**48.15**	**0.75**	**0.75**	**-1.5**
CO High	15:15	100ppm	96.7	96.83			
CO High	15:45	100ppm	96.7	96.30			
CO High	16:13	100ppm	96.7	96.40			
	Average	100	**96.7**	**96.51**	**0.19**	**0.19**	**-0.2**
CO2 Zero	15:38	25%	0	0.03			
CO2 Zero	15:45	25%	0	0.08			
CO2 Zero	16:49	25%	0	0.20			
CO2 Zero	16:13	25%	0	0.03			
	Average	**25**	**0**	**0.09**	**-0.09**	**-0.34**	
CO2 Low	16:23	25%	3.98	4.14			
CO2 Low	16:56	25%	3.98	4.20			
CO2 Low	17:29	25%	3.98	4.16			
	Average	**25**	**3.98**	**4.17**	**-0.19**	**-0.75**	**4.7**
CO2 Mid	17:18	25%	7.96	8.21			
CO2 Mid	17:45	25%	7.96	8.23			
CO2 Mid	18:01	25%	7.96	8.35			
	Average	**25**	**7.96**	**8.3**	**0.30**	**1.21**	**3.8**
CO2 High	16:31	25%	13.0	13.04			
CO2 High	16:36	25%	13.0	13.13			
CO2 High	17:13	25%	13.0	13.14			
CO2 High	17:46	25%	13.0	13.17			
	Average	**25**	**13.0**	**13.1**	**0.12**	**0.48**	**0.9**

Barrow TOS
Cylinder Gas Audit

August 21, 2003

40 CFR Part 60, Appendix F, Section 6.3, Equation 1-1

A = ((Cm - Ca)/Ca) x 100

A = Accuracy of the CEMS, percent

Cm = Average CEMS response during audit in units of applicable standard or appropriate concentration

Ca = Average audit value (CGA certified value) in units of applicable standard or appropriate concentration

Example CO Low:
Cm = (23.33+26.83+23.11)/3 = 24.423 ppm
Ca = 23.25 ppm Calibration Gas

A = ((24.423-23.25)/23.25) x 100
A = (1.17/23.25) x 100
A = 0.05 x 100
A = 5.0 ppm

North Slope Borough
Service Area Ten Incinerator Plant
Summary Report
Particulate Testing & CO/CEMS RATA

Prepared for:

North Slope Borough
Pouch 340044
Prudhoe Bay, AK 99737-0044

Prepared by:

Alaska Source Testing, LLC
520 W 58th, Unit A
Anchorage, Alaska 99518

July 26, 2002

1. INTRODUCTION

North Slope Borough, Service Area Ten operates a 2,500-pound per hour municipal solid waste (MWS) and oily waste (SOW) incinerator in Prudhoe Bay, Alaska. To comply with conditions in the Title V operating permit (Permit No. 187TVP01), North Slope Borough engaged Alaska Source Testing, LLC (AST) to perform a source test.

The testing consisted of measuring total particulate (PM) in the exhaust gases of the unit and a relative accuracy test audit (RATA) of the unit's continuous emission monitor. AST performed the particulate test in accordance with USEPA Reference Methods 1-5 as prescribed in 40 *CFR 60, Appendix A*. The RATA was performed in accordance with 40 CFR 60, Appendix B-Performance Specifications 2 and 4. In addition to the testing, a visual emission observation was performed in accordance with USEPA Reference Method 9. AST performed the emission testing on June 18-19, 2002.

W.M. Hudson was project manager and on-site team leader. He was assisted during the on-site testing by plant personnel.

Particulate testing consisted of three, 72-minute runs. The CO RATA consisted of twelve, twenty-two-minute runs; nine were used for calculations. This document provides a summary report of the emission testing results.

2. SUMMARY OF RESULTS

2.1. Particulate Test Results

The results of sample runs are presented in Table 2-1.

Table 2-1 Summary of Particulate Test Results

Run	Particulate Matter gr/scf	Particulate Matter (corrected to 12% CO_2) gr/scf	Particulate Matter Lb/hr	Opacity %
1	0.005	0.011	0.59	2.08
2	0.006	0.014	0.75	1.04
3	0.004	0.010	0.50	0.63
Average	**0.005**	**0.012**	**0.61**	**1.25**

*gr/scf = grains per standard cubic foot of exhaust gas

Visual surveillance observations were performed in accordance with USEPA Method 9 and were conducted by Bill Hudson. The field data sheets are included in Appendix C.

Figure 4-1 shows the cross-sectional area of stack at the sample location. The measurements for the traverse points are provided on the figure.

5. OPERATIONS AND TESTING CONDITIONS

The table below summarizes the operation data during particulate testing. The Coms Output during the RATA is summarized in Appendix A; the feedrate average during the RATA was 1131 lbs/hr. Please refer to Appendix E for copies of the unit log sheets and operational notes during the tests.

coms

Particulate Run	1	2	3
Feed Rate (lb/hr)	1343	1341	1750
Combustion Zone Temp.	1565°F ✓	1582°F ✓	1578°F ✓
CEMS ~~COMS~~ Output instantaneous [illegible]	9.1 0	19.8 1	6.9 0
Damper Position	closed	closed	closed

see Appendix E

6. TEST PROCEDURES AND APPARATUS

The individual test procedures used during this testing program were conducted in accordance with U.S. EPA Reference Methods as prescribed in 40 CFR 60, Appendix A. The specific methods are listed below.

Method 1	Sample and Velocity traverses for Stationary Sources
Method 2	Determination of Stack Gas Velocity and Volumetric Flow Rate (Type S Pitot Tube)
Method 3A	Determination of Oxygen and Carbon Dioxide Concentrations in Emissions from Stationary Sources (Instrumental Analyzer Procedure)
Method 4	Determination of Moisture Content in Stack Gases
Method 5	Determination of Particulate Emissions from Stationary Sources
Method 9	Visual Determination of the Opacity of Emissions from Stationary Sources
Method 10	Determination of Carbon Monoxide Emissions from Stationary Sources

6.1 Description of Particulate Matter Testing

The particulate testing consisted of 3 three 72-minute sample runs. All runs were performed in accordance with Reference Methods 1 – 5. Isokinetic variation (Appendix A) for all runs met Method 5 standards. There were no voided sample runs.

There were no problems with the testing equipment.

2.2. CO RATA Results

The RATA evaluates system performance by comparing emission test results derived from EPA Reference Methods to monitoring results derived from the unit's CEMS. The acceptance criterion for relative accuracy for each of the CEMS monitors is referenced back to Performance Specifications prescribed in 40 CFR 60, Appendix B, Performance Specification 4 (PS4).

Relative Accuracy (RA) is the absolute mean difference between the values measured by the CEMS and the value measured by the Reference Methods (RM) plus the percent error confidence coefficient of the series of tests divided by the mean of the RM tests or the applicable emission limit. The RA acceptance criteria for a CO monitor is specified in PS 4 as no greater than 10% of the mean value of the RM test data in terms of the emission standard or 5 % of the applicable standard, whichever is greater.

Table 2-2 Summary of RATA Results

Performance Specifications for Relative Accuracy	**No greater than 5% (PS 4)**
Absolute Value of the mean differences	3.28
Confidence Coefficient	1.41
Average RM Value	10.7
Emission Standard (applicable emission limit)	100 ppm
5% applicable emission limit	5.00 ppm
CEMS Monitor Relative Accuracy	4.69 ppm

The RATA results for each test run are presented in tabular form in Appendix A along with example calculations. The RM and CEMS field data are presented in Appendices B and E, respectively.

3. SOURCE DESCRIPTION

The source tested was a Basic Pulse Hearth Boiler Model 5000 identified as Source ID 1. The incinerator uses natural gas for the supplemental fuel, with an electrostatic precipitator (ESP) for a control device. The unit is rated at 2500 lb/hr @ 8000 Btu/lb.

4. SAMPLE LOCATION AND TRAVERSE METHODOLOGY

The unit emissions were sampled from the exhaust stack through two four-inch sample ports that were accessed from the roof. The sample ports were located approximately 38 feet downstream of an ID fan and approximately 8 feet upstream of the stack exit. Bill Hudson, AST, verified that the ports met EPA Reference Method 1 siting criteria prior to testing.
In accordance with U.S. EPA Reference Method 1, this sample location required a minimum of 24 points, 12 points on each traverse from 2 ports.

Barrow Test Results

Air Emission Standards	USEPA - 40 CFR Part 60.33 Capacity of > 250 tons per day	Test 1	Test 2
Dust (particulate)	24 mg / m^3	7.32	9.38
HCl	25 ppm		
Hydrogen flouride	no standard		
Sulphur Dioxide	30 ppm	51.4	
NOx	150 ppm	143.7	
CO	50 ppm	0.7	
Total Organic Compounds	no standard		
Dioxins/Furans*	13 ng/cft		
Total Metals	no standard		
Mercury and compounds	.08 mg/m^3		
Lead and compounds	0.20 mg/m^3		
Cadmium and compounds	0.02 mg/m^3		

TCLP Ash Testing	USEPA RCRA Limit	
Chlorides	no limit	
Silver	no limit	undet.
Barium	100 mg / L	0.476
Cadmium	1 mg / L	undet.
Nickel	no limit	
Lead	5 mg / L	undet.
Arsenic	5 mg / L	undet.
Selenium	1 mg / L	undet.
Chromium	1 mg / L	undet.
Mercury	0.2 mg / L	undet.
Thallium	no limit	

[Last updated 2/3/00]
{Source: Federal Register dated Mar. 12, 1996. Updated to reflect 6/16/98 revisions, revised 2/3/00 to reflect 2/24/99 corrections.}

Subpart Cc--Emission Guidelines and Compliance Times for Municipal Solid Waste Landfills

Sec.

Subpart Cc--Emission Guidelines and Compliance Times for Municipal Solid Waste Landfills

§ 60.30c Scope.

This subpart contains emission guidelines and compliance times for the control of certain designated pollutants from certain designated municipal solid waste landfills in accordance with section 111(d) of the Act and subpart B.

§ 60.31c Definitions.

Terms used but not defined in this subpart have the meaning given them in the Act and in subparts A, B, and WWW of this part.

Municipal solid waste landfill or MSW landfill means an entire disposal facility in a contiguous geographical space where household waste is placed in or on land. An MSW landfill may also receive other types of RCRA Subtitle D wastes such as commercial solid waste, nonhazardous sludge, conditionally exempt small quantity generator waste, and industrial solid waste. Portions of an MSW landfill may be separated by access roads. An MSW landfill may be publicly or privately owned. An MSW landfill may be a new MSW landfill, an existing MSW landfill or a lateral expansion.

§ 60.32c Designated facilities.

(a) The designated facility to which the guidelines apply is each existing MSW landfill for which construction, reconstruction or modification was commenced before May 30, 1991.

(b) Physical or operational changes made to an existing MSW landfill solely to comply with an emission guideline are not considered a modification or reconstruction and would not subject an existing MSW landfill to the requirements of subpart WWW [see § 60.750 of Subpart WWW].

(c) For purposes of obtaining an operating permit under title V of the Act, the owner or operator of a MSW landfill subject to this subpart with a design capacity less than 2.5 million megagrams or 2.5 million cubic meters is not subject to the requirement to obtain an operating permit for the landfill under part 70 or 71 of this chapter, unless the landfill is otherwise subject to either part 70 or 71. For purposes of submitting a timely application for an operating permit under part 70 or 71, the owner or operator of a MSW landfill subject to this subpart with a design capacity greater than or equal to 2.5 million megagrams and 2.5 million cubic meters on the effective date of EPA approval of the State's program under section 111(d) of the Act, and not otherwise subject to either part 70 or 71, becomes subject to the requirements of Secs. 70.5(a)(1)(i) or

71.5(a)(1)(i) of this chapter 90 days after the effective date of such 111(d) program approval, even if the design capacity report is submitted earlier.

(d) When a MSW landfill subject to this subpart is closed, the owner or operator is no longer subject to the requirement to maintain an operating permit under part 70 or 71 of this chapter for the landfill if the landfill is not otherwise subject to the requirements of either part 70 or 71 and if either of the following conditions are met.

(1) The landfill was never subject to the requirement for a control system under § 60.33c(c) of this subpart; or

(2) The owner or operator meets the conditions for control system removal specified in § 60.752(b)(2)(v) of subpart WWW.

§ 60.33c Emission guidelines for municipal solid waste landfill emissions.

(a) For approval, a State plan shall include control of MSW landfill emissions at each MSW landfill meeting the following three conditions:

(1) The landfill has accepted waste at any time since November 8, 1987, or has additional design capacity available for future waste deposition;

(2) The landfill has a design capacity greater than or equal to 2.5 million megagrams or 2.5 million cubic meters. The landfill may calculate design capacity in either megagrams or cubic meters for comparison with the exemption values. Any density conversions shall be documented and submitted with the design capacity report; and

(3) The landfill has a nonmethane organic compound emission rate of 50 megagrams per year or more.

(b) For approval, a State plan shall include the installation of a collection and control system meeting the conditions provided in § 60.752(b)(2)(ii) of this part at each MSW landfill meeting the conditions in paragraph (a) of this section. The State plan shall include a process for State review and approval of the site-specific design plans for the gas collection and control system(s).

(c) For approval, a State plan shall include provisions for the control of collected MSW landfill emissions through the use of control devices meeting the requirements of paragraph (c)(1), (2), or (3) of this section, except as provided in § 60.24.

(1) An open flare designed and operated in accordance with the parameters established in § 60.18; or

(2) A control system designed and operated to reduce NMOC by 98 weight percent; or

(3) An enclosed combustor designed and operated to reduce the outlet NMOC concentration to 20 parts per million as hexane by volume, dry basis at 3 percent oxygen, or less.

(d) For approval, a State plan shall require each owner or operator of an MSW landfill having a design capacity less than 2.5 million megagrams by mass or 2.5 million meters by volume to submit an initial design capacity report to the Administrator as provided in § 60.757(a)(2) of subpart WWW by the date specified in § 60.35c of this subpart. The landfill may calculate design capacity in either megagrams or cubic meters for comparison with the exemption values. Any density conversions shall be documented and submitted with the report. Submittal of the initial design capacity report shall fulfill the requirements of this subpart except as provided in paragraph (d)(1) and (d)(2) of this section.

(1) The owner or operator shall submit an amended design capacity report as provided in § 60.757(a)(3) of subpart WWW. [Guidance: Note that if the design capacity increase is the result of a modification, as defined in § 60.751 of subpart WWW, that was commenced on or after May 30, 1991, the landfill will become subject to subpart WWW instead of this subpart. If the design capacity increase is a result of a change in operating practices, density, or some other modification, the landfill remains subject to this subpart.]

(2) When an increase in the maximum design capacity of a landfill with an initial design capacity less than 2.5 million megagrams or 2.5 million cubic meters results in a revised maximum design capacity equal to or greater than 2.5 million megagrams and 2.5 million cubic meters, the owner or operator shall comply with paragraph (e) of this section.

(e) For approval, a State plan shall require each owner or operator of an MSW landfill having a design capacity equal to or greater than 2.5 million megagrams and 2.5 million cubic meters to either install a collection and control system as provided in paragraph (b) of this section and Sec. 60.752(b)(2) of subpart WWW or calculate an initial NMOC emission rate for the landfill using the procedures specified in Sec. 60.34c of this subpart and Sec. 60.754 of subpart WWW. The NMOC emission rate shall be recalculated annually, except as provided in Sec. 60.757(b)(1)(ii) of subpart WWW.

(1) If the calculated NMOC emission rate is less than 50 megagrams per year, the owner or operator shall:

(i) submit an annual emission report, except as provided for in Sec. 60.757(b)(1)(ii); and

(ii) recalculate the NMOC emission rate annually using the procedures specified in Sec. 60.754(a)(1) of subpart WWW until such time as the calculated NMOC emission rate is equal to or greater than 50 megagrams per year, or the landfill is closed.

(2) (i) If the NMOC emission rate, upon initial calculation or annual recalculation required in paragraph (e)(1)(ii) of this section, is equal to or greater than 50 megagrams per year, the owner or operator shall install a collection and control system as provided in paragraph (b) of this section and Sec. 60.752(b)(2) of subpart WWW.

(ii) If the landfill is permanently closed, a closure notification shall be submitted to the Administrator as provided in Sec. 60.35c of this subpart and Sec. 60.757(d) of subpart WWW.

§ 60.34c Test methods and procedures.

For approval, a State plan shall include provisions for: the calculation of the landfill NMOC emission rate listed in § 60.754, as applicable, to determine whether the landfill meets the condition in § 60.33c(a)(3); the operational standards in § 60.753; the compliance provisions in § 60.755; and the monitoring provisions in § 60.756.

§ 60.35c Reporting and recordkeeping guidelines.

For approval, a State plan shall include the recordkeeping and reporting provisions listed in Secs. 60.757 and 60.758, as applicable, except as provided under § 60.24.

(a) For existing MSW landfills subject to this subpart the initial design capacity report shall be submitted no later than 90 days after the effective date of EPA approval of the State's plan under section 111(d) of the Act.

(b) For existing MSW landfills covered by this subpart with a design capacity equal to or greater than 2.5 million megagrams and 2.5 million cubic meters, the initial NMOC emission rate report shall be submitted no later than 90 days after the effective date of EPA approval of the State's plan under section 111(d) of the Act.

§ 60.36c Compliance times.

(a) Except as provided for under paragraph (b) of this section, planning, awarding of contracts, and installation of MSW landfill air emission collection and control equipment capable of meeting the emission guidelines established under § 60.33c shall be accomplished within 30 months after the date the initial NMOC emission rate report shows NMOC emissions equal or exceed 50 megagrams per year.

(b) For each existing MSW landfill meeting the conditions in § 60.33c(a)(1) and § 60.33c(a)(2) whose NMOC emission rate is less than 50 megagrams per year on the effective date of the State emission standard, installation of collection and control systems capable of meeting emission guidelines in § 60.33c shall be accomplished within 30 months of the date when the condition in § 60.33c(a)(3) is met (i.e., the date of the first annual nonmethane organic compounds emission rate which equals or exceeds 50 megagrams per year).

[Last Updated: 12/21/00]
[Source: Federal Register dated 12/6/00]

40 CFR 60 - Subpart AAAA--Standards of Performance for New Stationary Sources: Small Municipal Waste Combustion Units

Sec.

60.1180 Where must I keep the plant-specific operating manual?

GOOD COMBUSTION PRACTICES: OPERATOR CERTIFICATION

60.1185 What types of operator certification must the chief facility operator and shift supervisor obtain and by when must they obtain it?
60.1190 After the required date for operator certification, who may operate the municipal waste combustion unit?
60.1195 What if all the certified operators must be temporarily offsite?

GOOD COMBUSTION PRACTICES: OPERATING REQUIREMENTS

60.1200 What are the operating practice requirements for my municipal waste combustion unit?
60.1205 What happens to the operating requirements during periods of startup, shutdown, and malfunction?

EMISSION LIMITS

60.1210 What pollutants are regulated by this subpart?
60.1215 What emission limits must I meet? By when?
60.1220 What happens to the emission limits during periods of startup, shutdown, and malfunction?

CONTINUOUS EMISSION MONITORING

60.1225 What types of continuous emission monitoring must I perform?
60.1230 What continuous emission monitoring systems must I install or gaseous pollutants?
60.1235 How are the data from the continuous emission monitoring ystems used?
60.1240 How do I make sure my continuous emission monitoring systems are operating correctly?
60.1245 Am I exempt from any appendix B or appendix F requirements to evaluate continuous emission monitoring systems?
60.1250 What is my schedule for evaluating continuous emission monitoring systems?
60.1255 What must I do if I choose to monitor carbon dioxide instead of oxygen as a diluent gas?
60.1260 What is the minimum amount of monitoring data I must collect with my continuous emission monitoring systems and is this requirement enforceable?
60.1265 How do I convert my 1-hour arithmetic averages into the appropriate averaging times and units for this standard?
60.1270 What is required for my continuous opacity monitoring system and how are the data used?
60.1275 What additional requirements must I meet for the operation of my continuous emission monitoring systems and continuous opacity monitoring system?
60.1280 What must I do if my continuous emission monitoring system is temporarily unavailable to meet the data collection requirements?

STACK TESTING

60.1285 What types of stack tests must I conduct?
60.1290 How are the stack test data used?
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OTHER MONITORING REQUIREMENTS

60.1315 Must I meet other requirements for continuous monitoring?
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60.1325 How do I monitor the temperature of flue gases at the inlet of my particulate matter control device?
60.1330 How do I monitor the injection rate of activated carbon?
60.1335 What is the minimum amount of monitoring data I must collect with my continuous parameter monitoring systems and is this requirement enforceable?

RECORDKEEPING

60.1340 What records must I keep?
60.1345 Where must I keep my records and for how long?
60.1350 What records must I keep for the materials separation plan and siting analysis?
60.1355 What records must I keep for operator training and certification?

REPORTING

AIR CURTAIN INCINERATORS THAT BURN 100 PERCENT YARD WASTE

EQUATIONS

DEFINITIONS

TABLES

Subpart AAAA--Standards of Performance for New Stationary Sources: Small Municipal Waste Combustion Units

INTRODUCTION

§ 60.1000 What does this subpart do?

This subpart establishes new source performance standards for new small municipal waste combustion units.

§ 60.1005 When does this subpart become effective?

This subpart takes effect June 6, 2001. Some of the requirements in this subpart apply to municipal waste combustion unit planning and must be completed before construction is commenced on the municipal waste combustion unit. In particular, the preconstruction requirements in §§ 60.1050 through 60.1150 must be completed prior to commencing construction. Other requirements (such as the emission limits) apply when the municipal waste combustion unit begins operation.

APPLICABILITY

§ 60.1010 Does this subpart apply to my municipal waste combustion unit?

Yes, if your municipal waste combustion unit meets two criteria:
(a) Your municipal waste combustion unit is a new municipal waste combustion unit.

(b) Your municipal waste combustion unit has the capacity to combust at least 35 tons per day but no more than 250 tons per day of municipal solid waste or refuse-derived fuel.

§ 60.1015 What is a new municipal waste combustion unit?

(a) A new municipal waste combustion unit is a municipal waste combustion unit that meets either of two criteria:

(1) Commenced construction after August 30, 1999.
(2) Commenced reconstruction or modification at least 6 months after June 6, 2001.

(b) This subpart does not apply to your municipal waste combustion unit if you make physical or operational changes to an existing municipal waste combustion unit primarily to comply with the emission guidelines in subpart BBBB of this part. Such changes do not qualify as reconstruction or modification under this subpart.

§ 60.1020 Does this subpart allow any exemptions?

(a) Small municipal waste combustion units that combust less than 11 tons per day. You are exempt from this subpart if you meet four requirements:

(1) Your municipal waste combustion unit is subject to a federally enforceable operating permit limiting the amount of municipal solid waste combusted to less than 11 tons per day.
(2) You notify the Administrator that the unit qualifies for this exemption.
(3) You provide the Administrator with a copy of the federally enforceable permit.
(4) You keep daily records of the amount of municipal solid waste combusted.

(b) Small power production facilities. You are exempt from this subpart if you meet four requirements:

(1) Your unit qualifies as a small power-production facility under section 3(17)(C) of the Federal Power Act (16 U.S.C. 796(17)(C)).
(2) Your unit combusts homogeneous waste (excluding refuse-derived fuel) to produce electricity.
(3) You notify the Administrator that the unit qualifies for this exemption.
(4) You provide the Administrator with documentation that the unit qualifies for this exemption.

(c) Cogeneration facilities. You are exempt from this subpart if you meet four requirements:

(1) Your unit qualifies as a cogeneration facility under section 3(18)(B) of the Federal Power Act (16 U.S.C. 796(18)(B)).
(2) Your unit combusts homogeneous waste (excluding refuse-derived fuel) to produce electricity and steam or other forms of energy used for industrial, commercial, heating, or cooling purposes.
(3) You notify the Administrator that the unit qualifies for this exemption.
(4) You provide the Administrator with documentation that the unit qualifies for this exemption.

(d) Municipal waste combustion units that combust only tires. You are exempt from this subpart if you meet three requirements:

(1) Your municipal waste combustion unit combusts a single-item waste stream of tires and no other municipal waste (the unit can cofire coal, fuel oil, natural gas, or other nonmunicipal solid waste).
(2) You notify the Administrator that the unit qualifies for this exemption.
(3) You provide the Administrator with documentation that the unit qualifies for this exemption.

(e) Hazardous waste combustion units. You are exempt from this subpart if you get a permit for your unit under section 3005 of the Solid Waste Disposal Act.

(f) Materials recovery units. You are exempt from this subpart if your unit combusts waste mainly to recover metals. Primary and secondary smelters qualify for this exemption.

(g) Cofired combustors. You are exempt from this subpart if you meet four requirements:

(1) Your unit has a federally enforceable permit limiting the combustion of municipal solid waste to 30 percent of the total fuel input by weight.

(2) You notify the Administrator that the unit qualifies for this exemption.

(3) You provide the Administrator with a copy of the federally enforceable permit.

(4) You record the weights, each quarter, of municipal solid waste and of all other fuels combusted.

(h) Plastics/rubber recycling units. You are exempt from this subpart if you meet four requirements:

(1) Your pyrolysis/combustion unit is an integrated part of a plastics/rubber recycling unit as defined under ``Definitions" (§ 60.1465).

(2) You record the weights, each quarter, of plastics, rubber, and rubber tires processed.

(3) You record the weights, each quarter, of feed stocks produced and marketed from chemical plants and petroleum refineries.

(4) You keep the name and address of the purchaser of these feed stocks.

(i) Units that combust fuels made from products of plastics/rubber recycling plants. You are exempt from this subpart if you meet two requirements:

(1) Your unit combusts gasoline, diesel fuel, jet fuel, fuel oils, residual oil, refinery gas, petroleum coke, liquified petroleum gas, propane, or butane produced by chemical plants or petroleum refineries that use feedstocks produced by plastics/rubber recycling units.

(2) Your unit does not combust any other municipal solid waste.

(j) Cement kilns. You are exempt from this subpart if your cement kiln combusts municipal solid waste.

(k) Air curtain incinerators. If your air curtain incinerator (see § 60.1465 for definition) combusts 100 percent yard waste, you must only meet the requirements under ``Air Curtain Incinerators That Burn 100 Percent Yard Waste" (§§ 60.1435 through 60.1455).

§ 60.1025 Do subpart E new source performance standards also apply to my municipal waste combustion unit?

If this subpart (subpart AAAA) applies to your municipal waste combustion unit, then subpart E does not apply to your municipal waste combustion unit.

§ 60.1030 Can the Administrator delegate authority to enforce these Federal standards to a State agency?

Yes. The Administrator can delegate all authorities in all sections of this subpart to the State for direct State enforcement.

§ 60.1035 How are the standards structured?

The standards contain five major components:

(a) Preconstruction requirements.

(1) Materials separation plan.
(2) Siting analysis.

(b) Good combustion practices.
(1) Operator training.
(2) Operator certification.
(3) Operating requirements.

(c) Emission limits.

(d) Monitoring and stack testing.

(e) Recordkeeping and reporting.

§ 60.1040 Do all five components of the standards apply at the same time?

No. You must meet the preconstruction requirements before you commence construction of the municipal waste combustion unit. After the municipal waste combustion unit begins operation, you must meet all of the good combustion practices, emission limits, monitoring, stack testing, and most recordkeeping and reporting requirements.

§ 60.1045 Are there different subcategories of small municipal waste combustion units within this subpart?

(a) Yes. This subpart subcategorizes small municipal waste combustion units into two groups based on the aggregate capacity of the municipal waste combustion plant and the type of municipal waste combustion unit as follows:

(1) Class I Units. These are small municipal waste combustion units that are located at municipal waste combustion plants with an aggregate plant combustion capacity of more than 250 tons per day of municipal solid waste. (See the definition of ``municipal waste combustion plant capacity" in § 60.1465 for specification of which units at a plant are included in the aggregate capacity calculation.)

(2) Class II Units. These are small municipal waste combustion units that are located at municipal waste combustion plants with an aggregate plant combustion capacity no more than 250 tons per day of municipal solid waste. (See the definition of ``municipal waste combustion plant capacity" in § 60.1465 for specification of which units at a plant are included in the aggregate capacity calculation.)

(b) The requirements for Class I and Class II units are identical except for two items:

(1) Class I units have a nitrogen oxide emission limit. Class II units do not have a nitrogen oxide emission limit (see table 1 of this subpart). Additionally, Class I units have continuous emission monitoring, recordkeeping, and reporting requirements for nitrogen oxides.

(2) Class II units are eligible for the reduced testing option provided in § 60.1305.

PRECONSTRUCTION REQUIREMENTS: MATERIALS SEPARATION PLAN

§ 60.1050 Who must submit a materials separation plan?

(a) You must prepare a materials separation plan for your municipal waste combustion unit if you plan to commence construction of a new small municipal waste combustion unit after December 6, 2000.

(b) If you commence construction of your municipal waste combustion unit after August 30, 1999 but before December 6, 2000, you are not required to prepare the materials separation plan specified in this subpart.

(c) You must prepare a materials separation plan if you are required to submit an initial application for a construction permit, under 40 CFR part 51, subpart I, or part 52, as applicable, for the reconstruction or modification of your municipal waste combustion unit.

§ 60.1055 What is a materials separation plan?

The plan identifies a goal and an approach for separating certain components of municipal solid waste for a given service area prior to waste combustion and making them available for recycling.

§ 60.1060 What steps must I complete for my materials separation plan?

(a) For your materials separation plan, you must complete nine steps:

(1) Prepare a draft materials separation plan.
(2) Make your draft plan available to the public.
(3) Hold a public meeting on your draft plan.
(4) Prepare responses to public comments received during the public comment period on your draft plan.
(5) Prepare a revised materials separation plan.
(6) Discuss the revised plan at the public meeting for review of the siting analysis.
(7) Prepare responses to public comments received on your revised plan.
(8) Prepare a final materials separation plan.
(9) Submit the final materials separation plan.

(b) You may use analyses conducted under the requirements of 40 CFR part 51, subpart I, or part 52, to comply with some of the materials separation requirements of this subpart.

§ 60.1065 What must I include in my draft materials separation plan?

(a) You must prepare and submit a draft materials separation plan for your municipal waste combustion unit and its service area.

(b) Your draft materials separation plan must identify a goal and an approach for separating certain components of municipal solid waste for a given service area prior to waste combustion and making them available for recycling. A materials separation plan may include such elements as dropoff facilities, buy-back or deposit-return incentives, programs for curbside pickup, and centralized systems for mechanical separation.

(c) Your materials separation plan may include different goals or approaches for different subareas in the service area.

(d) Your materials separation plan may exclude materials separation activities for certain subareas or, if warranted, the entire service area.

§ 60.1070 How do I make my draft materials separation plan available to the public?

(a) Distribute your draft materials separation plan to the main public libraries in the area where you will construct the municipal waste combustion unit.

(b) Publish a notice of a public meeting in the main newspapers that serve these two areas:

(1) The area where you will construct the municipal waste combustion unit.
(2) The areas where the waste that your municipal waste combustion unit combusts will be collected.

(c) Include six items in your notice of the public meeting:
(1) The date of the public meeting.
(2) The time of the public meeting.
(3) The location of the public meeting.
(4) The location of the public libraries where the public can find your materials separation plan. Include the normal business hours of each library.
(5) An agenda of the topics that will be discussed at the public meeting.
(6) The beginning and ending dates of the public comment period on your draft materials separation plan.

§ 60.1075 When must I accept comments on the materials separation plan?

(a) You must accept verbal comments at the public meeting.

(b) You must accept written comments anytime during the period that begins on the date the document is distributed to the main public libraries and ends 30 days after the date of the public meeting.

§ 60.1080 Where and when must I hold a public meeting on my draft materials separation plan?

(a) You must hold a public meeting and accept comments on your draft materials separation plan.

(b) You must hold the public meeting in the county where you will construct the municipal waste combustion unit.

(c) You must schedule the public meeting to occur at least 30 days after you make your draft materials separation plan available to the public.

(d) You may combine this public meeting with any other public meeting required as part of any other Federal, State, or local permit review. However, you may not combine it with the public meeting required for the siting analysis under ``Preconstruction Requirements: Siting Analysis" (§ 60.1140).

(e) You are encouraged to address eight topics at the public meeting for your draft materials separation plan:
(1) Expected size of the service area for your municipal waste combustion unit.
(2) Amount of waste you will collect in the service area.
(3) Types and estimated amounts of materials proposed for separation.
(4) Methods proposed for materials separation.
(5) Amount of residual waste for disposal.
(6) Alternate disposal methods for handling the residual waste.
(7) Where your responses to public comments on the draft materials separation plan will be available for inspection.
(8) Where your revised materials separation plan will be available for inspection.

(f) You must prepare a transcript of the public meeting on your draft materials separation plan.

§ 60.1085 What must I do with any public comments I receive during the public comment period on my draft materials separation plan?

You must do three steps:

(a) Prepare written responses to any public comments you received during the public comment period. Summarize these responses to public comments in a document that is separate from your revised materials separation plan.

(b) Make the comment response document available to the public in the service area where you will construct your municipal waste combustion unit. You must distribute the document at least to the main public libraries used to announce the public meeting.

(c) Prepare a revised materials separation plan for the municipal waste combustion unit that includes, as appropriate, changes made in response to any public comments you received during the public comment period.

§ 60.1090 What must I do with my revised materials separation plan?

You must do two tasks:
(a) As specified under ``Reporting'' (§ 60.1375), submit five items to the Administrator by the date you submit the application for a construction permit under 40 CFR part 51, subpart I, or part 52. (If you are not required to submit an application for a construction permit under 40 CFR part 51, subpart I, or part 52, submit five items to the Administrator by the date of your notice of construction under § 60.1380):
(1) Your draft materials separation plan.
(2) Your revised materials separation plan.
(3) Your notice of the public meeting for your draft materials separation plan.
(4) A transcript of the public meeting on your draft materials separation plan.
(5) The document that summarizes your responses to the public comments you received during the public comment period on your draft materials separation plan.

(b) Make your revised materials separation plan available to the public as part of the siting analysis procedures under ``Preconstruction Requirements: Siting Analysis'' (§ 60.1130).

§ 60.1095 What must I include in the public meeting on my revised materials separation plan?

As part of the public meeting for review of the siting analysis, as specified under ``Preconstruction Requirements: Siting Analysis'' (§ 60.1140), you must discuss two areas:
(a) Differences between your revised materials separation plan and your draft materials separation plan discussed at the first public meeting (§ 60.1080).

(b) Questions about your revised materials separation plan.

§ 60.1100 What must I do with any public comments I receive on my revised materials separation plan?

(a) Prepare written responses to any public comments and include them in the document that summarizes your responses to public comments on the siting analysis.

(b) Prepare a final materials separation plan that includes, as appropriate, changes made in response to any public comments you received on your revised materials separation plan.

§ 60.1105 How do I submit my final materials separation plan?

As specified under ``Reporting'' (§ 60.1380), submit your final materials separation plan to the Administrator as part of the notice of construction for the municipal waste combustion unit.

PRECONSTRUCTION REQUIREMENTS: SITING ANALYSIS

§ 60.1110 Who must submit a siting analysis?

(a) You must prepare a siting analysis if you plan to commence construction of a small municipal waste combustion unit after December 6, 2000.

(b) If you commence construction on your municipal waste combustion unit after August 30, 1999, but before December 6, 2000, you are not required to prepare the siting analysis specified in this subpart.

(c) You must prepare a siting analysis if you are required to submit an initial application for a construction permit, under 40 CFR part 51, subpart I, or part 52, as applicable, for the reconstruction or modification of your municipal waste combustion unit.

§ 60.1115 What is a siting analysis?

The siting analysis addresses how your municipal waste combustion unit affects ambient air quality, visibility, soils, vegetation, and other relevant factors. This analysis can be used to determine whether the benefits of your proposed facility significantly outweigh the environmental and social costs resulting from its location and construction. This analysis must also consider other major industrial facilities near the proposed site.

§ 60.1120 What steps must I complete for my siting analysis?

(a) For your siting analysis, you must complete five steps:

(1) Prepare an analysis.
(2) Make your analysis available to the public.
(3) Hold a public meeting on your analysis.
(4) Prepare responses to public comments received on your analysis.
(5) Submit your analysis.

(b) You may use analyses conducted under the requirements of 40 CFR part 51, subpart I, or part 52, to comply with some of the siting analysis requirements of this subpart.

§ 60.1125 What must I include in my siting analysis?

(a) Include an analysis of how your municipal waste combustion unit affects these four areas:

(1) Ambient air quality.
(2) Visibility.
(3) Soils.
(4) Vegetation.

(b) Include an analysis of alternatives for controlling air pollution that minimize potential risks to the public health and the environment.

§ 60.1130 How do I make my siting analysis available to the public?

(a) Distribute your siting analysis and revised materials separation plan to the main public libraries in the area where you will construct your municipal waste combustion unit.

(b) Publish a notice of a public meeting in the main newspapers that serve these two areas:

(1) The area where you will construct your municipal waste combustion unit.
(2) The areas where the waste that your municipal waste combustion unit combusts will be collected.

(c) Include six items in your notice of the public meeting:
(1) The date of the public meeting.
(2) The time of the public meeting.
(3) The location of the public meeting.
(4) The location of the public libraries where the public can find your siting analysis and revised materials separation plan. Include the normal business hours of each library.
(5) An agenda of the topics that will be discussed at the public meeting.
(6) The beginning and ending dates of the public comment period on your siting analysis and revised materials separation plan.

§ 60.1135 When must I accept comments on the siting analysis and revised materials separation plan?

(a) You must accept verbal comments at the public meeting.

(b) You must accept written comments anytime during the period that begins on the date the document is distributed to the main public libraries and ends 30 days after the date of the public meeting.

§ 60.1140 Where and when must I hold a public meeting on the siting analysis?

(a) You must hold a public meeting to discuss and accept comments on your siting analysis and your revised materials separation plan.

(b) You must hold the public meeting in the county where you will construct your municipal waste combustion unit.

(c) You must schedule the public meeting to occur at least 30 days after you make your siting analysis and revised materials separation available to the public.

(d) You must prepare a transcript of the public meeting on your siting analysis.

§ 60.1145 What must I do with any public comments I receive during the public comment period on my siting analysis?

You must do three things:
(a) Prepare written responses to any public comments on your siting analysis and the revised materials separation plan you received during the public comment period. Summarize these responses to public comments in a document that is separate from your materials separation plan and siting analysis.

(b) Make the comment response document available to the public in the service area where you will construct your municipal waste combustion unit. You must distribute the document at least to the main public libraries used to announce the public meeting for the siting analysis.

(c) Prepare a revised siting analysis for the municipal waste combustion unit that includes, as appropriate, changes made in response to any public comments you received during the public comment period.

§ 60.1150 How do I submit my siting analysis?

As specified under ``Reporting" (§ 60.1380), submit four items as part of the notice of construction:

(a) Your siting analysis.

(b) Your notice of the public meeting on your siting analysis.

(c) A transcript of the public meeting on your siting analysis.

(d) The document that summarizes your responses to the public comments you received during the public comment period.

GOOD COMBUSTION PRACTICES: OPERATOR TRAINING

§ 60.1155 What types of training must I do?

There are two types of required training:
(a) Training of operators of municipal waste combustion units using the EPA or a State-approved training course.

(b) Training of plant personnel using a plant-specific training course.

§ 60.1160 Who must complete the operator training course? By when?

(a) Three types of employees must complete the EPA or State-approved operator training course:
  (1) Chief facility operators.
  (2) Shift supervisors.
  (3) Control room operators.

(b) These employees must complete the operator training course by the later of three dates:
  (1) Six months after your municipal waste combustion unit starts up.
  (2) December 6, 2001.
  (3) The date before an employee assumes responsibilities that affect operation of the municipal waste combustion unit.

§ 60.1165 Who must complete the plant-specific training course?

All employees with responsibilities that affect how a municipal waste combustion unit operates must complete the plant-specific training course. Include at least six types of employees:
(a) Chief facility operators.

(b) Shift supervisors.

(c) Control room operators.

(d) Ash handlers.

(e) Maintenance personnel.

(f) Crane or load handlers.

§ 60.1170 What plant-specific training must I provide?

For plant-specific training, you must do four things:

(a) For training at a particular plant, develop a specific operating manual for that plant by the later of two dates:

(1) Six months after your municipal waste combustion unit starts up.
(2) December 6, 2001.

(b) Establish a program to review the plant-specific operating manual with people whose responsibilities affect the operation of your municipal waste combustion unit. Complete the initial review by the later of three dates:

(1) Six months after your municipal waste combustion unit starts up.
(2) December 6, 2001.
(3) The date before an employee assumes responsibilities that affect operation of the municipal waste combustion unit.

(c) Update your manual annually.

(d) Review your manual with staff annually.

§ 60.1175 What information must I include in the plant-specific operating manual?

You must include 11 items in the operating manual for your plant:
(a) A summary of all applicable standards in this subpart.

(b) A description of the basic combustion principles that apply to municipal waste combustion units.

(c) Procedures for receiving, handling, and feeding municipal solid waste.

(d) Procedures to be followed during periods of startup, shutdown, and malfunction of the municipal waste combustion unit.

(e) Procedures for maintaining a proper level of combustion air supply.

(f) Procedures for operating the municipal waste combustion unit within the standards contained in this subpart.

(g) Procedures for responding to periodic upset or off- specification conditions.

(h) Procedures for minimizing carryover of particulate matter.

(i) Procedures for handling ash.

(j) Procedures for monitoring emissions from the municipal waste combustion unit.

(k) Procedures for recordkeeping and reporting.

§ 60.1180 Where must I keep the plant-specific operating manual?

You must keep your operating manual in an easily accessible location at your plant. It must be available for review or inspection by all employees who must review it and by the Administrator.

GOOD COMBUSTION PRACTICES: OPERATOR CERTIFICATION

§ 60.1185 What types of operator certification must the chief facility operator and shift supervisor obtain and by when must they obtain it?

(a) Each chief facility operator and shift supervisor must obtain and keep a current provisional operator certification from the American Society of Mechanical Engineers (QRO-1-1994 (incorporated by reference in § 60.17 of subpart A of this part)) or a current provisional operator certification from your State certification program.

(b) Each chief facility operator and shift supervisor must obtain a provisional certification by the later of three dates:

(1) Six months after the municipal waste combustion unit starts up.

(2) December 6, 2001.

(3) Six months after they transfer to the municipal waste combustion unit or 6 months after they are hired to work at the municipal waste combustion unit.

(c) Each chief facility operator and shift supervisor must take one of three actions:

(1) Obtain a full certification from the American Society of Mechanical Engineers or a State certification program in your State.

(2) Schedule a full certification exam with the American Society of Mechanical Engineers (QRO-1-1994 (incorporated by reference in § 60.17 of subpart A of this part)).

(3) Schedule a full certification exam with your State certification program.

(d) The chief facility operator and shift supervisor must obtain the full certification or be scheduled to take the certification exam by the later of three dates:

(1) Six months after the municipal waste combustion unit starts up.

(2) December 6, 2001.

(3) Six months after they transfer to the municipal waste combustion unit or 6 months after they are hired to work at the municipal waste combustion unit.

§ 60.1190 After the required date for operator certification, who may operate the municipal waste combustion unit?

After the required date for full or provisional certifications, you must not operate your municipal waste combustion unit unless one of four employees is on duty:

(a) A fully certified chief facility operator.

(b) A provisionally certified chief facility operator who is scheduled to take the full certification exam.

(c) A fully certified shift supervisor.

(d) A provisionally certified shift supervisor who is scheduled to take the full certification exam.

§ 60.1195 What if all the certified operators must be temporarily offsite?

If the certified chief facility operator and certified shift supervisor both must leave your municipal waste combustion unit, a provisionally certified control room operator at the municipal waste combustion unit may fulfill the certified operator requirement. Depending on the length of time that a certified chief facility operator and certified shift supervisor are away, you must meet one of three criteria:

(a) When the certified chief facility operator and certified shift supervisor are both offsite for less than 8 hours, and no other certified operator is onsite, the provisionally certified control room operator may perform those duties without notice to, or approval by, the Administrator.

(b) When the certified chief facility operator and certified shift supervisor are offsite for more than 8 hours, but less than 2 weeks, and no other certified operator is onsite, the provisionally certified control room operator may perform those duties without notice to, or approval by, the Administrator. However, you must record the period when the certified chief facility operator and certified shift supervisor are offsite and include this information in the annual report as specified under § 60.1410(l).

(c) When the certified chief facility operator and certified shift supervisor are offsite for more than 2 weeks, and no other certified operator is onsite, the provisionally certified control room operator may perform those duties without notice to, or approval by, the Administrator. However, you must take two actions:

(1) Notify the Administrator in writing. In the notice, state what caused the absence and what you are doing to ensure that a certified chief facility operator or certified shift supervisor is onsite.

(2) Submit a status report and corrective action summary to the Administrator every 4 weeks following the initial notification. If the Administrator notifies you that your status report or corrective action summary is disapproved, the municipal waste combustion unit may continue operation for 90 days, but then must cease operation. If corrective actions are taken in the 90-day period such that the Administrator withdraws the disapproval, municipal waste combustion unit operation may continue.

GOOD COMBUSTION PRACTICES: OPERATING REQUIREMENTS

§ 60.1200 What are the operating practice requirements for my municipal waste combustion unit?

(a) You must not operate your municipal waste combustion unit at loads greater than 110 percent of the maximum demonstrated unit load of the municipal waste combustion unit (4-hour block average), as specified under ``Definitions'' (§ 60.1465).

(b) You must not operate your municipal waste combustion unit so that the temperature at the inlet of the particulate matter control device exceeds 17 deg.C above the maximum demonstrated temperature of the particulate matter control device (4-hour block average), as specified under ``Definitions'' (§ 60.1465).

(c) If your municipal waste combustion unit uses activated carbon to control dioxin/furan or mercury emissions, you must maintain an 8-hour block average carbon feed rate at or above the highest average level established during the most recent dioxin/furan or mercury test.

(d) If your municipal waste combustion unit uses activated carbon to control dioxin/furan or mercury emissions, you must evaluate total carbon usage for each calendar quarter. The total amount of carbon purchased and delivered to your municipal waste combustion plant must be at or above the required quarterly usage of carbon. At your option, you may choose to evaluate required quarterly carbon usage on a municipal waste combustion unit basis for each individual municipal waste combustion unit at your plant. Calculate the required quarterly usage of carbon using the appropriate equation in § 60.1460(f).

(e) Your municipal waste combustion unit is exempt from limits on load level, temperature at the inlet of the particulate matter control device, and carbon feed rate during any of five situations:

(1) During your annual tests for dioxins/furans.
(2) During your annual mercury tests (for carbon feed rate requirements only).
(3) During the 2 weeks preceding your annual tests for dioxins/ furans.
(4) During the 2 weeks preceding your annual mercury tests (for carbon feed rate requirements only).
(5) Whenever the Administrator or delegated State authority permits you to do any of five activities:
    (i) Evaluate system performance.
    (ii) Test new technology or control technologies.
    (iii) Perform diagnostic testing.

(iv) Perform other activities to improve the performance of your municipal waste combustion unit.

(v) Perform other activities to advance the state of the art for emission controls for your municipal waste combustion unit.

§ 60.1205 What happens to the operating requirements during periods of startup, shutdown, and malfunction?

(a) The operating requirements of this subpart apply at all times except during periods of municipal waste combustion unit startup, shutdown, or malfunction.

(b) Each startup, shutdown, or malfunction must not last for longer than 3 hours.

EMISSION LIMITS

§ 60.1210 What pollutants are regulated by this subpart?

Eleven pollutants, in four groupings, are regulated:
(a) Organics. Dioxins/furans.
(b) Metals.
    (1) Cadmium.
    (2) Lead.
    (3) Mercury.
    (4) Opacity.
    (5) Particulate matter.

(c) Acid gases.
    (1) Hydrogen chloride.
    (2) Nitrogen oxides.
    (3) Sulfur dioxide.

(d) Other.
    (1) Carbon monoxide.
    (2) Fugitive ash.

§ 60.1215 What emission limits must I meet? By when?

You must meet the emission limits specified in tables 1 and 2 of this subpart. You must meet these limits 60 days after your municipal waste combustion unit reaches the maximum load level but no later than 180 days after its initial startup.

§ 60.1220 What happens to the emission limits during periods of startup, shutdown, and malfunction?

(a) The emission limits of this subpart apply at all times except during periods of municipal waste combustion unit startup, shutdown, or malfunction.

(b) Each startup, shutdown, or malfunction must not last for longer than 3 hours.

CONTINUOUS EMISSION MONITORING

§ 60.1225 What types of continuous emission monitoring must I perform?

To continuously monitor emissions, you must perform four tasks:
(a) Install continuous emission monitoring systems for certain gaseous pollutants.

(b) Make sure your continuous emission monitoring systems are operating correctly.

(c) Make sure you obtain the minimum amount of monitoring data.

(d) Install a continuous opacity monitoring system.

§ 60.1230 What continuous emission monitoring systems must I install for gaseous pollutants?

(a) You must install, calibrate, maintain, and operate continuous emission monitoring systems for oxygen (or carbon dioxide), sulfur dioxide, and carbon monoxide. If you operate a Class I municipal waste combustion unit, also install, calibrate, maintain, and operate a continuous emission monitoring system for nitrogen oxides. Install the continuous emission monitoring system for sulfur dioxide and nitrogen oxides at the outlet of the air pollution control device.

(b) You must install, evaluate, and operate each continuous emission monitoring system according to the ``Monitoring Requirements'' in § 60.13 of subpart A of this part.

(c) You must monitor the oxygen (or carbon dioxide) concentration at each location where you monitor sulfur dioxide and carbon monoxide. Additionally, if you operate a Class I municipal waste combustion unit, you must also monitor the oxygen (or carbon dioxide) concentration at the location where you monitor nitrogen oxides.

(d) You may choose to monitor carbon dioxide instead of oxygen as a diluent gas. If you choose to monitor carbon dioxide, then an oxygen monitor is not required, and you must follow the requirements in § 60.1255.

(e) If you choose to demonstrate compliance by monitoring the percent reduction of sulfur dioxide, you must also install a continuous emission monitoring system for sulfur dioxide and oxygen (or carbon dioxide) at the inlet of the air pollution control device.

§ 60.1235 How are the data from the continuous emission monitoring systems used?

You must use data from the continuous emission monitoring systems for sulfur dioxide, nitrogen oxides, and carbon monoxide to demonstrate continuous compliance with the emission limits specified in tables 1 and 2 of this subpart. To demonstrate compliance for dioxins/furans, cadmium, lead, mercury, particulate matter, opacity, hydrogen chloride, and fugitive ash, see § 60.1290.

§ 60.1240 How do I make sure my continuous emission monitoring systems are operating correctly?

(a) Conduct initial, daily, quarterly, and annual evaluations of your continuous emission monitoring systems that measure oxygen (or carbon dioxide), sulfur dioxide, nitrogen oxides (Class I municipal waste combustion units only), and carbon monoxide.

(b) Complete your initial evaluation of the continuous emission monitoring systems within 60 days after your municipal waste combustion unit reaches the maximum load level at which it will operate, but no later than 180 days after its initial startup.

(c) For initial and annual evaluations, collect data concurrently (or within 30 to 60 minutes) using your oxygen (or carbon dioxide) continuous emission monitoring system, your sulfur dioxide, nitrogen oxides, or carbon monoxide continuous emission monitoring systems, as appropriate, and the appropriate test methods specified in table 3 of this subpart. Collect these data during each initial and annual evaluation of your continuous emission monitoring systems following the applicable performance specifications in appendix B of this part. Table 4 of this subpart shows the performance specifications that apply to each continuous emission monitoring system.

(d) Follow the quality assurance procedures in Procedure 1 of appendix F of this part for each continuous emission monitoring system. These procedures include daily calibration drift and quarterly accuracy determinations.

§ 60.1245 Am I exempt from any appendix B or appendix F requirements to evaluate continuous emission monitoring systems?

Yes, the accuracy tests for your sulfur dioxide continuous emission monitoring system require you to also evaluate your oxygen (or carbon dioxide) continuous emission monitoring system. Therefore, your oxygen (or carbon dioxide) continuous emission monitoring system is exempt from two requirements:
(a) Section 2.3 of performance specification 3 in appendix B of this part (relative accuracy requirement).

(b) Section 5.1.1 of appendix F of this part (relative accuracy test audit).

§ 60.1250 What is my schedule for evaluating continuous emission monitoring systems?

(a) Conduct annual evaluations of your continuous emission monitoring systems no more than 12 months after the previous evaluation was conducted.

(b) Evaluate your continuous emission monitoring systems daily and quarterly as specified in appendix F of this part.

§ 60.1255 What must I do if I choose to monitor carbon dioxide instead of oxygen as a diluent gas?

You must establish the relationship between oxygen and carbon dioxide during the initial evaluation of your continuous emission monitoring system. You may reestablish the relationship during annual evaluations. To establish the relationship use three procedures:
(a) Use EPA Reference Method 3 or 3A to determine oxygen concentration at the location of your carbon dioxide monitor.

(b) Conduct at least three test runs for oxygen. Make sure each test run represents a 1-hour average and that sampling continues for at least 30 minutes in each hour.

(c) Use the fuel-factor equation in EPA Reference Method 3B to determine the relationship between oxygen and carbon dioxide.

§ 60.1260 What is the minimum amount of monitoring data I must collect with my continuous emission monitoring systems and is this requirement enforceable?

(a) Where continuous emission monitoring systems are required, obtain 1-hour arithmetic averages. Make sure the averages for sulfur dioxide, nitrogen oxides, and carbon monoxide are in parts per million by dry volume at 7 percent oxygen (or the equivalent carbon dioxide level). Use the 1-hour averages of oxygen (or carbon dioxide) data from your continuous emission monitoring system to determine the actual oxygen (or carbon dioxide) level and to calculate emissions at 7 percent oxygen (or the equivalent carbon dioxide level).

(b) Obtain at least two data points per hour in order to calculate a valid 1-hour arithmetic average. Section 60.13(e)(2) of subpart A of this part requires your continuous emission monitoring systems to complete at least one cycle of operation (sampling, analyzing, and data recording) for each 15-minute period.

(c) Obtain valid 1-hour averages for 75 percent of the operating hours per day and for 90 percent of the operating days per calendar quarter. An operating day is any day the unit combusts any municipal solid waste or refuse-derived fuel.

(d) If you do not obtain the minimum data required in paragraphs (a) through (c) of this section, you are in violation of this data collection requirement regardless of the emission level monitored, and you must notify the Administrator according to § 60.1410(e).

(e) If you do not obtain the minimum data required in paragraphs (a) and (c) of this section, you must still use all valid data from the continuous emission monitoring systems in calculating emission concentrations and percent reductions in accordance with § 60.1265.

§ 60.1265 How do I convert my 1-hour arithmetic averages into the appropriate averaging times and units for this standard?

(a) Use the equation in § 60.1460(a) to calculate emissions at 7 percent oxygen.

(b) Use EPA Reference Method 19, section 4.3, to calculate the daily geometric average concentrations of sulfur dioxide emissions. If you are monitoring the percent reduction of sulfur dioxide, use EPA Reference Method 19, section 5.4, to determine the daily geometric average percent reduction of potential sulfur dioxide emissions.

(c) If you operate a Class I municipal waste combustion unit, use EPA Reference Method 19, section 4.1, to calculate the daily arithmetic average for concentrations of nitrogen oxides.

(d) Use EPA Reference Method 19, section 4.1, to calculate the 4-hour or 24-hour daily block averages (as applicable) for concentrations of carbon monoxide.

§ 60.1270 What is required for my continuous opacity monitoring system and how are the data used?

(a) Install, calibrate, maintain, and operate a continuous opacity monitoring system.

(b) Install, evaluate, and operate each continuous opacity monitoring system according to § 60.13 of subpart A of this part.

(c) Complete an initial evaluation of your continuous opacity monitoring system according to performance specification 1 in appendix B of this part. Complete this evaluation within 60 days after your municipal waste combustion unit reaches the maximum load level at which it will operate, but no more than 180 days after its initial startup.

(d) Complete each annual evaluation of your continuous opacity monitoring system no more than 12 months after the previous evaluation.

(e) Use tests conducted according to EPA Reference Method 9, as specified in § 60.1300, to determine compliance with the emission limit for opacity in table 1 of this subpart. The data obtained from your continuous opacity monitoring system are not used to determine compliance with the limit on opacity emissions.

§ 60.1275 What additional requirements must I meet for the operation of my continuous emission monitoring systems and continuous opacity monitoring system?

Use the required span values and applicable performance specifications in table 4 of this subpart.

§ 60.1280 What must I do if my continuous emission monitoring system is temporarily unavailable to meet the data collection requirements?

Refer to table 5 of this subpart. It shows alternate methods for collecting data when these systems malfunction or when repairs, calibration checks, or zero and span checks keep you from collecting the minimum amount of data.

STACK TESTING

§ 60.1285 What types of stack tests must I conduct?

Conduct initial and annual stack tests to measure the emission levels of dioxins/furans, cadmium, lead, mercury, particulate matter, opacity, hydrogen chloride, and fugitive ash.

§ 60.1290 How are the stack test data used?

You must use results of stack tests for dioxins/furans, cadmium, lead, mercury, particulate matter, opacity, hydrogen chloride, and fugitive ash to demonstrate compliance with the emission limits in table 1 of this subpart. To demonstrate compliance for carbon monoxide, nitrogen oxides, and sulfur dioxide, see § 60.1235.

§ 60.1295 What schedule must I follow for the stack testing?

(a) Conduct initial stack tests for the pollutants listed in § 60.1285 within 60 days after your municipal waste combustion unit reaches the maximum load level at which it will operate, but no later than 180 days after its initial startup.

(b) Conduct annual stack tests for these pollutants after the initial stack test. Conduct each annual stack test within 12 months after the previous stack test.

§ 60.1300 What test methods must I use to stack test?

(a) Follow table 5 of this subpart to establish the sampling location and to determine pollutant concentrations, number of traverse points, individual test methods, and other specific testing requirements for the different pollutants.

(b) Make sure that stack tests for all these pollutants consist of at least three test runs, as specified in § 60.8 (Performance Tests) of subpart A of this part. Use the average of the pollutant emission concentrations from the three test runs to determine compliance with the emission limits in table 1 of this subpart.

(c) Obtain an oxygen (or carbon dioxide) measurement at the same time as your pollutant measurements to determine diluent gas levels, as specified in § 60.1230.

(d) Use the equations in § 60.1460(a) to calculate emission levels at 7 percent oxygen (or an equivalent carbon dioxide basis), the percent reduction in potential hydrogen chloride emissions, and the reduction efficiency for mercury emissions. See the individual test methods in table 5 of this subpart for other required equations.

§ 60.1305 May I conduct stack testing less often?

(a) You may test less often if you own or operate a Class II municipal waste combustion unit and if all stack tests for a given pollutant over 3 consecutive years show you comply with the emission limit. In this case, you are not required to conduct a stack test for that pollutant for the next 2 years. However, you must conduct another stack test within 36 months of the anniversary date of the third consecutive stack test that shows you comply with the emission limit. Thereafter, you must perform stack tests every third year but no later than 36 months following the previous stack tests. If a stack test shows noncompliance with an emission limit, you must conduct annual stack tests for that pollutant until all stack tests over a 3-year period show compliance.

(b) You can test less often if you own or operate a municipal waste combustion plant that meets two conditions. First, you have multiple municipal waste combustion units onsite that are subject to this subpart. Second, all these municipal waste combustion units have demonstrated levels of dioxin/furan emissions no more than 7 nanograms per dry standard cubic meter (total mass) for 2 consecutive years. In this case, you may choose to conduct annual stack tests on only one municipal waste combustion unit per year at your plant.

(1) Conduct the stack test no more than 12 months following a stack test on any municipal waste combustion unit subject to this subpart at your plant. Each year, test a different municipal waste combustion unit subject to this subpart and test all municipal waste combustion units subject to this subpart in a sequence that you determine. Once you determine a testing sequence, it must not be changed without approval by the Administrator.

(2) If each annual stack test shows levels of dioxin/furan emissions less than 7 nanograms per dry standard cubic meter (total mass), you may continue stack tests on only one municipal waste combustion unit subject to this subpart per year.

(3) If any annual stack test indicates levels of dioxin/furan emissions greater than 7 nanograms per dry standard cubic meter (total mass), conduct subsequent annual stack tests on all municipal waste combustion units subject to this subpart at your plant. You may return to testing one municipal waste combustion unit subject to this subpart per year if you can demonstrate dioxin/furan emission levels less than 7 nanograms per dry standard cubic meter (total mass) for all municipal waste combustion units at your plant subject to this subpart for 2 consecutive years.

§ 60.1310 May I deviate from the 12-month testing schedule if unforeseen circumstances arise?

You may not deviate from the 12-month testing schedules specified in §§ 60.1295(b) and 60.1305(b)(1) unless you apply to the Administrator for an alternative schedule, and the Administrator approves your request for alternative scheduling prior to the date on which you would otherwise have been required to conduct the next stack test.

OTHER MONITORING REQUIREMENTS

§ 60.1315 Must I meet other requirements for continuous monitoring?

You must also monitor three operating parameters:
(a) Load level of each municipal waste combustion unit.

(b) Temperature of flue gases at the inlet of your particulate matter air pollution control device.

(c) Carbon feed rate if activated carbon is used to control dioxin/furan or mercury emissions.

§ 60.1320 How do I monitor the load of my municipal waste combustion unit?

(a) If your municipal waste combustion unit generates steam, you must install, calibrate, maintain, and operate a steam flowmeter or a feed water flowmeter and meet five requirements:

(1) Continuously measure and record the measurements of steam (or feed water) in kilograms per hour (or pounds per hour).

(2) Calculate your steam (or feed water) flow in 4-hour block averages.

(3) Calculate the steam (or feed water) flow rate using the method in ``American Society of Mechanical Engineers Power Test Codes: Test Code for Steam Generating Units, Power Test Code 4.1--1964 (R1991)," section 4 (incorporated by reference in § 60.17 of subpart A of this part).

(4) Design, construct, install, calibrate, and use nozzles or orifices for flow rate measurements, using the recommendations in ``American Society of Mechanical Engineers Interim Supplement 19.5 on Instruments and Apparatus: Application, Part II of Fluid Meters," 6th Edition (1971), chapter 4 (incorporated by reference in § 60.17 of subpart A of this part).

(5) Before each dioxin/furan stack test, or at least once a year, calibrate all signal conversion elements associated with steam (or feed water) flow measurements according to the manufacturer instructions.

(b) If your municipal waste combustion unit does not generate steam, you must determine, to the satisfaction of the Administrator, one or more operating parameters that can be used to continuously estimate load level (for example, the feed rate of municipal solid waste or refuse-derived fuel). You must continuously monitor the selected parameters.

§ 60.1325 How do I monitor the temperature of flue gases at the inlet of my particulate matter control device?

You must install, calibrate, maintain, and operate a device to continuously measure the temperature of the flue gas stream at the inlet of each particulate matter control device.

§ 60.1330 How do I monitor the injection rate of activated carbon?

If your municipal waste combustion unit uses activated carbon to control dioxin/furan or mercury emissions, you must meet three requirements:

(a) Select a carbon injection system operating parameter that can be used to calculate carbon feed rate (for example, screw feeder speed).

(b) During each dioxin/furan and mercury stack test, determine the average carbon feed rate in kilograms (or pounds) per hour. Also, determine the average operating parameter level that correlates to the carbon feed rate. Establish a relationship between the operating parameter and the carbon feed rate in order to calculate the carbon feed rate based on the operating parameter level.

(c) Continuously monitor the selected operating parameter during all periods when the municipal waste combustion unit is operating and combusting waste and calculate the 8-hour block average carbon feed rate in kilograms (or pounds) per hour, based on the selected operating parameter. When calculating the 8-hour block average, do two things:

(1) Exclude hours when the municipal waste combustion unit is not operating.

(2) Include hours when the municipal waste combustion unit is operating but the carbon feed system is not working correctly.

§ 60.1335 What is the minimum amount of monitoring data I must collect with my continuous parameter monitoring systems and is this requirement enforceable?

(a) Where continuous parameter monitoring systems are used, obtain 1-hour arithmetic averages for three parameters:

(1) Load level of the municipal waste combustion unit.
(2) Temperature of the flue gases at the inlet of your particulate matter control device.
(3) Carbon feed rate if activated carbon is used to control dioxin/ furan or mercury emissions.

(b) Obtain at least two data points per hour in order to calculate a valid 1-hour arithmetic average.

(c) Obtain valid 1-hour averages for, at a minimum, 75 percent of the operating hours per day and for 90 percent of the operating days per calendar quarter. An operating day is any day the unit combusts any municipal solid waste or refuse-derived fuel.

(d) If you do not obtain the minimum data required in paragraphs (a) through (c) of this section, you are in violation of this data collection requirement and you must notify the Administrator according to § 60.1410(e).

RECORDKEEPING

§ 60.1340 What records must I keep?

You must keep five types of records:
(a) Materials separation plan and siting analysis.

(b) Operator training and certification.

(c) Stack tests.

(d) Continuously monitored pollutants and parameters.

(e) Carbon feed rate.

§ 60.1345 Where must I keep my records and for how long?

(a) Keep all records onsite in paper copy or electronic format unless the Administrator approves another format.

(b) Keep all records on each municipal waste combustion unit for at least 5 years.

(c) Make all records available for submittal to the Administrator, or for onsite review by an inspector.

§ 60.1350 What records must I keep for the materials separation plan and siting analysis?

You must keep records of five items:
(a) The date of each record.

(b) The final materials separation plan.

(c) The siting analysis.

(d) A record of the location and date of the public meetings.

(e) Your responses to the public comments received during the public comment periods.

§ 60.1355 What records must I keep for operator training and certification?

You must keep records of six items:
(a) Records of provisional certifications. Include three items:
    (1) For your municipal waste combustion plant, names of the chief facility operator, shift supervisors, and control room operators who are provisionally certified by the American Society of Mechanical Engineers or an equivalent State-approved certification program.
    (2) Dates of the initial provisional certifications.
    (3) Documentation showing current provisional certifications.

(b) Records of full certifications. Include three items:
    (1) For your municipal waste combustion plant, names of the chief facility operator, shift supervisors, and control room operators who are fully certified by the American Society of Mechanical Engineers or an equivalent State-approved certification program.
    (2) Dates of initial and renewal full certifications.
    (3) Documentation showing current full certifications.

(c) Records showing completion of the operator training course. Include three items:
    (1) For your municipal waste combustion plant, names of the chief facility operator, shift supervisors, and control room operators who have completed the EPA or State municipal waste combustion operator training course.
    (2) Dates of completion of the operator training course.
    (3) Documentation showing completion of the operator training course.

(d) Records of reviews for plant-specific operating manuals. Include three items:
    (1) Names of persons who have reviewed the operating manual.
    (2) Date of the initial review.
    (3) Dates of subsequent annual reviews.

(e) Records of when a certified operator is temporarily offsite. Include two main items:
    (1) If the certified chief facility operator and certified shift supervisor are offsite for more than 8 hours, but less than 2 weeks, and no other certified operator is onsite, record the dates that the certified chief facility operator and certified shift supervisor were offsite.
    (2) When the certified chief facility operator and certified shift supervisor are offsite for more than 2 weeks and no other certified operator is onsite, keep records of four items:
        (i) Your notice that all certified persons are offsite.
        (ii) The conditions that cause these people to be offsite.
        (iii) The corrective actions you are taking to ensure a certified chief facility operator or certified shift supervisor is onsite.
        (iv) Copies of the written reports submitted every 4 weeks that summarize the actions taken to ensure that a certified chief facility operator or certified shift supervisor will be onsite.

(f) Records of calendar dates. Include the calendar date on each record.

§ 60.1360 What records must I keep for stack tests?

For stack tests required under § 60.1285, you must keep records of four items:
(a) The results of the stack tests for eight pollutants or parameters recorded in the appropriate units of measure specified in table 1 of this subpart:

(1) Dioxins/furans.
(2) Cadmium.
(3) Lead.
(4) Mercury.
(5) Opacity.
(6) Particulate matter.
(7) Hydrogen chloride.
(8) Fugitive ash.

(b) Test reports including supporting calculations that document the results of all stack tests.

(c) The maximum demonstrated load of your municipal waste combustion units and maximum temperature at the inlet of your particulate matter control device during all stack tests for dioxin/furan emissions.

(d) The calendar date of each record.

§ 60.1365 What records must I keep for continuously monitored pollutants or parameters?

You must keep records of eight items:
(a) Records of monitoring data. Document six parameters measured using continuous monitoring systems:

(1) All 6-minute average levels of opacity.

(2) All 1-hour average concentrations of sulfur dioxide emissions.

(3) For Class I municipal waste combustion units only, all 1-hour average concentrations of nitrogen oxides emissions.

(4) All 1-hour average concentrations of carbon monoxide emissions.

(5) All 1-hour average load levels of your municipal waste combustion unit.

(6) All 1-hour average flue gas temperatures at the inlet of the particulate matter control device.

(b) Records of average concentrations and percent reductions. Document five parameters:

(1) All 24-hour daily block geometric average concentrations of sulfur dioxide emissions or average percent reductions of sulfur dioxide emissions.

(2) For Class I municipal waste combustion units only, all 24-hour daily arithmetic average concentrations of nitrogen oxides emissions.

(3) All 4-hour block or 24-hour daily block arithmetic average concentrations of carbon monoxide emissions.

(4) All 4-hour block arithmetic average load levels of your municipal waste combustion unit.

(5) All 4-hour block arithmetic average flue gas temperatures at the inlet of the particulate matter control device.

(c) Records of exceedances. Document three items:

(1) Calendar dates whenever any of the five pollutant or parameter levels recorded in paragraph (b) or the opacity level recorded in paragraph (a)(1) of this section did not meet the emission limits or operating levels specified in this subpart.

(2) Reasons you exceeded the applicable emission limits or operating levels.

(3) Corrective actions you took, or are taking, to meet the emission limits or operating levels.

(d) Records of minimum data. Document three items:

(1) Calendar dates for which you did not collect the minimum amount of data required under §§ 60.1260 and 60.1335. Record these dates for five types of pollutants and parameters:

(i) Sulfur dioxide emissions.
(ii) For Class I municipal waste combustion units only, nitrogen oxides emissions.
(iii) Carbon monoxide emissions.
(iv) Load levels of your municipal waste combustion unit.
(v) Temperatures of the flue gases at the inlet of the particulate matter control device.

(2) Reasons you did not collect the minimum data.

(3) Corrective actions you took, or are taking, to obtain the required amount of data.

(e) Records of exclusions. Document each time you have excluded data from your calculation of averages for any of the following five pollutants or parameters and the reasons the data were excluded:

(1) Sulfur dioxide emissions.
(2) For Class I municipal waste combustion units only, nitrogen oxides emissions.
(3) Carbon monoxide emissions.
(4) Load levels of your municipal waste combustion unit.
(5) Temperatures of the flue gases at the inlet of the particulate matter control device.

(f) Records of drift and accuracy. Document the results of your daily drift tests and quarterly accuracy determinations according to procedure 1 of appendix F of this part. Keep these records for the sulfur dioxide, nitrogen oxides (Class I municipal waste combustion units only), and carbon monoxide continuous emissions monitoring systems.

(g) Records of the relationship between oxygen and carbon dioxide. If you chose to monitor carbon dioxide instead of oxygen as a diluent gas, document the relationship between oxygen and carbon dioxide, as specified in § 60.1255.

(h) Records of calendar dates. Include the calendar date on each record.

§ 60.1370 What records must I keep for municipal waste combustion units that use activated carbon?

For municipal waste combustion units that use activated carbon to control dioxin/furan or mercury emissions, you must keep records of five items:

(a) Records of average carbon feed rate. Document five items:

(1) Average carbon feed rate (in kilograms or pounds per hour) during all stack tests for dioxin/furan and mercury emissions. Include supporting calculations in the records.

(2) For the operating parameter chosen to monitor carbon feed rate, average operating level during all stack tests for dioxin/furans and mercury emissions. Include supporting data that document the relationship between the operating parameter and the carbon feed rate.

(3) All 8-hour block average carbon feed rates in kilograms (pounds) per hour calculated from the monitored operating parameter.

(4) Total carbon purchased and delivered to the municipal waste combustion plant for each calendar quarter. If you choose to evaluate total carbon purchased and delivered on a municipal waste combustion unit basis, record the total carbon purchased and delivered for each individual municipal waste combustion unit at your plant. Include supporting documentation.

(5) Required quarterly usage of carbon for the municipal waste combustion plant, calculated using the appropriate equation in § 60.1460(f). If you choose to evaluate required quarterly usage for carbon on a municipal waste combustion unit basis, record the required quarterly usage for each municipal waste combustion unit at your plant. Include supporting calculations.

(b) Records of low carbon feed rates. Document three items:

(1) The calendar dates when the average carbon feed rate over an 8-hour block was less than the average carbon feed rates determined during the most recent stack test for dioxin/furan or mercury emissions (whichever has a higher feed rate).

(2) Reasons for the low carbon feed rates.

(3) Corrective actions you took or are taking to meet the 8-hour average carbon feed rate requirement.

(c) Records of minimum carbon feed rate data. Document three items:

(1) Calendar dates for which you did not collect the minimum amount of carbon feed rate data required under § 60.1335.

(2) Reasons you did not collect the minimum data.

(3) Corrective actions you took or are taking to get the required amount of data.

(d) Records of exclusions. Document each time you have excluded data from your calculation of average carbon feed rates and the reasons the data were excluded.

(e) Records of calendar dates. Include the calendar date on each record.

REPORTING

§ 60.1375 What reports must I submit before I submit my notice of construction?

(a) If you are required to submit an application for a construction permit under 40 CFR, part 51, subpart I, or part 52, you must submit five items by the date you submit your application.

(1) Your draft materials separation plan, as specified in § 60.1065.

(2) Your revised materials separation plan, as specified in § 60.1085(c).

(3) Your notice of the initial public meeting for your draft materials separation plan, as specified in § 60.1070(b).

(4) A transcript of the initial public meeting, as specified in § 60.1080(f).

(5) The document that summarizes your responses to the public comments you received during the initial public comment period, as specified in § 60.1085(a).

(b) If you are not required to submit an application for a construction permit under 40 CFR part 51, subpart I, or part 52, you must submit the items in paragraph (a) of this section with your notice of construction.

§ 60.1380 What must I include in my notice of construction?

(a) Include ten items:

(1) A statement of your intent to construct the municipal waste combustion unit.

(2) The planned initial startup date of your municipal waste combustion unit.

(3) The types of fuels you plan to combust in your municipal waste combustion unit.

(4) The capacity of your municipal waste combustion unit including supporting capacity calculations, as specified in § 60.1460(d) and (e).

(5) Your siting analysis, as specified in § 60.1125.

(6) Your final materials separation plan, as specified in § 60.1100(b).

(7) Your notice of the second public meeting (siting analysis meeting), as specified in § 60.1130(b).

(8) A transcript of the second public meeting, as specified in § 60.1140(d).

(9) A copy of the document that summarizes your responses to the public comments you received during the second public comment period, as specified in § 60.1145(a).

(10) Your final siting analysis, as specified in § 60.1145(c).

(b) Submit your notice of construction no later than 30 days after you commence construction, reconstruction, or modification of your municipal waste combustion unit.

§ 60.1385 What reports must I submit after I submit my notice of construction and in what form?

(a) Submit an initial report and annual reports, plus semiannual reports for any emission or parameter level that does not meet the limits specified in this subpart.

(b) Submit all reports on paper, postmarked on or before the submittal dates in §§ 60.1395, 60.1405, and 60.1420. If the Administrator agrees, you may submit electronic reports.

(c) Keep a copy of all reports required by §§ 60.1400, 60.1410, and 60.1425 onsite for 5 years.

§ 60.1390 What are the appropriate units of measurement for reporting my data?

See tables 1 and 2 of this subpart for appropriate units of measurement.

§ 60.1395 When must I submit the initial report?

As specified in subpart A of this part, submit your initial report within 60 days after your municipal waste combustion unit reaches the maximum load level at which it will operate, but no later than 180 days after its initial startup.

§ 60.1400 What must I include in my initial report?

You must include seven items:
(a) The emission levels measured on the date of the initial evaluation of your continuous emission monitoring systems for all of the following five pollutants or parameters as recorded in accordance with § 60.1365(b).

(1) The 24-hour daily geometric average concentration of sulfur dioxide emissions or the 24-hour daily geometric percent reduction of sulfur dioxide emissions.

(2) For Class I municipal waste combustion units only, the 24-hour daily arithmetic average concentration of nitrogen oxides emissions.

(3) The 4-hour block or 24-hour daily arithmetic average concentration of carbon monoxide emissions.

(4) The 4-hour block arithmetic average load level of your municipal waste combustion unit.

(5) The 4-hour block arithmetic average flue gas temperature at the inlet of the particulate matter control device.

(b) The results of the initial stack tests for eight pollutants or parameters (use appropriate units as specified in table 2 of this subpart):

(1) Dioxins/furans.
(2) Cadmium.
(3) Lead.
(4) Mercury.
(5) Opacity.
(6) Particulate matter.
(7) Hydrogen chloride.
(8) Fugitive ash emissions.

(c) The test report that documents the initial stack test including supporting calculations.

(d) The initial performance evaluation of your continuous emissions monitoring systems. Use the applicable performance specifications in appendix B of this part in conducting the evaluation.

(e) The maximum demonstrated load of your municipal waste combustion unit and the maximum demonstrated temperature of the flue gases at the inlet of the particulate matter control device. Use values established during your initial stack test for dioxin/furan emissions and include supporting calculations.

(f) If your municipal waste combustion unit uses activated carbon to control dioxin/furan or mercury emissions, the average carbon feed rates that you recorded during the initial stack tests for dioxin/furan and mercury emissions. Include supporting calculations as specified in § 60.1370(a)(1) and (2).

(g) If you choose to monitor carbon dioxide instead of oxygen as a diluent gas, documentation of the relationship between oxygen and carbon dioxide, as specified in § 60.1255.

§ 60.1405 When must I submit the annual report?

Submit the annual report no later than February 1 of each year that follows the calendar year in which you collected the data. If you have an operating permit for any unit under title V of the Clean Air Act, the permit may require you to submit semiannual reports. Parts 70 and 71 of this chapter contain program requirements for permits.

§ 60.1410 What must I include in my annual report?

Summarize data collected for all pollutants and parameters regulated under this subpart. Your summary must include twelve items:

(a) The results of the annual stack test, using appropriate units, for eight pollutants, as recorded under § 60.1360(a):

(1) Dioxins/furans.
(2) Cadmium.
(3) Lead.
(4) Mercury.
(5) Particulate matter.
(6) Opacity.
(7) Hydrogen chloride.
(8) Fugitive ash.

(b) A list of the highest average levels recorded, in the appropriate units. List these values for five pollutants or parameters:

(1) Sulfur dioxide emissions.
(2) For Class 1 municipal waste combustion units only, nitrogen oxides emissions.
(3) Carbon monoxide emissions.
(4) Load level of the municipal waste combustion unit.
(5) Temperature of the flue gases at the inlet of the particulate matter air pollution control device (4-hour block average).

(c) The highest 6-minute opacity level measured. Base this value on all 6-minute average opacity levels recorded by your continuous opacity monitoring system (§ 60.1365(a)(1)).

(d) For municipal waste combustion units that use activated carbon for controlling dioxin/furan or mercury emissions, include four records:

(1) The average carbon feed rates recorded during the most recent dioxin/furan and mercury stack tests.

(2) The lowest 8-hour block average carbon feed rate recorded during the year.

(3) The total carbon purchased and delivered to the municipal waste combustion plant for each calendar quarter. If you choose to evaluate total carbon purchased and delivered on a municipal waste combustion unit basis, record the total carbon purchased and delivered for each individual municipal waste combustion unit at your plant.

(4) The required quarterly carbon usage of your municipal waste combustion plant, calculated using the appropriate equation in § 60.1460(f). If you choose to evaluate required quarterly usage for carbon on a municipal waste combustion unit basis, record the required quarterly usage for each municipal waste combustion unit at your plant.

(e) The total number of days that you did not obtain the minimum number of hours of data for six pollutants or parameters. Include the reasons you did not obtain the data and corrective actions that you have taken to obtain the data in the future. Include data on:

(1) Sulfur dioxide emissions.
(2) For Class I municipal waste combustion units only, nitrogen oxides emissions.
(3) Carbon monoxide emissions.
(4) Load level of the municipal waste combustion unit.
(5) Temperature of the flue gases at the inlet of the particulate matter air pollution control device.
(6) Carbon feed rate.

(f) The number of hours you have excluded data from the calculation of average levels (include the reasons for excluding it). Include data for six pollutants or parameters:

(1) Sulfur dioxide emissions.
(2) For Class I municipal waste combustion units only, nitrogen oxides emissions.
(3) Carbon monoxide emissions.
(4) Load level of the municipal waste combustion unit.
(5) Temperature of the flue gases at the inlet of the particulate matter air pollution control device.
(6) Carbon feed rate.

(g) A notice of your intent to begin a reduced stack testing schedule for dioxin/furan emissions during the following calendar year, if you are eligible for alternative scheduling (§ 60.1305 (a) or (b)).

(h) A notice of your intent to begin a reduced stack testing schedule for other pollutants during the following calendar year, if you are eligible for alternative scheduling (§ 60.1305(a)).

(i) A summary of any emission or parameter level that did not meet the limits specified in this subpart.

(j) A summary of the data in paragraphs (a) through (d) of this section from the year preceding the reporting year. This summary gives the Administrator a summary of the performance of the municipal waste combustion unit over a 2-year period.

(k) If you choose to monitor carbon dioxide instead of oxygen as a diluent gas, documentation of the relationship between oxygen and carbon dioxide, as specified in § 60.1255.

(l) Documentation of periods when all certified chief facility operators and certified shift supervisors are offsite for more than 8 hours.

§ 60.1415 What must I do if I am out of compliance with these standards?

You must submit a semiannual report on any recorded emission or parameter level that does not meet the requirements specified in this subpart.

§ 60.1420 If a semiannual report is required, when must I submit it?

(a) For data collected during the first half of a calendar year, submit your semiannual report by August 1 of that year.

(b) For data you collected during the second half of the calendar year, submit your semiannual report by February 1 of the following year.

§ 60.1425 What must I include in the semiannual out-of-compliance reports?

You must include three items in the semiannual report:
(a) For any of the following six pollutants or parameters that exceeded the limits specified in this subpart, include the calendar date they exceeded the limits, the averaged and recorded data for that date, the reasons for exceeding the limits, and your corrective actions:

(1) Concentration or percent reduction of sulfur dioxide emissions.
(2) For Class I municipal waste combustion units only, concentration of nitrogen oxides emissions.
(3) Concentration of carbon monoxide emissions.
(4) Load level of your municipal waste combustion unit.
(5) Temperature of the flue gases at the inlet of your particulate matter air pollution control device.
(6) Average 6-minute opacity level.

(b) If the results of your annual stack tests (as recorded in § 60.1360(a)) show emissions above the limits specified in table 1 of this subpart for dioxins/furans, cadmium, lead, mercury, particulate matter, opacity, hydrogen chloride, and fugitive ash, include a copy of the test report that documents the emission levels and your corrective actions.

(c) For municipal waste combustion units that apply activated carbon to control dioxin/furan or mercury emissions, include two items:

(1) Documentation of all dates when the 8-hour block average carbon feed rate (calculated from the carbon injection system operating parameter) is less than the highest carbon feed rate established during the most recent mercury and dioxin/furan stack test (as specified in § 60.1370(a)(1)). Include four items:

(i) Eight-hour average carbon feed rate.
(ii) Reasons for these occurrences of low carbon feed rates.
(iii) The corrective actions you have taken to meet the carbon feed rate requirement.
(iv) The calendar date.

(2) Documentation of each quarter when total carbon purchased and delivered to the municipal waste combustion plant is less than the total required quarterly usage of carbon. If you choose to evaluate total carbon purchased and delivered on a municipal waste combustion unit basis, record the total carbon purchased and delivered for each individual municipal waste combustion unit at your plant. Include five items:

(i) Amount of carbon purchased and delivered to the plant.
(ii) Required quarterly usage of carbon.
(iii) Reasons for not meeting the required quarterly usage of carbon.
(iv) The corrective actions you have taken to meet the required quarterly usage of carbon.
(v) The calendar date.

§ 60.1430 Can reporting dates be changed?

(a) If the Administrator agrees, you may change the semiannual or annual reporting dates.

(b) See § 60.19(c) in subpart A of this part for procedures to seek approval to change your reporting date.

AIR CURTAIN INCINERATORS THAT BURN 100 PERCENT YARD WASTE

§ 60.1435 What is an air curtain incinerator?

An air curtain incinerator operates by forcefully projecting a curtain of air across an open chamber or open pit in which combustion occurs. Incinerators of this type can be constructed above or below ground and with or without refractory walls and floor.

§ 60.1440 What is yard waste?

Yard waste is grass, grass clippings, bushes, shrubs, and clippings from bushes and shrubs. They come from residential, commercial/retail, institutional, or industrial sources as part of maintaining yards or other private or public lands. Yard waste does not include two items:
(a) Construction, renovation, and demolition wastes that are exempt from the definition of ``municipal solid waste'' in § 60.1465 of this subpart.

(b) Clean wood that is exempt from the definition of ``municipal solid waste'' in § 60.1465 of this subpart.

§ 60.1445 What are the emission limits for air curtain incinerators that burn 100 percent yard waste?

(a) Within 60 days after your air curtain incinerator reaches the maximum load level at which it will operate, but no later than 180 days after its initial startup, you must meet two limits:

(1) The opacity limit is 10 percent (6-minute average) for air curtain incinerators that can combust at least 35 tons per day of municipal solid waste and no more than 250 tons per day of municipal solid waste.

(2) The opacity limit is 35 percent (6-minute average) during the startup period that is within the first 30 minutes of operation.

(b) Except during malfunctions, the requirements of this subpart apply at all times. Each malfunction must not exceed 3 hours.

§ 60.1450 How must I monitor opacity for air curtain incinerators that burn 100 percent yard waste?

(a) Use EPA Reference Method 9 to determine compliance with the opacity limit.

(b) Conduct an initial test for opacity as specified in § 60.8 of subpart A of this part.

(c) After the initial test for opacity, conduct annual tests no more than 12 calendar months following the date of your previous test.

§ 60.1455 What are the recordkeeping and reporting requirements for air curtain incinerators that burn 100 percent yard waste?

(a) Provide a notice of construction that includes four items:
    (1) Your intent to construct the air curtain incinerator.
    (2) Your planned initial startup date.
    (3) Types of fuels you plan to combust in your air curtain incinerator.

(4) The capacity of your incinerator, including supporting capacity calculations, as specified in § 60.1460 (d) and (e).

(b) Keep records of results of all opacity tests onsite in either paper copy or electronic format unless the Administrator approves another format.

(c) Keep all records for each incinerator for at least 5 years.

(d) Make all records available for submittal to the Administrator or for onsite review by an inspector.

(e) Submit the results (each 6-minute average) of the opacity tests by February 1 of the year following the year of the opacity emission test.

(f) Submit reports as a paper copy on or before the applicable submittal date. If the Administrator agrees, you may submit reports on electronic media.

(g) If the Administrator agrees, you may change the annual reporting dates (see § 60.19(c) in subpart A of this part).

(h) Keep a copy of all reports onsite for a period of 5 years.

EQUATIONS

§ 60.1460 What equations must I use?

(a) Concentration correction to 7 percent oxygen. Correct any pollutant concentration to 7 percent oxygen using the following equation:

$$C_{7\%} = C_{unc} *(13.9) * (1/(20.9 - C_{O2}))$$

Where:

$C_{7\%}$ = concentration corrected to 7 percent oxygen.
C_{unc} = uncorrected pollutant concentration.
C_{O2} = concentration of oxygen (%).

(b) Percent reduction in potential mercury emissions. Calculate the percent reduction in potential mercury emissions ($\%P_{Hg}$) using the following equation:

$$\%P_{Hg} = (E_i - E_o) * (100/E_i)$$

Where:

$\%P_{Hg}$ = percent reduction of potential mercury emissions
E_i = mercury emission concentration as measured at the air pollution control device inlet, corrected to 7 percent oxygen, dry basis
E_o = mercury emission concentration as measured at the air pollution control device outlet, corrected to 7 percent oxygen, dry basis

(c) Percent reduction in potential hydrogen chloride emissions. Calculate the percent reduction in potential hydrogen chloride emissions ($\%P_{HCl}$) using the following equation:

$\%P_{HCl} = (E_i - E_o) * (100/E_i)$

Where:

$\%P_{HCl}$ = percent reduction of the potential hydrogen chloride emissions
E_i = hydrogen chloride emission concentration as measured at the air pollution control device inlet, corrected to 7 percent oxygen, dry basis
E_o = hydrogen chloride emission concentration as measured at the air pollution control device outlet, corrected to 7 percent oxygen, dry basis

(d) Capacity of a municipal waste combustion unit. For municipal waste combustion units that can operate continuously for 24-hour periods, calculate the municipal waste combustion units capacity based on 24 hours of operation at the maximum charge rate. To determine the maximum charge rate, use one of two methods:

(1) For municipal waste combustion units with a design based on heat input capacity, calculate the maximum charging rate based on this maximum heat input capacity and one of two heating values:

(i) If your municipal waste combustion unit combusts refuse-derived fuel, use a heating value of 12,800 kilojoules per kilogram (5,500 British thermal units per pound).

(ii) If your municipal waste combustion unit combusts municipal solid waste, use a heating value of 10,500 kilojoules per kilogram (4,500 British thermal units per pound).

(2) For municipal waste combustion units with a design not based on heat input capacity, use the maximum designed charging rate.

(e) Capacity of a batch municipal waste combustion unit. Calculate the capacity of a batch municipal waste combustion unit as the maximum design amount of municipal solid waste they can charge per batch multiplied by the maximum number of batches they can process in 24 hours. Calculate this maximum number of batches by dividing 24 by the number of hours needed to process one batch. Retain fractional batches in the calculation. For example, if one batch requires 16 hours, the municipal waste combustion unit can combust 24/16, or 1.5 batches, in 24 hours.

(f) Quarterly carbon usage. If you use activated carbon to comply with the dioxin/furan or mercury limits, calculate the required quarterly usage of carbon using the appropriate equation for plant basis or unit basis:

(1) Plant basis.

$$C = \sum_{i=1}^{n} f_i \times h_i$$

Where:
C = required quarterly carbon usage for the plant in kilograms (or pounds).
f_i = required carbon feed rate for the municipal waste combustion unit in kilograms (or pounds) per hour. This is the average carbon feed rate during the most recent mercury or dioxin/furan stack tests (whichever has a higher feed rate).
h_i = number of hours the municipal waste combustion unit was in operation during the calendar quarter (hours).
n = number of municipal waste combustion units, i, located at your plant.

(2) Unit basis.

$$C = f * h$$

Where:

C = required quarterly carbon usage for the unit in kilograms (or pounds).
f = required carbon feed rate for the municipal waste combustion unit in kilograms (or pounds) per hour. This is the average carbon feed rate during the most recent mercury or dioxin/furan stack tests (whichever has a higher feed rate).
h = number of hours the municipal waste combustion unit was in operation during the calendar quarter (hours).

DEFINITIONS

§ 60.1465 What definitions must I know?

Terms used but not defined in this section are defined in the Clean Air Act and in subparts A and B of this part.

Administrator means the Administrator of the U.S. Environmental Protection Agency or his/her authorized representative or the Administrator of a State Air Pollution Control Agency.

Air curtain incinerator means an incinerator that operates by forcefully projecting a curtain of air across an open chamber or pit in which combustion occurs. Incinerators of this type can be constructed above or below ground and with or without refractory walls and floor.

Batch municipal waste combustion unit means a municipal waste combustion unit designed so it cannot combust municipal solid waste continuously 24 hours per day because the design does not allow waste to be fed to the unit or ash to be removed during combustion.

Calendar quarter means three consecutive months (nonoverlapping) beginning on: January 1, April 1, July 1, or October 1.

Calendar year means 365 (366 in leap years) consecutive days starting on January 1 and ending on December 31.

Chief facility operator means the person in direct charge and control of the operation of a municipal waste combustion unit. This person is responsible for daily onsite supervision, technical direction, management, and overall performance of the municipal waste combustion unit.

Class I units mean small municipal waste combustion units subject to this subpart that are located at municipal waste combustion plants with an aggregate plant capacity more than 250 tons per day of municipal solid waste. See the definition of ``municipal waste combustion plant capacity'' for specification of which units at a plant site are included in the aggregate capacity calculation.

Class II units mean small municipal waste combustion units subject to this subpart at municipal waste combustion plants with an aggregate plant capacity no more than 250 tons per day of municipal solid waste. See the definition of ``municipal waste combustion plant capacity'' for specification of which units at a plant site are included in the aggregate capacity calculation.

Clean wood means untreated wood or untreated wood products including clean untreated lumber, tree stumps (whole or chipped), and tree limbs (whole or chipped). Clean wood does not include two items:

(1) Yard waste, which is defined elsewhere in this section.

(2) Construction, renovation, or demolition wastes (for example, railroad ties and telephone poles) that are exempt from the definition of municipal solid waste in this section.

Cofired combustion unit means a unit that combusts municipal solid waste with nonmunicipal solid waste fuel (for example, coal, industrial process waste). To be considered a cofired combustion unit, the unit must be subject to a federally enforceable permit that limits it to combusting a fuel feed stream which is 30 percent or less (by weight) municipal solid waste as measured each calendar quarter.

Continuous burning means the continuous, semicontinuous, or batch feeding of municipal solid waste to dispose of the waste, produce energy, or provide heat to the combustion system in preparation for waste disposal or energy production. Continuous burning does not mean the use of municipal solid waste solely to thermally protect the grate or hearth during the startup period when municipal solid waste is not fed to the grate or hearth.

Continuous emission monitoring system means a monitoring system that continuously measures the emissions of a pollutant from a municipal waste combustion unit.

Dioxins/furans mean tetra- through octachlorinated dibenzo-p- dioxins and dibenzofurans.

Eight-hour block average means the average of all hourly emission concentrations or parameter levels when the municipal waste combustion unit operates and combusts municipal solid waste measured over any of three 8-hour periods of time:

(1) 12:00 midnight to 8:00 a.m.
(2) 8:00 a.m. to 4:00 p.m.
(3) 4:00 p.m. to 12:00 midnight.

Federally enforceable means all limits and conditions the Administrator can enforce (including the requirements of 40 CFR parts 60, 61, and 63), requirements in a State's implementation plan, and any permit requirements established under 40 CFR 52.21 or under 40 CFR 51.18 and 40 CFR 51.24.

First calendar half means the period that starts on January 1 and ends on June 30 in any year.

Fluidized bed combustion unit means a unit where municipal waste is combusted in a fluidized bed of material. The fluidized bed material may remain in the primary combustion zone or may be carried out of the primary combustion zone and returned through a recirculation loop.

Four-hour block average or 4-hour block average means the average of all hourly emission concentrations or parameter levels when the municipal waste combustion unit operates and combusts municipal solid waste measured over any of six 4-hour periods:

(1) 12:00 midnight to 4 a.m.
(2) 4 a.m. to 8 a.m.
(3) 8 a.m. to 12:00 noon.
(4) 12:00 noon to 4 p.m.
(5) 4 p.m. to 8 p.m.
(6) 8 p.m. to 12:00 midnight.

Mass burn refractory municipal waste combustion unit means a field- erected municipal waste combustion unit that combusts municipal solid waste in a refractory wall furnace. Unless otherwise specified, this includes municipal waste combustion units with a cylindrical rotary refractory wall furnace.

Mass burn rotary waterwall municipal waste combustion unit means a field-erected municipal waste combustion unit that combusts municipal solid waste in a cylindrical rotary waterwall furnace.

Mass burn waterwall municipal waste combustion unit means a field- erected municipal waste combustion unit that combusts municipal solid waste in a waterwall furnace.

Materials separation plan means a plan that identifies a goal and an approach for separating certain components of municipal solid waste for a given service area in order to make the separated materials available for recycling. A materials separation plan may include three items:

(1) Elements such as dropoff facilities, buy-back or deposit-return incentives, curbside pickup programs, or centralized mechanical separation systems.

(2) Different goals or approaches for different subareas in the service area.

(3) No materials separation activities for certain subareas or, if warranted, the entire service area.

Maximum demonstrated load of a municipal waste combustion unit means the highest 4-hour block arithmetic average municipal waste combustion unit load achieved during 4 consecutive hours in the course of the most recent dioxin/furan stack test that demonstrates compliance with the applicable emission limit for dioxins/furans specified in this subpart.

Maximum demonstrated temperature of the particulate matter control device means the highest 4-hour block arithmetic average flue gas temperature measured at the inlet of the particulate matter control device during 4 consecutive hours in the course of the most recent stack test for dioxin/furan emissions that demonstrates compliance with the limits specified in this subpart.

Mixed fuel-fired (pulverized coal/refuse-derived fuel) combustion unit means a combustion unit that combusts coal and refuse-derived fuel simultaneously, in which pulverized coal is introduced into an air stream that carries the coal to the combustion chamber of the unit where it is combusted in suspension. This includes both conventional pulverized coal and micropulverized coal.

Modification or modified municipal waste combustion unit means a municipal waste combustion unit you have changed later than 6 months after promulgation of this subpart and that meets one of two criteria:

(1) The cumulative cost of the changes over the life of the unit exceeds 50 percent of the original cost of building and installing the unit (not including the cost of land) updated to current costs.

(2) Any physical change in the municipal waste combustion unit or change in the method of operating it that increases the emission level of any air pollutant for which standards have been established under section 129 or section 111 of the Clean Air Act. Increases in the emission level of any air pollutant are determined when the municipal waste combustion unit operates at 100 percent of its physical load capability and are measured downstream of all air pollution control devices. Load restrictions based on permits or other nonphysical operational restrictions cannot be considered in this determination.

Modular excess-air municipal waste combustion unit means a municipal waste combustion unit that combusts municipal solid waste, is not field-erected, and has multiple combustion chambers, all of which are designed to operate at conditions with combustion air amounts in excess of theoretical air requirements.

Modular starved-air municipal waste combustion unit means a municipal waste combustion unit that combusts municipal solid waste, is not field-erected, and has multiple combustion chambers in which the primary combustion chamber is designed to operate at substoichiometric conditions.

Municipal solid waste or municipal-type solid waste means household, commercial/retail, or institutional waste. Household waste includes material discarded by residential dwellings, hotels, motels, and other similar permanent or temporary housing. Commercial/retail waste includes material discarded by stores, offices, restaurants, warehouses, nonmanufacturing activities at industrial facilities, and other similar establishments or facilities. Institutional waste includes materials discarded by schools, by hospitals (nonmedical), by nonmanufacturing activities at prisons and government facilities, and other similar establishments or facilities. Household, commercial/ retail, and institutional waste does include yard waste and refuse- derived fuel. Household, commercial/retail, and institutional waste does not include used oil; sewage sludge; wood pallets; construction, renovation, and demolition wastes (which include railroad ties and telephone poles); clean wood; industrial process or manufacturing wastes; medical waste; or motor vehicles (including motor vehicle parts or vehicle fluff).

Municipal waste combustion plant means one or more municipal waste combustion units at the same location as specified under ``Applicability'' (§ 60.1015(a) and (b)).

Municipal waste combustion plant capacity means the aggregate municipal waste combustion unit capacity at a plant for all municipal waste combustion units at the plant that are subject to subparts Ea or Eb of this part, or this subpart.

Municipal waste combustion unit means any setting or equipment that combusts solid, liquid, or gasified municipal solid waste including, but not limited to, field-erected combustion units (with or without heat recovery), modular combustion units (starved-air or excess-air), boilers (for example, steam generating units), furnaces (whether suspension-fired, grate-fired, mass-fired, air curtain incinerators, or fluidized bed-fired), and pyrolysis/combustion units. Two criteria further define these municipal waste combustion units:

(1) Municipal waste combustion units do not include pyrolysis or combustion units located at a plastics or rubber recycling unit as specified under ``Applicability'' (§ 60.1020(h) and (i)). Municipal waste combustion units also do not include cement kilns that combust municipal solid waste as specified under ``Applicability'' (§ 60.1020(j)). They also do not include internal combustion engines, gas turbines, or other combustion devices that combust landfill gases collected by landfill gas collection systems.

(2) The boundaries of a municipal waste combustion unit are defined as follows. The municipal waste combustion unit includes, but is not limited to, the municipal solid waste fuel feed system, grate system, flue gas system, bottom ash system, and the combustion unit water system. The municipal waste combustion unit does not include air pollution control equipment, the stack, water treatment equipment, or the

turbine-generator set. The municipal waste combustion unit boundary starts at the municipal solid waste pit or hopper and extends through three areas:

(i) The combustion unit flue gas system, which ends immediately after the heat recovery equipment or, if there is no heat recovery equipment, immediately after the combustion chamber.

(ii) The combustion unit bottom ash system, which ends at the truck loading station or similar equipment that transfers the ash to final disposal. It includes all ash handling systems connected to the bottom ash handling system.

(iii) The combustion unit water system, which starts at the feed water pump and ends at the piping that exits the steam drum or superheater.

Particulate matter means total particulate matter emitted from municipal waste combustion units as measured by EPA Reference Method 5 (§ 60.1300).

Plastics or rubber recycling unit means an integrated processing unit for which plastics, rubber, or rubber tires are the only feed materials (incidental contaminants may be in the feed materials). These materials are processed and marketed to become input feed stock for chemical plants or petroleum refineries. The following three criteria further define a plastics or rubber recycling unit:

(1) Each calendar quarter, the combined weight of the feed stock that a plastics or rubber recycling unit produces must be more than 70 percent of the combined weight of the plastics, rubber, and rubber tires that recycling unit processes.

(2) The plastics, rubber, or rubber tires fed to the recycling unit may originate from separating or diverting plastics, rubber, or rubber tires from municipal or industrial solid waste. These feed materials may include manufacturing scraps, trimmings, and off-specification plastics, rubber, and rubber tire discards.

(3) The plastics, rubber, and rubber tires fed to the recycling unit may contain incidental contaminants (for example, paper labels on plastic bottles or metal rings on plastic bottle caps).

Potential hydrogen chloride emissions means the level of emissions from a municipal waste combustion unit that would occur from combusting municipal solid waste without emission controls for acid gases.

Potential mercury emissions means the level of emissions from a municipal waste combustion unit that would occur from combusting municipal solid waste without controls for mercury emissions.

Potential sulfur dioxide emissions means the level of emissions from a municipal waste combustion unit that would occur from combusting municipal solid waste without emission controls for acid gases.

Pyrolysis/combustion unit means a unit that produces gases, liquids, or solids by heating municipal solid waste. The gases, liquids, or solids produced are combusted and the emissions vented to the atmosphere.

Reconstruction means rebuilding a municipal waste combustion unit and meeting two criteria:

(1) The reconstruction begins 6 months or more after [publication date of final rule].

(2) The cumulative cost of the construction over the life of the unit exceeds 50 percent of the original cost of building and installing the municipal waste combustion unit (not including land) updated to current costs (current dollars). To determine what systems are within the boundary of the municipal waste combustion unit used to calculate these costs, see the definition of municipal waste combustion unit.

Refractory unit or refractory wall furnace means a municipal waste combustion unit that has no energy recovery (such as through a waterwall) in the furnace of the municipal waste combustion unit.

Refuse-derived fuel means a type of municipal solid waste produced by processing municipal solid waste through shredding and size classification. This includes all classes of refuse-derived fuel including two fuels:

(1) Low-density fluff refuse-derived fuel through densified refuse- derived fuel.

(2) Pelletized refuse-derived fuel.

Same location means the same or contiguous properties under common ownership or control, including those separated only by a street, road, highway, or other public right-of-way. Common ownership or control includes properties that are owned, leased, or operated by the same entity, parent entity, subsidiary, subdivision, or any combination thereof. Entities may include a municipality, other governmental unit, or any quasi-governmental authority (for example, a public utility district or regional authority for waste disposal).

Second calendar half means the period that starts on July 1 and ends on December 31 in any year.

Shift supervisor means the person who is in direct charge and control of operating a municipal waste combustion unit and who is responsible for onsite supervision, technical direction, management, and overall performance of the municipal waste combustion unit during an assigned shift.

Spreader stoker, mixed fuel-fired (coal/refuse-derived fuel) combustion unit means a municipal waste combustion unit that combusts coal and refuse-derived fuel simultaneously, in which coal is introduced to the combustion zone by a mechanism that throws the fuel onto a grate from above. Combustion takes place both in suspension and on the grate.

Standard conditions when referring to units of measure mean a temperature of 20 deg.C and a pressure of 101.3 kilopascals.

Startup period means the period when a municipal waste combustion unit begins the continuous combustion of municipal solid waste. It does not include any warmup period during which the municipal waste combustion unit combusts fossil fuel or other solid waste fuel but receives no municipal solid waste.

Stoker (refuse-derived fuel) combustion unit means a steam generating unit that combusts refuse-derived fuel in a semisuspension combusting mode, using air-fed distributors.

Total mass dioxins/furans or total mass means the total mass of tetra-through octachlorinated dibenzo-p-dioxins and dibenzofurans as determined using EPA Reference Method 23 and the procedures specified in § 60.1300.

Twenty-four hour daily average or 24-hour daily average means either the arithmetic mean or geometric mean (as specified) of all hourly emission concentrations when the municipal waste combustion unit operates and combusts municipal solid waste measured during the 24 hours between 12:00 midnight and the following midnight.

Untreated lumber means wood or wood products that have been cut or shaped and include wet, air-dried, and kiln-dried wood products. Untreated lumber does not include wood products that have been painted, pigment-stained, or pressure-treated by compounds such as chromate copper arsenate, pentachlorophenol, and creosote.

Waterwall furnace means a municipal waste combustion unit that has energy (heat) recovery in the furnace (for example, radiant heat transfer section) of the combustion unit.

Yard waste means grass, grass clippings, bushes, shrubs, and clippings from bushes and shrubs. They come from residential, commercial/retail, institutional, or industrial sources as part of maintaining yards or other private or public lands. Yard waste does not include two items:

(1) Construction, renovation, and demolition wastes that are exempt from the definition of ``municipal solid waste" in this section.

(2) Clean wood that is exempt from the definition of ``municipal solid waste" in this section.

Table 1 of Subpart AAAA - Emission Limits for New Municipal Waste Combustion Units.

For these pollutants	You must meet these emission limits[a]	Using these averaging times	And determine compliance by these methods
Organics			
Dioxins/furans (total mass basis)	13 nanograms per dry standard cubic meter	3-run average (minimum run duration is 4 hours)	Stack test
Metals			
Cadmium	0.020 milligrams per dry standard cubic meter	3-run average (run duration specified in test method)	Stack test
Lead	0.20 milligrams per dry standard cubic meter	3-run average (run duration specified in test method)	Stack test
Mercury	0.080 milligrams per dry standard cubic meter -or- 85 percent reduction of potential mercury emissions	3-run average (run duration specified in test method)	Stack test
Opacity	10 percent	Thirty 6-minute averages.	Stack test
Particulate matter	24 milligrams per dry standard cubic meter	3-run average (run duration specified in test method)	Stack test
Acid Gases			
Hydrogen chloride	25 parts per million by dry volume -or- 95 percent reduction of potential hydrogen chloride emissions	3-run average (minimum run duration is 1 hour)	Stack test
Nitrogen oxides (Class I units)[b]	150 (180 for first year of operation) parts per million by dry volume	24-hour daily block arithmetic average concentration	Continuous emission monitoring system
Nitrogen oxides (Class II units)[c]	500 parts per million by dry volume	See footnote[d]	See footnote[d]

Table 1 of Subpart AAAA - Emission Limits for New Municipal Waste Combustion Units (Continued)

For these pollutants	You must meet these emission limits[a]	Using these averaging times	And determine compliance by these methods
Acid Gases (Continued)			
Sulfur Dioxide	30 parts per million by dry volume -or- 80 percent reduction of potential sulfur dioxide emissions	24-hour daily block geometric average concentration -or- percent reduction	Continuous emission monitoring system
Other			
Fugitive ash	Visible emissions for no more than 5 percent of hourly observation period	Three 1-hour observation periods	Visible emission test

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[a] All emission limits measured at 7 percent oxygen.

[b] Class I units mean small municipal waste combustion units subject to this subpart that are located at municipal waste combustion plants with an aggregate plant combustion capacity more than 250 tons per day of municipal solid waste. See § 60.1465 for definitions.

[c] Class II units mean small municipal waste combustion units subject to this subpart that are located at municipal waste combustion plants with an aggregate plant combustion capacity no more than 250 tons of day per day of municipal solid waste. See § 60.1465 for definitions.

[d] No monitoring, testing, recordkeeping or reporting is required to demonstrate compliance with the nitrogen oxides limit for Class II units.

Table 2 of Subpart AAAA - Carbon Monoxide Emission Limits For New Municipal Waste Combustion Units

For these municipal waste combustion units	You must meet these carbon monoxide limits[a]	Using these averaging times[b]
Fluidized bed	100 parts per million by dry volume	4-hour
Fluidized bed, mixed fuel, (wood/refuse-derived fuel)	100 parts per million by dry volume	24-hour[c]
Mass burn rotary refractory	100 parts per million by dry volume	4-hour
Mass burn rotary waterwall	100 parts per million by dry volume	24-hour
Mass burn waterwall and refractory	100 parts per million by dry volume	4-hour
Mixed fuel-fired (pulverized coal/refuse-derived fuel)	150 parts per million by dry volume	4-hour
Modular starved-air and excess air	50 parts per million by dry volume	4-hour
Spreader stoker, mixed fuel fired (coal/refuse-derived fuel)	150 parts per million by dry volume	24-hour daily
Stoker, refuse-derived fuel	150 parts per million by dry volume	24-hour daily

[a] All limits are measured at 7 percent oxygen. Compliance is determined by continuous emission monitoring systems.

[b] All averages are block averages. See §60.1465 for definitions.

[c] 24-hour block average, geometric mean. See § 60.1465 for definitions.

Table 3 of Subpart AAAA - Requirements For Validating Continuous Emission Monitoring Systems (CEMS)

For these continuous monitoring systems	Use these methods to validate pollutant concentration levels	Use these methods to measure oxygen (or carbon monoxide)
Nitrogen oxides (Class 1 units only)	Method 7, 7A, 7B, 7C, 7D, or 7E	Method 3 or 3A
Sulfur dioxide	Method 6 or 6C	Method 3 or 3A
Carbon monoxide	Method 10, 10A, or 10B	Method 3 or 3A

[a] Class I units mean small municipal waste combustion units subject to this subpart that are located at

municipal waste combustion plants with an aggregate plant combustion capacity more than 250 tons per day of municipal solid waste. See § 60.1465 for definitions.

Table 4 of Subpart AAAA - Requirements for Continuous Emission Monitoring Systems (CEMS)

For these pollutants	Use these span values for your CEMS	Use these performance specifications for your CEMS (from appendix B)	If needed to meet minimum data requirements, use these alternative methods to collect data
Opacity	100 percent opacity	P.S. 1	Method 9
Nitrogen oxides (Class I units only)	**Control device outlet:** 125 percent of the maximum expected hourly potential nitrogen oxides emissions of the municipal waste combustion unit	P.S. 2	Method 7E
Sulfur dioxide	**Inlet to control device:** 125 percent of the maximum expected sulfur dioxide emissions of the municipal waste combustion unit **Control device outlet:** 50 percent of the maximum expected hourly potential sulfur dioxide emissions of the municipal waste combustion unit	P.S.2	Method 6C
Carbon monoxide	125 percent of the maximum expected hourly potential carbon monoxide emissions of the municipal waste combustion unit	P.S. 4A	Method 10 with alternative interference trap
Oxygen or **carbon dioxide**	25 percent oxygen or 25 percent carbon dioxide	P.S. 3	Method 3A or 3B

[a] Class I units mean small municipal waste combustion units subject to this subpart that are located at municipal waste combustion plants with an aggregate plant combustion capacity more than 250 tons per day of municipal solid waste. See § 60.1465 for definitions.

Table 5 of Subpart AAAA - Requirements for Stack Tests

To measure these pollutants	Use these methods to determine the sampling location	Use these methods to measure pollutant concentration	Also note the following additional information
Organics			
Dioxins/furans	Method 1	Method 23[a]	The minimum sampling time must be 4 hours per test run while the municipal waste combustion unit is operating at full load.
Metals			
Cadmium	Method 1	Method 29[a]	Compliance testing must be performed while the municipal waste combustion unit is at full load.
Lead	Method 1	Method 29[a]	Compliance testing must be performed while the municipal waste combustion unit is operating at full load.
Mercury	Method 1	Method 29[a]	Compliance testing must be performed while the municipal waste combustion unit is operating at full load.
Opacity	Not applicable	Method 9	Use Method 9 to determine compliance with opacity limit. 3-hour observation period (thirty 6-minute averages).
Particulate matter	Method 1	Method 5[a]	The minimum sample volume must be 1.7 cubic meters. The probe and filter holder heating systems in the sample train must be set to provide a gas temperature no greater than 160 ±14°C.
Acid Gases[b]			
Hydrogen Chloride	Not applicable	Method 26[a]	Test runs must be at least 1 hour long.
Other [b]			
Fugitive ash	Not applicable	Method 22 (visible emissions)	The three 1-hour observation period must include periods when the

facility transfers fugitive ash from the municipal waste combustion unit to the area where the fugitive ash is stored or loaded into containers or trucks.

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[a] Must simultaneously measure oxygen (or carbon dioxide) using Method 3 or 3A.

[b] Use CEMS to test sulfur dioxide, nitrogen oxide, and carbon monoxide. Stack tests are not required except for quality assurance requirements in Appendix F of this part.

[Last Updated 1/31/03]
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Subpart WWW--Standards of Performance for Municipal Solid Waste Landfills

Sec.

Subpart WWW--Standards of Performance for Municipal Solid Waste Landfills

§ 60.750 Applicability, designation of affected facility, and delegation of authority.

(a) The provisions of this subpart apply to each municipal solid waste landfill that commenced construction, reconstruction or modification on or after May 30, 1991. Physical or operational changes made to an existing MSW landfill solely to comply with Subpart Cc of this part are not considered construction, reconstruction, or modification for the purposes of this section.

(b) The following authorities shall be retained by the Administrator and not transferred to the State: § 60.754(a)(5).

(c) Activities required by or conducted pursuant to a CERCLA, RCRA, or State remedial action are not considered construction, reconstruction, or modification for purposes of this subpart.

§ 60.751 Definitions.

As used in this subpart, all terms not defined herein shall have the meaning given them in the Act or in subpart A of this part.

Active collection system means a gas collection system that uses gas mover equipment.

Active landfill means a landfill in which solid waste is being placed or a landfill that is planned to accept waste in the future.

Closed landfill means a landfill in which solid waste is no longer being placed, and in which no additional solid wastes will be placed without first filing a notification of modification as prescribed under § 60.7(a)(4). Once a notification of modification has been filed, and additional solid waste is placed in the landfill, the landfill is no longer closed. A landfill is considered closed after meeting the criteria of § 258.60 of this title.

Closure means that point in time when a landfill becomes a closed landfill.

Commercial solid waste means all types of solid waste generated by stores, offices, restaurants, warehouses, and other nonmanufacturing activities, excluding residential and industrial wastes.

Controlled landfill means any landfill at which collection and control systems are required under this subpart as a result of the nonmethane organic compounds emission rate. The landfill is considered controlled at the time a collection and control system design plan is submitted in compliance with § 60.752(b)(2)(i).

Design capacity means the maximum amount of solid waste a landfill can accept, as indicated in terms of volume or mass in the most recent permit issued by the State, local, or Tribal agency responsible for regulating the landfill, plus any in-place waste not accounted for in the most recent permit. If the owner or operator chooses to convert the design capacity from volume to mass or from mass to volume to demonstrate its design capacity is less than 2.5 million megagrams or 2.5 million cubic meters, the calculation must include a site specific density, which must be recalculated annually.

Disposal facility means all contiguous land and structures, other appurtenances, and improvements on the land used for the disposal of solid waste.

Emission rate cutoff means the threshold annual emission rate to which a landfill compares its estimated emission rate to determine if control under the regulation is required.

Enclosed combustor means an enclosed firebox which maintains a relatively constant limited peak temperature generally using a limited supply of combustion air. An enclosed flare is considered an enclosed combustor.

Flare means an open combustor without enclosure or shroud.

Gas mover equipment means the equipment (i.e., fan, blower, compressor) used to transport landfill gas through the header system.

Household waste means any solid waste (including garbage, trash, and sanitary waste in septic tanks) derived from households (including, but not limited to, single and multiple residences, hotels and motels, bunkhouses, ranger stations, crew quarters, campgrounds, picnic grounds, and day-use recreation areas).

Industrial solid waste means solid waste generated by manufacturing or industrial processes that is not a hazardous waste regulated under Subtitle C of the Resource Conservation and Recovery Act, parts 264 and 265 of this title. Such waste may include, but is not limited to, waste resulting from the following manufacturing processes: electric power generation; fertilizer/agricultural chemicals; food and related products/by-products; inorganic chemicals; iron and steel manufacturing; leather and leather products; nonferrous metals manufacturing/foundries; organic chemicals; plastics and resin manufacturing; pulp and paper industry; rubber and miscellaneous plastic products; stone, glass, clay, and concrete products; textile manufacturing; transportation equipment; and water treatment. This term does not include mining waste or oil and gas waste.

Interior well means any well or similar collection component located inside the perimeter of the landfill waste. A perimeter well located outside the landfilled waste is not an interior well.

Landfill means an area of land or an excavation in which wastes are placed for permanent disposal, and that is not a land application unit, surface impoundment, injection well, or waste pile as those terms are defined under § 257.2 of this title.

Lateral expansion means a horizontal expansion of the waste boundaries of an existing MSW landfill. A lateral expansion is not a modification unless it results in an increase in the design capacity of the landfill.

Modification means an increase in the permitted volume design capacity of the landfill by either horizontal or vertical expansion based on its permitted design capacity as of May 30, 1991. Modification does not occur until the owner or operator commences construction or the horizontal or vertical expansion.

Municipal solid waste landfill or MSW landfill means an entire disposal facility in a contiguous geographical space where household waste is placed in or on land. An MSW landfill may also receive other types of RCRA Subtitle D wastes (§ 257.2 of this title) such as commercial solid waste, nonhazardous sludge, conditionally exempt small quantity generator waste, and industrial solid waste. Portions of an MSW landfill may be separated by access roads. An MSW landfill may be publicly or privately owned. An MSW landfill may be a new MSW landfill, an existing MSW landfill, or a lateral expansion.

Municipal solid waste landfill emissions or MSW landfill emissions means gas generated by the decomposition of organic waste deposited in an MSW landfill or derived from the evolution of organic compounds in the waste.

NMOC means nonmethane organic compounds, as measured according to the provisions of § 60.754.

Nondegradable waste means any waste that does not decompose through chemical breakdown or microbiological activity. Examples are, but are not limited to, concrete, municipal waste combustor ash, and metals.

Passive collection system means a gas collection system that solely uses positive pressure within the landfill to move the gas rather than using gas mover equipment.

Sludge means any solid, semisolid, or liquid waste generated from a municipal, commercial, or industrial wastewater treatment plant, water supply treatment plant, or air pollution control facility, exclusive of the treated effluent from a wastewater treatment plant.

Solid waste means any garbage, sludge from a wastewater treatment plant, water supply treatment plant, or air pollution control facility and other discarded material, including solid, liquid, semisolid, or contained gaseous material resulting from industrial, commercial, mining, and agricultural operations, and from community activities, but does not include solid or dissolved material in domestic sewage, or solid or dissolved materials in irrigation return flows or industrial discharges that are point sources subject to permits under 33 U.S.C. 1342, or source, special nuclear, or by-product material as defined by the Atomic Energy Act of 1954, as amended (42 U.S.C 2011 et seq.).

Sufficient density means any number, spacing, and combination of collection system components, including vertical wells, horizontal collectors, and surface collectors, necessary to maintain emission and migration control as determined by measures of performance set forth in this part.

Sufficient extraction rate means a rate sufficient to maintain a negative pressure at all wellheads in the collection system without causing air infiltration, including any wellheads connected to the system as a result of expansion or excess surface emissions, for the
life of the blower.

§ 60.752 Standards for air emissions from municipal solid waste landfills.

(a) Each owner or operator of an MSW landfill having a design capacity less than 2.5 million megagrams by mass or 2.5 million cubic meters by volume shall submit an initial design capacity report to the Administrator as provided in § 60.757(a). The landfill may calculate design capacity in either megagrams or cubic meters for comparison with the exemption values. Any density conversions shall be documented and submitted with the report. Submittal of the initial design capacity report shall fulfill the requirements of this subpart except as provided for in paragraphs (a)(1) and (a)(2) of this section.

(1) The owner or operator shall submit to the Administrator an amended design capacity report, as provided for in § 60.757(a)(3).

(2) When an increase in the maximum design capacity of a landfill exempted from the provisions of § 60.752(b) through § 60.759 of this subpart on the basis of the design capacity exemption in paragraph (a) of this section results in a revised maximum design capacity equal to or greater than 2.5 million megagrams and 2.5 million cubic meters, the owner or operator shall comply with the provision of paragraph (b) of this section.

(b) Each owner or operator of an MSW landfill having a design capacity equal to or greater than 2.5 million megagrams and 2.5 million cubic meters, shall either comply with paragraph (b)(2) of this section or calculate an NMOC emission rate for the landfill using the procedures specified in § 60.754. The NMOC emission rate shall be recalculated annually, except as provided in § 60.757(b)(1)(ii) of this subpart. The owner or operator of an MSW landfill subject to this subpart with a design capacity greater than or equal to 2.5 million megagrams and 2.5 million cubic meters is subject to part 70 or 71 permitting requirements.

(1) If the calculated NMOC emission rate is less than 50 megagrams per year, the owner or operator shall:

(i) Submit an annual emission report to the Administrator, except as provided for in § 60.757(b)(1)(ii); and

(ii) Recalculate the NMOC emission rate annually using the procedures specified in § 60.754(a)(1) until such time as the calculated NMOC emission rate is equal to or greater than 50 megagrams per year, or the landfill is closed.

(A) If the NMOC emission rate, upon recalculation required in paragraph (b)(1)(ii) of this section, is equal to or greater than 50 megagrams per year, the owner or operator shall install a collection and control system in compliance with paragraph (b)(2) of this section.

(B) If the landfill is permanently closed, a closure notification shall be submitted to the Administrator as provided for in § 60.757(d).

(2) If the calculated NMOC emission rate is equal to or greater than 50 megagrams per year, the owner or operator shall:

(i) Submit a collection and control system design plan prepared by a professional engineer to the Administrator within 1 year:

(A) The collection and control system as described in the plan shall meet the design requirements of paragraph (b)(2)(ii) of this section.

(B) The collection and control system design plan shall include any alternatives to the operational standards, test methods, procedures, compliance measures, monitoring, recordkeeping or reporting provisions of §§ 60.753 through 60.758 proposed by the owner or operator.

(C) The collection and control system design plan shall either conform with specifications for active collection systems in § 60.759 or include a demonstration to the Administrator's satisfaction of the sufficiency of the alternative provisions to § 60.759.

(D) The Administrator shall review the information submitted under paragraphs (b)(2)(i) (A),(B) and (C) of this section and either approve it, disapprove it, or request that additional information be submitted. Because of the many site-specific factors involved with landfill gas system design, alternative systems may be necessary. A wide variety of system designs are possible, such as vertical wells, combination horizontal and vertical collection systems, or horizontal trenches only, leachate collection components, and passive systems.

(ii) Install a collection and control system that captures the gas generated within the landfill as required by paragraphs (b)(2)(ii)(A) or (B) and (b)(2)(iii) of this section within 30 months after the first annual report in which the emission rate equals or exceeds 50 megagrams per year, unless Tier 2 or Tier 3 sampling demonstrates that the emission rate is less than 50 megagrams per year, as specified in § 60.757(c)(1) or (2).

(A) An active collection system shall:

(1) Be designed to handle the maximum expected gas flow rate from the entire area of the landfill that warrants control over the intended use period of the gas control or treatment system equipment;

(2) Collect gas from each area, cell, or group of cells in the landfill in which the initial solid waste has been placed for a period of:

(i) 5 years or more if active; or

(ii) 2 years or more if closed or at final grade;

(3) Collect gas at a sufficient extraction rate;

(4) Be designed to minimize off-site migration of subsurface gas.

(B) A passive collection system shall:

(1) Comply with the provisions specified in paragraphs (b)(2)(ii)(A)(1), (2), and (2)(ii)(A)(4) of this section.

(2) Be installed with liners on the bottom and all sides in all areas in which gas is to be collected. The liners shall be installed as required under § 258.40 of this title.

(iii) Route all the collected gas to a control system that complies with the requirements in either paragraph (b)(2)(iii) (A), (B) or (C) of this section.

(A) An open flare designed and operated in accordance with § 60.18;

(B) A control system designed and operated to reduce NMOC by 98 weight-percent, or, when an enclosed combustion device is used for control, to either reduce NMOC by 98 weight percent or reduce the outlet NMOC concentration to less than 20 parts per million by volume, dry basis as hexane at 3 percent oxygen. The reduction efficiency or parts per million by volume shall be established by an initial performance test to be completed no later than 180 days after the initial startup of the approved control system using the test methods specified in § 60.754(d).

(1) If a boiler or process heater is used as the control device, the landfill gas

stream shall be introduced into the flame zone.

(2) The control device shall be operated within the parameter ranges established during the initial or most recent performance test. The operating parameters to be monitored are specified in § 60.756;

(C) Route the collected gas to a treatment system that processes the collected gas for subsequent sale or use. All emissions from any atmospheric vent from the gas treatment system shall be subject to the requirements of paragraph (b)(2)(iii) (A) or (B) of this section.

(iv) Operate the collection and control device installed to comply with this subpart in accordance with the provisions of § § 60.753, 60.755 and 60.756.

(v) The collection and control system may be capped or removed provided that all the conditions of paragraphs (b)(2)(v) (A), (B), and (C) of this section are met:

(A) The landfill shall be a closed landfill as defined in § 60.751 of this subpart. A closure report shall be submitted to the Administrator as provided in § 60.757(d);

(B) The collection and control system shall have been in operation a minimum of 15 years; and

(C) Following the procedures specified in § 60.754(b) of this subpart, the calculated NMOC gas produced by the landfill shall be less than 50 megagrams per year on three successive test dates. The test dates shall be no less than 90 days apart, and no more than 180 days apart.

(c) For purposes of obtaining an operating permit under title V of the Act, the owner or operator of a MSW landfill subject to this subpart with a design capacity less than 2.5 million megagrams or 2.5 million cubic meters is not subject to the requirement to obtain an operating permit for the landfill under part 70 or 71 of this chapter, unless the landfill is otherwise subject to either part 70 or 71. For purposes of submitting a timely application for an operating permit under part 70 or 71, the owner or operator of a MSW landfill subject to this subpart with a design capacity greater than or equal to 2.5 million megagrams and 2.5 million cubic meters, and not otherwise subject to either part 70 or 71, becomes subject to the requirements of §§ 70.5(a)(1)(i) or 71.5(a)(1)(i) of this chapter, regardless of when the design capacity report is actually submitted, no later than:

(1) June 10, 1996 for MSW landfills that commenced construction, modification, or reconstruction on or after May 30, 1991 but before March 12, 1996;

(2) Ninety days after the date of commenced construction, modification, or reconstruction for MSW landfills that commence construction, modification, or reconstruction on or after March 12, 1996.

(d) When a MSW landfill subject to this subpart is closed, the owner or operator is no longer subject to the requirement to maintain an operating permit under part 70 or 71 of this chapter for the landfill if the landfill is not otherwise subject to the requirements of either part 70 or 71 and if either of the following conditions are met:

(1) The landfill was never subject to the requirement for a control system under paragraph (b)(2) of this section; or

(2) The owner or operator meets the conditions for control system removal specified in paragraph (b)(2)(v) of this section.

§ 60.753 Operational standards for collection and control systems.

Each owner or operator of an MSW landfill with a gas collection and control system used to comply with the provisions of § 60.752(b)(2)(ii) of this subpart shall:

(a) Operate the collection system such that gas is collected from each area, cell, or group of cells in the MSW landfill in which solid waste has been in place for:

(1) 5 years or more if active; or

(2) 2 years or more if closed or at final grade;

(b) Operate the collection system with negative pressure at each wellhead except under the following conditions:

(1) A fire or increased well temperature. The owner or operator shall record instances when positive pressure occurs in efforts to avoid a fire. These records shall be submitted with the annual reports as provided in § 60.757(f)(1);

(2) Use of a geomembrane or synthetic cover. The owner or operator shall develop acceptable pressure limits in the design plan;

(3) A decommissioned well. A well may experience a static positive pressure after shut down to accommodate for declining flows. All design changes shall be approved by the Administrator;

(c) Operate each interior wellhead in the collection system with a landfill gas temperature less than 55° C and with either a nitrogen level less than 20 percent or an oxygen level less than 5 percent. The owner or operator may establish a higher operating temperature, nitrogen, or oxygen value at a particular well. A higher operating value demonstration shall show supporting data that the elevated parameter does not cause fires or significantly inhibit anaerobic decomposition by killing methanogens.

(1) The nitrogen level shall be determined using Method 3C, unless an alternative test method is established as allowed by § 60.752(b)(2)(i) of this subpart.

(2) Unless an alternative test method is established as allowed by § 60.752(b)(2)(i) of this subpart, the oxygen shall be determined by an oxygen meter using Method 3A or 3C except that:

(i) The span shall be set so that the regulatory limit is between 20 and 50 percent of the span;

(ii) A data recorder is not required;

(iii) Only two calibration gases are required, a zero and span, and ambient air may be used as the span;

(iv) A calibration error check is not required;

(v) The allowable sample bias, zero drift, and calibration drift are ±10 percent.

(d) Operate the collection system so that the methane concentration is less than 500 parts per million above background at the surface of the landfill. To determine if this level is exceeded, the owner or operator shall conduct surface testing around the perimeter of the collection area and along a pattern that traverses the landfill at 30 meter intervals and where visual observations indicate elevated concentrations of landfill gas, such as distressed vegetation and cracks or seeps in the cover. The owner or operator may establish an alternative traversing pattern that ensures equivalent coverage. A surface monitoring design plan shall be developed that includes a topographical map with the monitoring route and the rationale for any site-specific deviations from the 30 meter intervals. Areas with steep slopes or other dangerous areas may be excluded from the surface testing.

(e) Operate the system such that all collected gases are vented to a control system designed and operated in compliance with § 60.752(b)(2)(iii). In the event the collection or control system is inoperable, the gas mover system shall be shut down and all valves in the collection and control system contributing to venting of the gas to the atmosphere shall be closed within 1 hour; and

(f) Operate the control or treatment system at all times when the collected gas is routed to the system.

(g) If monitoring demonstrates that the operational requirement in paragraphs (b), (c), or (d) of this section are not met, corrective action shall be taken as specified in § 60.755(a) (3) through (5) or § 60.755(c) of this subpart. If corrective actions are taken as specified in § 60.755, the monitored exceedance is not a violation of the operational requirements in this section.

§ 60.754 Test methods and procedures.

(a) (1) The landfill owner or operator shall calculate the NMOC emission rate using either the equation provided in paragraph (a)(1)(i) of this section or the equation provided in paragraph (a)(1)(ii) of this section. Both equations may be used if the actual year-to-year solid waste acceptance rate is known, as specified in paragraph (a)(1)(i), for part of the life of the landfill and the actual year-to- year solid waste acceptance rate is unknown, as specified in paragraph (a)(1)(ii), for part of the life of the landfill. The values to be used in both equations are 0.05 per year for k, 170 cubic meters per megagram for L_o, and 4,000 parts per million by volume as hexane for the C_{NMOC}. For landfills located in geographical areas with a thirty year annual average precipitation of less than 25 inches, as measured at the nearest representative official meteorologic site, the k value to be used is 0.02 per year.

(i) The following equation shall be used if the actual year-to-year solid waste acceptance rate is known.

$$M_{NMOC} = \sum_{i=1}^{n} 2kL_oM_i\left(e^{-kt}i\right)\left(C_{NMOC}\right)\left(3.6X10^{-9}\right)$$

where,

M_{NMOC} = Total NMOC emission rate from the landfill, megagrams per year
k = methane generation rate constant, $year^{-1}$
L_o = methane generation potential, cubic meters per megagram solid waste
Mi = mass of solid waste in the i^{th} section, megagrams
t_i = age of the i^{th} section, years
C_{NMOC} = concentration of NMOC, parts per million by volume as hexane
3.6×10^{-9} = conversion factor

The mass of nondegradable solid waste may be subtracted from the total mass of solid waste in a particular section of the landfill when calculating the value for M_i if documentation of the nature and amount of such wastes is maintained.

(ii) The following equation shall be used if the actual year-to- year solid waste acceptance rate is unknown.

$$M_{NMOC} = 2L_o R\ (e^{-kc} - e^{-kt})\ (C_{NMOC})\ (3.6 \times 10^{-9})$$

where,

M_{NMOC} = mass emission rate of NMOC, megagrams per year
L_o = methane generation potential, cubic meters per megagram solid waste
R = average annual acceptance rate, megagrams per year
k = methane generation rate constant, $year^{-1}$
t = age of landfill, years
C_{NMOC} = concentration of NMOC, parts per million by volume as hexane
c = time since closure, years. For active landfill c = O and $e^{-kc}=1$
3.6×10^{-9} = conversion factor

The mass of nondegradable solid waste may be subtracted from the total mass of solid waste in a particular section of the landfill when calculating a value for R, if documentation of the nature and amount of such wastes is maintained.

(2) Tier 1. The owner or operator shall compare the calculated NMOC mass emission rate to the standard of 50 megagrams per year.

(i) If the NMOC emission rate calculated in paragraph (a)(1) of this section is less than 50 megagrams per year, then the landfill owner shall submit an emission rate report as provided in § 60.757(b)(1), and shall recalculate the NMOC mass emission rate annually as required under § 60.752(b)(1).

(ii) If the calculated NMOC emission rate is equal to or greater than 50 megagrams per year, then the landfill owner shall either comply with § 60.752(b)(2), or determine a site-specific NMOC concentration and recalculate the NMOC emission rate using the procedures provided in paragraph (a)(3) of this section.

(3) Tier 2. The landfill owner or operator shall determine the NMOC concentration using the following sampling procedure. The landfill owner or operator shall install at least two sample probes per hectare of landfill surface that has retained waste for at least 2 years. If the landfill is larger than 25 hectares in area, only 50 samples are required. The sample probes should be located to avoid known areas of nondegradable solid waste. The owner or operator shall collect and analyze one sample of landfill gas from each probe to determine the NMOC concentration using Method 25 or 25C of Appendix A of this part. Method 18 of Appendix A of this part may be used to analyze the samples collected by the Method 25 or 25C sampling procedure. Taking composite samples from different probes into a single cylinder is allowed; however, equal sample volumes must be taken from each probe. For each composite, the sampling rate, collection times, beginning and ending cylinder vacuums, or alternative volume measurements must be recorded to verify that composite volumes are equal. Composite sample volumes should not be less than one liter unless evidence can be provided to substantiate the accuracy of smaller volumes. Terminate compositing before the cylinder approaches ambient pressure where measurement accuracy diminishes. If using Method 18, the owner or operator must identify all compounds in the sample and, as a minimum, test for those compounds published in the most recent Compilation of Air Pollutant Emission Factors (AP-42), minus carbon monoxide, hydrogen sulfide, and mercury. As a minimum, the instrument must be calibrated for each of the compounds on the list. Convert the concentration of each Method 18 compound to CNMOC as hexane by multiplying by the ratio of its carbon atoms divided by six. If more than the required number of samples are taken, all samples must be used in the analysis. The landfill owner or operator must divide the NMOC concentration from Method 25 or 25C of Appendix A of this part by six to convert from CNMOC as carbon to CNMOC as hexane. If the landfill has an active or passive gas removal system in place, Method 25 or 25C samples may be collected from these systems instead of surface probes provided the removal system can be shown to provide sampling as representative as the two sampling probe per hectare requirement. For active collection systems, samples may be collected from the common header pipe before the gas moving or condensate removal equipment. For these systems, a minimum of three samples must be collected from the header pipe.

(i) The landfill owner or operator shall recalculate the NMOC mass emission rate using the equations provided in paragraph (a)(1)(i) or (a)(1)(ii) of this section and using the average NMOC concentration from the collected samples instead of the default value in the equation provided in paragraph (a)(1) of this section.

(ii) If the resulting mass emission rate calculated using the site-specific NMOC concentration is equal to or greater than 50 megagrams per year, then the landfill owner or operator shall either comply with § 60.752(b)(2), or determine the site-specific methane generation rate constant and recalculate the NMOC emission rate using the site-specific methane generation rate using the procedure specified in paragraph (a)(4) of this section.

(iii) If the resulting NMOC mass emission rate is less than 50 megagrams per year, the owner or operator shall submit a periodic estimate of the emission rate report as provided in § 60.757(b)(1) and retest the site-specific NMOC concentration every 5 years using the methods specified in this section.

(4) Tier 3. The site-specific methane generation rate constant shall be determined using the procedures provided in Method 2E of appendix A of this part. The landfill owner or operator shall estimate the NMOC mass emission rate using equations in paragraph (a)(1)(i) or (a)(1)(ii) of this section and using a site-specific methane generation rate constant k, and the site-specific NMOC concentration as determined

in paragraph (a)(3) of this section instead of the default values provided in paragraph (a)(1) of this section. The landfill owner or operator shall compare the resulting NMOC mass emission rate to the standard of 50 megagrams per year.

(i) If the NMOC mass emission rate as calculated using the site-specific methane generation rate and concentration of NMOC is equal to or greater than 50 megagrams per year, the owner or operator shall comply with § 60.752(b)(2).

(ii) If the NMOC mass emission rate is less than 50 megagrams per year, then the owner or operator shall submit a periodic emission rate report as provided in § 60.757(b)(1) and shall recalculate the NMOC mass emission rate annually, as provided in § 60.757(b)(1) using the equations in paragraph (a)(1) of this section and using the site-specific methane generation rate constant and NMOC concentration obtained in paragraph (a)(3) of this section. The calculation of the methane generation rate constant is performed only once, and the value obtained from this test shall be used in all subsequent annual NMOC emission rate calculations.

(5) The owner or operator may use other methods to determine the NMOC concentration or a site-specific k as an alternative to the methods required in paragraphs (a)(3) and (a)(4) of this section if the method has been approved by the Administrator.

(b) After the installation of a collection and control system in compliance with § 60.755, the owner or operator shall calculate the NMOC emission rate for purposes of determining when the system can be removed as provided in § 60.752(b)(2)(v), using the following equation:

$$M_{NMOC} = 1.89 \times 10^{-3} Q_{LFG} C_{NMOC}$$

where,

M_{NMOC} = mass emission rate of NMOC, megagrams per year
Q_{LFG} = flow rate of landfill gas, cubic meters per minute
C_{NMOC} = NMOC concentration, parts per million by volume as hexane

(1) The flow rate of landfill gas, QLFG, shall be determined by measuring the total landfill gas flow rate at the common header pipe that leads to the control device using a gas flow measuring device calibrated according to the provisions of section 4 of Method 2E of appendix A of this part.

(2) The average NMOC concentration, CNMOC, shall be determined by collecting and analyzing landfill gas sampled from the common header pipe before the gas moving or condensate removal equipment using the procedures in Method 25C or Method 18 of appendix A of this part. If using Method 18 of appendix A of this part, the minimum list of compounds to be tested shall be those published in the most recent Compilation of Air Pollutant Emission Factors (AP-42). The sample location on the common header pipe shall be before any condensate removal or other gas refining units. The landfill owner or operator shall divide the NMOC concentration from Method 25C of appendix A of this part by six to convert from C_{NMOC} as carbon to C_{NMOC} as hexane.

(3) The owner or operator may use another method to determine landfill gas flow rate and NMOC concentration if the method has been approved by the Administrator.

(c) When calculating emissions for PSD purposes, the owner or operator of each MSW landfill subject to the provisions of this subpart shall estimate the NMOC emission rate for comparison to the PSD major source and significance levels in §§ 51.166 or 52.21 of this chapter using AP-42 or other approved measurement procedures.

(d) For the performance test required in § 60.752(b)(2)(iii)(B), Method 25, 25C or Method 18 of appendix A of this part shall be used to determine compliance with 98 weight-percent efficiency or the 20 ppmv outlet concentration level, unless another method to demonstrate compliance has been approved by the Administrator as provided by § 60.752(b)(2)(i)(B). Method 3 or 3A shall be used to determine oxygen for correcting the NMOC concentration as hexane to 3 percent. In cases where the outlet concentration is less than 50 ppm NMOC as carbon (8ppm NMOC as Hexane), Method 25A should be used in place of Method 25. If using Method 18 of appendix A of this part, the minimum list of compounds to be tested shall be those published in the most recent Compilation of Air Pollutant Emission Factors (AP-42). The following equation shall be used to calculate efficiency:

Control Efficiency = $(NMOC_{in} - NMOC_{out})/(NMOC_{in})$

where,
$NMOC_{in}$ = mass of NMOC entering control device
$NMOC_{out}$ = mass of NMOC exiting control device

§ 60.755 Compliance provisions.

(a) Except as provided in § 60.752(b)(2)(i)(B), the specified methods in paragraphs (a)(1) through (a)(6) of this section shall be used to determine whether the gas collection system is in compliance with § 60.752(b)(2)(ii).

(1) For the purposes of calculating the maximum expected gas generation flow rate from the landfill to determine compliance with § 60.752(b)(2)(ii)(A)(1), one of the following equations shall be used. The k and L_o kinetic factors should be those published in the most recent Compilation of Air Pollutant Emission Factors (AP-42) or other site specific values demonstrated to be appropriate and approved by the Administrator. If k has been determined as specified in § 60.754(a)(4), the value of k determined from the test shall be used. A value of no more than 15 years shall be used for the intended use period of the gas mover equipment. The active life of the landfill is the age of the landfill plus the estimated number of years until closure.

(i) For sites with unknown year-to-year solid waste acceptance rate:

$$Q_m = 2L_o R \left(e^{-kc} - e^{-kt}\right)$$

where,

Q_m = maximum expected gas generation flow rate, cubic meters per year
L_o = methane generation potential, cubic meters per megagram solid waste
R = average annual acceptance rate, megagrams per year
k = methane generation rate constant, $year^{-1}$
t = age of the landfill at equipment installation plus the time the owner or operator intends to use the gas mover equipment or active life of the landfill, whichever is less. If the equipment is installed after closure, t is the age of the landfill at installation, years
c = time since closure, years (for an active landfill c = O and $e^{-kc} = 1$)

(ii) For sites with known year-to-year solid waste acceptance rate:

$$Q_M = \sum_{i=1}^{n} 2kLoMi\left(e^{-kt}i\right)$$

where,

Q_M = maximum expected gas generation flow rate, cubic meters per year
k = methane generation rate constant, $year^{-1}$
L_o = methane generation potential, cubic meters per megagram solid waste

M_i = mass of solid waste in the i^{th} section, megagrams
t_i = age of the i^{th} section, years

(iii) If a collection and control system has been installed, actual flow data may be used to project the maximum expected gas generation flow rate instead of, or in conjunction with, the equations in paragraphs (a)(1) (i) and (ii) of this section. If the landfill is still accepting waste, the actual measured flow data will not equal the maximum expected gas generation rate, so calculations using the equations in paragraphs (a)(1) (i) or (ii) or other methods shall be used to predict the maximum expected gas generation rate over the intended period of use of the gas control system equipment.

(2) For the purposes of determining sufficient density of gas collectors for compliance with § 60.752(b)(2)(ii)(A)(2), the owner or operator shall design a system of vertical wells, horizontal collectors, or other collection devices, satisfactory to the Administrator, capable of controlling and extracting gas from all portions of the landfill sufficient to meet all operational and performance standards.

(3) For the purpose of demonstrating whether the gas collection system flow rate is sufficient to determine compliance with § 60.752(b)(2)(ii)(A)(3), the owner or operator shall measure gauge pressure in the gas collection header at each individual well, monthly. If a positive pressure exists, action shall be initiated to correct the exceedance within 5 calendar days, except for the three conditions allowed under § 60.753(b). If negative pressure cannot be achieved without excess air infiltration within 15 calendar days of the first measurement, the gas collection system shall be expanded to correct the exceedance within 120 days of the initial measurement of positive pressure. Any attempted corrective measure shall not cause exceedances of other operational or performance standards. An alternative timeline for correcting the exceedence may be submitted to the Administrator for approval.

(4) Owners or operators are not required to expand the system as required in paragraph (a)(3) of this section during the first 180 days after gas collection system startup.

(5) For the purpose of identifying whether excess air infiltration into the landfill is occurring, the owner or operator shall monitor each well monthly for temperature and nitrogen or oxygen as provided in § 60.753(c). If a well exceeds one of these operating parameters, action shall be initiated to correct the exceedance within 5 calendar days. If correction of the exceedance cannot be achieved within 15 calendar days of the first measurement, the gas collection system shall be expanded to correct the exceedance within 120 days of the initial exceedance. Any attempted corrective measure shall not cause exceedances of other operational or performance standards. An alternative timeline for correcting the exceedence may be submitted to the Administrator for approval.

(6) An owner or operator seeking to demonstrate compliance with § 60.752(b)(2)(ii)(A)(4) through the use of a collection system not conforming to the specifications provided in § 60.759 shall provide information satisfactory to the Administrator as specified in § 60.752(b)(2)(i)(C) demonstrating that off-site migration is being controlled.

(b) For purposes of compliance with § 60.753(a), each owner or operator of a controlled landfill shall place each well or design component as specified in the approved design plan as provided in § 60.752(b)(2)(i). Each well shall be installed no later than 60 days after the date on which the initial solid waste has been in place for a period of:

(1) 5 years or more if active; or
(2) 2 years or more if closed or at final grade.

(c) The following procedures shall be used for compliance with the surface methane operational standard as provided in § 60.753(d).

(1) After installation of the collection system, the owner or operator shall monitor surface concentrations of methane along the entire perimeter of the collection area and along a pattern that traverses the landfill at 30 meter intervals (or a site-specific established spacing) for each collection area on a quarterly basis using an organic vapor analyzer, flame ionization detector, or other portable monitor meeting the specifications provided in paragraph (d) of this section.

(2) The background concentration shall be determined by moving the probe inlet upwind and downwind outside the boundary of the landfill at a distance of at least 30 meters from the perimeter wells.

(3) Surface emission monitoring shall be performed in accordance with section 4.3.1 of Method 21 of appendix A of this part, except that the probe inlet shall be placed within 5 to 10 centimeters of the ground. Monitoring shall be performed during typical meteorological conditions.

(4) Any reading of 500 parts per million or more above background at any location shall be recorded as a monitored exceedance and the actions specified in paragraphs (c)(4) (i) through (v) of this section shall be taken. As long as the specified actions are taken, the exceedance is not a violation of the operational requirements of § 60.753(d).

(i) The location of each monitored exceedance shall be marked and the location recorded.

(ii) Cover maintenance or adjustments to the vacuum of the adjacent wells to increase the gas collection in the vicinity of each exceedance shall be made and the location shall be re-monitored within 10 calendar days of detecting the exceedance.

(iii) If the re-monitoring of the location shows a second exceedance, additional corrective action shall be taken and the location shall be monitored again within 10 days of the second exceedance. If the re-monitoring shows a third exceedance for the same location, the action specified in paragraph (c)(4)(v) of this section shall be taken, and no further monitoring of that location is required until the action specified in paragraph (c)(4)(v) has been taken.

(iv) Any location that initially showed an exceedance but has a methane concentration less than 500 ppm methane above background at the 10-day re-monitoring specified in paragraph (c)(4) (ii) or (iii) of this section shall be re-monitored 1 month from the initial exceedance. If the 1-month remonitoring shows a concentration less than 500 parts per million above background, no further monitoring of that location is required until the next quarterly monitoring period. If the 1-month remonitoring shows an exceedance, the actions specified in paragraph (c)(4) (iii) or (v) shall be taken.

(v) For any location where monitored methane concentration equals or exceeds 500 parts per million above background three times within a quarterly period, a new well or other collection device shall be installed within 120 calendar days of the initial exceedance. An alternative remedy to the exceedance, such as upgrading the blower, header pipes or control device, and a corresponding timeline for installation may be submitted to the Administrator for approval.

(5) The owner or operator shall implement a program to monitor for cover integrity and implement cover repairs as necessary on a monthly basis.

(d) Each owner or operator seeking to comply with the provisions in paragraph (c) of this section shall comply with the following instrumentation specifications and procedures for surface emission monitoring devices:

(1) The portable analyzer shall meet the instrument specifications provided in section 3 of Method 21 of appendix A of this part, except that ``methane" shall replace all references to VOC.

(2) The calibration gas shall be methane, diluted to a nominal concentration of 500 parts per million in air.

(3) To meet the performance evaluation requirements in section 3.1.3 of Method 21 of appendix A of this part, the instrument evaluation procedures of section 4.4 of Method 21 of appendix A of this part shall be used.

(4) The calibration procedures provided in section 4.2 of Method 21 of appendix A of this part shall be followed immediately before commencing a surface monitoring survey.

(e) The provisions of this subpart apply at all times, except during periods of start-up, shutdown, or malfunction, provided that the duration of start-up, shutdown, or malfunction shall not exceed 5 days for collection systems and shall not exceed 1 hour for treatment or control devices.

§ 60.756 Monitoring of operations.

Except as provided in § 60.752(b)(2)(i)(B),

(a) Each owner or operator seeking to comply with § 60.752(b)(2)(ii)(A) for an active gas collection system shall install a sampling port and a thermometer other temperature measuring device, or an access port for temperature measurements at each wellhead and:

(1) Measure the gauge pressure in the gas collection header on a monthly basis as provided in § 60.755(a)(3); and

(2) Monitor nitrogen or oxygen concentration in the landfill gas on a monthly basis as provided in § 60.755(a)(5); and

(3) Monitor temperature of the landfill gas on a monthly basis as provided in § 60.755(a)(5).

(b) Each owner or operator seeking to comply with § 60.752(b)(2)(iii) using an enclosed combustor shall calibrate, maintain, and operate according to the manufacturer's specifications, the following equipment.

(1) A temperature monitoring device equipped with a continuous recorder and having a minimum accuracy of ±1 percent of the temperature being measured expressed in degrees Celsius or ±0.5 degrees C, whichever is greater. A temperature monitoring device is not required for boilers or process heaters with design heat input capacity equal to or greater than 44 megawatts.

(2) A device that records flow to or bypass of the control device. The owner or operator shall either:

(i) Install, calibrate, and maintain a gas flow rate measuring device that shall record the flow to the control device at least every 15 minutes; or

(ii) Secure the bypass line valve in the closed position with a car-seal or a lock-and-key type configuration. A visual inspection of the seal or closure mechanism shall be performed at least once every month to ensure that the valve is maintained in the closed position and that the gas flow is not diverted through the bypass line.

(c) Each owner or operator seeking to comply with § 60.752(b)(2)(iii) using an open flare shall install, calibrate, maintain, and operate according to the manufacturer's specifications the following equipment:

(1) A heat sensing device, such as an ultraviolet beam sensor or thermocouple, at the pilot light or the flame itself to indicate the continuous presence of a flame.

(2) A device that records flow to or bypass of the flare. The owner or operator shall either:

(i) Install, calibrate, and maintain a gas flow rate measuring device that shall record the flow to the control device at least every 15 minutes; or

(ii) Secure the bypass line valve in the closed position with a car-seal or a lock-and-key type configuration. A visual inspection of the seal or closure mechanism shall be performed at least once every month to ensure that the valve is maintained in the closed position and that the gas flow is not diverted through the bypass line.

(d) Each owner or operator seeking to demonstrate compliance with § 60.752(b)(2)(iii) using a device other than an open flare or an enclosed combustor shall provide information satisfactory to the Administrator as provided in § 60.752(b)(2)(i)(B) describing the operation of the control device, the operating parameters that would indicate proper performance, and appropriate monitoring procedures. The Administrator shall review the information and either approve it, or request that additional information be submitted. The Administrator may specify additional appropriate monitoring procedures.

(e) Each owner or operator seeking to install a collection system that does not meet the specifications in § 60.759 or seeking to monitor alternative parameters to those required by § 60.753 through § 60.756 shall provide information satisfactory to the Administrator as provided in § 60.752(b)(2)(i) (B) and (C) describing the design and operation of the collection system, the operating parameters that would indicate proper performance, and appropriate monitoring procedures. The Administrator may specify additional appropriate monitoring procedures.

(f) Each owner or operator seeking to demonstrate compliance with § 60.755(c), shall monitor surface concentrations of methane according to the instrument specifications and procedures provided in § 60.755(d). Any closed landfill that has no monitored exceedances of the operational standard in three consecutive quarterly monitoring periods may skip to annual monitoring. Any methane reading of 500 ppm or more above background detected during the annual monitoring returns the frequency for that landfill to quarterly monitoring.

§ 60.757 Reporting requirements.

Except as provided in § 60.752(b)(2)(i)(B),
(a) Each owner or operator subject to the requirements of this subpart shall submit an initial design capacity report to the Administrator.

(1) The initial design capacity report shall fulfill the requirements of the notification of the date construction is commenced as required by § 60.7(a)(1) and shall be submitted no later than:

(i) June 10, 1996, for landfills that commenced construction, modification, or reconstruction on or after May 30, 1991 but before March 12, 1996 or

(ii) Ninety days after the date of commenced construction, modification, or reconstruction for landfills that commence construction, modification, or reconstruction on or after March 12, 1996.

(2) The initial design capacity report shall contain the following information:

(i) A map or plot of the landfill, prroviding the size and location of the landfill, and identifying all areas where solid waste may be landfilled according to the permit issued by the State, local, or tribal agency responsible for regulating the landfill.

(ii) The maximum design capacity of the landfill. Where the maximum design capacity is specified in the permit issued by the State, local, or tribal agency responsible for regulating the landfill, a copy of the permit specifying the maximum design capacity may be submitted as part of the report. If the maximum design capacity of the landfill is not specified in the permit, the maximum design capacity shall be calculated using good engineering practices. The calculations shall be provided, along with the relevant parameters as part of the report. The State, Tribal, local agency or Administrator may request other reasonable information as may be necessary to verify the maximum design capacity of the landfill.

(3) An amended design capacity report shall be submitted to the Administrator providing notification of an increase in the design capacity of the landfill, within 90 days of an increase in the maximum design capacity of the landfill to or above 2.5 million megagrams and 2.5 million cubic meters. This increase in design capacity may result from an increase in the permitted volume of the landfill or an increase in the density as documented in the annual recalculation required in § 60.758(f).

(b) Each owner or operator subject to the requirements of this subpart shall submit an NMOC emission rate report to the Administrator initially and annually thereafter, except as provided for in paragraphs (b)(1)(ii) or (b)(3) of this section. The Administrator may request such additional information as may be necessary to verify the reported NMOC emission rate.

(1) The NMOC emission rate report shall contain an annual or 5-year estimate of the NMOC emission rate calculated using the formula and procedures provided in § 60.754(a) or (b), as applicable.

(i) The initial NMOC emission rate reeport may be combined with the initial design capacity report required in paragraph (a) of this section and shall be submitted no later than indicated in paragraphs (b)(1)(i)(A) and (B) of this section. Subsequent NMOC emission rate reports shall be submitted annually thereafter, except as provided for in paragraphs (b)(1)(ii) and (b)(3) of this section.

(A) June 10, 1996, for landfills that commenced construction, modification, or reconstruction on or after May 30, 1991, but before March 12, 1996, or

(B) Ninety days after the date of commenced construction, modification, or reconstruction for landfills that commence construction, modification, or reconstruction on or after March 12, 1996.

(ii) If the estimated NMOC emission rate as reported in the annual report to the Administrator is less than 50 megagrams per year in each of the next 5 consecutive years, the owner or operator may elect to submit an estimate of the NMOC emission rate for the next 5-year period in lieu of the annual report. This estimate shall include the current amount of solid waste-in-place and the estimated waste acceptance rate for each year of the 5 years for which an NMOC emission rate is estimated. All data and calculations upon which this estimate is based shall be provided to the Administrator. This estimate shall be revised at least once every 5 years. If the actual waste acceptance rate exceeds the estimated waste acceptance rate in any year reported in the 5-year estimate, a revised 5-year estimate shall be submitted to the Administrator. The revised estimate shall cover the 5-year period beginning with the year in which the actual waste acceptance rate exceeded the estimated waste acceptance rate.

(2) The NMOC emission rate report shall include all the data, calculations, sample reports and measurements used to estimate the annual or 5-year emissions.

(3) Each owner or operator subject to the requirements of this subpart is exempted from the requirements of paragraphs (b)(1) and (2) of this section, after the installation of a collection and control system in compliance with § 60.752(b)(2), during such time as the collection and control system is in operation and in compliance with § § 60.753 and 60.755.

(c) Each owner or operator subject to the provisions of § 60.752(b)(2)(i) shall submit a collection and control system design plan to the Administrator within 1 year of the first report required under paragraph (b) of this section, in which the emission rate exceeds 50 megagrams per year, except as follows:

(1) If the owner or operator elects to recalculate the NMOC emission rate after Tier 2 NMOC sampling and analysis as provided in § 60.754(a)(3) and the resulting rate is less than 50 megagrams per year, annual periodic reporting shall be resumed, using the Tier 2 determined site-specific NMOC concentration, until the calculated emission rate is equal to or greater than 50 megagrams per year or the landfill is closed. The revised NMOC emission rate report, with the recalculated emission rate based on NMOC sampling and analysis, shall be submitted within 180 days of the first calculated exceedance of 50 megagrams per year.

(2) If the owner or operator elects to recalculate the NMOC emission rate after determining a site-specific methane generation rate constant (k), as provided in Tier 3 in § 60.754(a)(4), and the resulting NMOC emission rate is less than 50 Mg/yr, annual periodic reporting shall be resumed. The resulting site-specific methane generation rate constant (k) shall be used in the emission rate calculation until such time as the emissions rate calculation results in an exceedance. The revised NMOC emission rate report based on the provisions of § 60.754(a)(4) and the resulting site-specific methane generation rate constant (k) shall be submitted to the Administrator within 1 year of the first calculated emission rate exceeding 50 megagrams per year.

(d) Each owner or operator of a controlled landfill shall submit a closure report to the Administrator within 30 days of waste acceptance cessation. The Administrator may request additional information as may be necessary to verify that permanent closure has taken place in accordance with the requirements of 40 CFR 258.60. If a closure report has been submitted to the Administrator, no additional wastes may be placed into the landfill without filing a notification of modification as described under § 60.7(a)(4).

(e) Each owner or operator of a controlled landfill shall submit an equipment removal report to the Administrator 30 days prior to removal or cessation of operation of the control equipment.

(1) The equipment removal report shall contain all of the following items:

(i) A copy of the closure report submitted in accordance with paragraph (d) of this section;

(ii) A copy of the initial performance test report demonstrating that the 15 year minimum control period has expired; and

(iii) Dated copies of three successive NMOC emission rate reports demonstrating that the landfill is no longer producing 50 megagrams or greater of NMOC per year.

(2) The Administrator may request such additional information as may be necessary to verify that all of the conditions for removal in § 60.752(b)(2)(v) have been met.

(f) Each owner or operator of a landfill seeking to comply with § 60.752(b)(2) using an active collection system designed in accordance with § 60.752(b)(2)(ii) shall submit to the Administrator annual reports of the recorded information in (f)(1) through (f)(6) of this paragraph. The initial annual report shall be submitted within 180 days of installation and start-up of the collection and control system, and shall include the initial performance test report required under § 60.8. For enclosed combustion devices and flares, reportable exceedances are defined under § 60.758(c).

(1) Value and length of time for exceedance of applicable parameters monitored under § 60.756(a), (b), (c), and (d).

(2) Description and duration of all periods when the gas stream is diverted from the control device through a bypass line or the indication of bypass flow as specified under § 60.756.

(3) Description and duration of all periods when the control device was not operating for a period exceeding 1 hour and length of time the control device was not operating.

(4) All periods when the collection system was not operating in excess of 5 days.

(5) The location of each exceedance of the 500 parts per million methane concentration as provided in § 60.753(d) and the concentration recorded at each location for which an exceedance was recorded in the previous month.

(6) The date of installation and the location of each well or collection system expansion added pursuant to paragraphs (a)(3), (b), and (c)(4) of § 60.755.

(g) Each owner or operator seeking to comply with § 60.752(b)(2)(iii) shall include the following information with the initial performance test report required under § 60.8:

(1) A diagram of the collection system showing collection system positioning including all wells, horizontal collectors, surface collectors, or other gas extraction devices, including the locations of any areas excluded from collection and the proposed sites for the future collection system expansion;

(2) The data upon which the sufficient density of wells, horizontal collectors, surface collectors, or other gas extraction devices and the gas mover equipment sizing are based;

(3) The documentation of the presence of asbestos or nondegradable material for each area from which collection wells have been excluded based on the presence of asbestos or nondegradable material;

(4) The sum of the gas generation flow rates for all areas from which collection wells have been excluded based on nonproductivity and the calculations of gas generation flow rate for each excluded area; and

(5) The provisions for increasing gas mover equipment capacity with increased gas generation flow rate, if the present gas mover equipment is inadequate to move the maximum flow rate expected over the life of the landfill; and

(6) The provisions for the control of off-site migration.

§ 60.758 Recordkeeping requirements.

(a) Except as provided in § 60.752(b)(2)(i)(B), each owner or operator of an MSW landfill subject to the provisions of § 60.752(b) shall keep for at least 5 years up-to-date, readily accessible, on-site records of the design capacity report which triggered § 60.752(b), the current amount of solid waste in-place, and the year-by-year waste acceptance rate. Off-site records may be maintained if they are retrievable within 4 hours. Either paper copy or electronic formats are acceptable.

(b) Except as provided in § 60.752(b)(2)(i)(B), each owner or operator of a controlled landfill shall keep up-to-date, readily accessible records for the life of the control equipment of the data listed in paragraphs (b)(1) through (b)(4) of this section as measured during the initial performance test or compliance determination.

Records of subsequent tests or monitoring shall be maintained for a minimum of 5 years. Records of the control device vendor specifications shall be maintained until removal.

(1) Where an owner or operator subject to the provisions of this subpart seeks to demonstrate compliance with § 60.752(b)(2)(ii):

(i) The maximum expected gas generation flow rate as calculated in § 60.755(a)(1). The owner or operator may use another method to determine the maximum gas generation flow rate, if the method has been approved by the Administrator.

(ii) The density of wells, horizontal collectors, surface collectors, or other gas extraction devices determined using the procedures specified in § 60.759(a)(1).

(2) Where an owner or operator subject to the provisions of this subpart seeks to demonstrate compliance with § 60.752(b)(2)(iii) through use of an enclosed combustion device other than a boiler or process heater with a design heat input capacity greater than 44 megawatts:

(i) The average combustion temperature measured at least every 15 minutes and averaged over the same time period of the performance test.

(ii) The percent reduction of NMOC determined as specified in § 60.752(b)(2)(iii)(B) achieved by the control device.

(3) Where an owner or operator subject to the provisions of this subpart seeks to demonstrate compliance with § 60.752(b)(2)(iii)(B)(1) through use of a boiler or process heater of any size: a description of the location at which the collected gas vent stream is introduced into the boiler or process heater over the same time period of the performance testing.

(4) Where an owner or operator subject to the provisions of this subpart seeks to demonstrate compliance with § 60.752(b)(2)(iii)(A) through use of an open flare, the flare type (i.e., steam-assisted, air-assisted, or nonassisted), all visible emission readings, heat content determination, flow rate or bypass flow rate measurements, and exit velocity determinations made during the performance test as specified in § 60.18; continuous records of the flare pilot flame or flare flame monitoring and records of all periods of operations during which the pilot flame of the flare flame is absent.

(c) Except as provided in § 60.752(b)(2)(i)(B), each owner or operator of a controlled landfill subject to the provisions of this subpart shall keep for 5 years up-to-date, readily accessible continuous records of the equipment operating parameters specified to be monitored in § 60.756 as well as up-to-date, readily accessible records for periods of operation during which the parameter boundaries established during the most recent performance test are exceeded.

(1) The following constitute exceedances that shall be recorded and reported under § 60.757(f):

(i) For enclosed combustors except for boilers and process heaters with design heat input capacity of 44 megawatts (150 million British thermal unit per hour) or greater, all 3-hour periods of operation during which the average combustion temperature was more than 28 °C below the average combustion temperature during the most recent performance test at which compliance with § 60.752(b)(2)(iii) was determined.

(ii) For boilers or process heaters, whenever there is a change in the location at which the vent stream is introduced into the flame zone as required under paragraph (b)(3) of this section.

(2) Each owner or operator subject to the provisions of this subpart shall keep up-to-date, readily accessible continuous records of the indication of flow to the control device or the indication of bypass flow or records of monthly inspections of car-seals or lock-and-key configurations used to seal bypass lines, specified under § 60.756.

(3) Each owner or operator subject to the provisions of this subpart who uses a boiler or process heater with a design heat input capacity of 44 megawatts or greater to comply with § 60.752(b)(2)(iii) shall keep an up-to-date, readily accessible record of all periods of operation of the boiler or process heater. (Examples of such records could include records of steam use, fuel use, or monitoring data collected pursuant to other State, local, Tribal, or Federal regulatory requirements.)

(4) Each owner or operator seeking to comply with the provisions of this subpart by use of an open flare shall keep up-to-date, readily accessible continuous records of the flame or flare pilot flame

monitoring specified under § 60.756(c), and up-to-date, readily accessible records of all periods of operation in which the flame or flare pilot flame is absent.

(d) Except as provided in § 60.752(b)(2)(i)(B), each owner or operator subject to the provisions of this subpart shall keep for the life of the collection system an up-to-date, readily accessible plot map showing each existing and planned collector in the system and providing a unique identification location label for each collector.

(1) Each owner or operator subject to the provisions of this subpart shall keep up-to-date, readily accessible records of the installation date and location of all newly installed collectors as specified under § 60.755(b).

(2) Each owner or operator subject to the provisions of this subpart shall keep readily accessible documentation of the nature, date of deposition, amount, and location of asbestos-containing or nondegradable waste excluded from collection as provided in § 60.759(a)(3)(i) as well as any nonproductive areas excluded from collection as provided in § 60.759(a)(3)(ii).

(e) Except as provided in § 60.752(b)(2)(i)(B), each owner or operator subject to the provisions of this subpart shall keep for at least 5 years up-to-date, readily accessible records of all collection and control system exceedances of the operational standards in § 60.753, the reading in the subsequent month whether or not the second reading is an exceedance, and the location of each exceedance.

(f) Landfill owners or operators who convert design capacity from volume to mass or mass to volume to demonstrate that landfill design capacity is less than 2.5 million megagrams or 2.5 million cubic meters, as provided in the definition of ``design capacity", shall keep readily accessible, on-site records of the annual recalculation of site-specific density, design capacity, and the supporting documentation. Off-site records may be maintained if they are retrievable within 4 hours. Either paper copy or electronic formats are acceptable.

§ 60.759 Specifications for active collection systems.

(a) Each owner or operator seeking to comply with § 60.752(b)(2)(i) shall site active collection wells, horizontal collectors, surface collectors, or other extraction devices at a sufficient density throughout all gas producing areas using the following procedures unless alternative procedures have been approved by the Administrator as provided in § 60.752(b)(2)(i)(C) and (D):

(1) The collection devices within the interior and along the perimeter areas shall be certified to achieve comprehensive control of surface gas emissions by a professional engineer. The following issues shall be addressed in the design: depths of refuse, refuse gas generation rates and flow characteristics, cover properties, gas system expandibility, leachate and condensate management, accessibility, compatibility with filling operations, integration with closure end use, air intrusion control, corrosion resistance, fill settlement, and resistance to the refuse decomposition heat.

(2) The sufficient density of gas collection devices determined in paragraph (a)(1) of this section shall address landfill gas migration issues and augmentation of the collection system through the use of active or passive systems at the landfill perimeter or exterior.

(3) The placement of gas collection devices determined in paragraph (a)(1) of this section shall control all gas producing areas, except as provided by paragraphs (a)(3)(i) and (a)(3)(ii) of this section.

(i) Any segregated area of asbestos or nondegradable material may be excluded from collection if documented as provided under § 60.758(d). The documentation shall provide the nature, date of deposition, location and amount of asbestos or nondegradable material deposited in the area, and shall be provided to the Administrator upon request.

(ii) Any nonproductive area of the landfill may be excluded from control, provided that the total of all excluded areas can be shown to contribute less than 1 percent of the total amount of NMOC emissions from the landfill. The amount, location, and age of the material shall be documented and provided to the Administrator upon request. A separate NMOC emissions estimate shall be made for each section proposed for exclusion, and the sum of all such sections shall be compared to the NMOC emissions estimate for the entire landfill. Emissions from each section shall be computed using the following equation:

$$Q_i = 2\ k\ L_o\ M_i\ (e^{-kt}i)\ (C_{NMOC})\ (3.6 \text{ x } 10^{-9})$$

where,

Q_i = NMOC emission rate from the ith section, megagrams per year
k = methane generation rate constant, year^{-1}
L_o = methane generation potential, cubic meters per megagram solid waste
M_i = mass of the degradable solid waste in the i^{th} section, megagram
t_i = age of the solid waste in the i^{th} section, years
C_{NMOC} = concentration of nonmethane organic compounds, parts per million by volume
$3.6 \text{ x } 10^{-9}$ = conversion factor

(iii) The values for k and C_{NMOC} determined in field testing shall be used if field testing has been performed in determining the NMOC emission rate or the radii of influence (the distance from the well center to a point in the landfill where the pressure gradient applied by the blower or compressor approaches zero). If field testing has not been performed, the default values for k, L_O and C_{NMOC} provided in § 60.754(a)(1) or the alternative values from § 60.754(a)(5) shall be used. The mass of nondegradable solid waste contained within the given section may be subtracted from the total mass of the section when estimating emissions provided the nature, location, age, and amount of the nondegradable material is documented as provided in paragraph (a)(3)(i) of this section.

(b) Each owner or operator seeking to comply with § 60.752(b)(2)(i)(A) shall construct the gas collection devices using the following equipment or procedures:

(1) The landfill gas extraction components shall be constructed of polyvinyl chloride (PVC), high density polyethylene (HDPE) pipe, fiberglass, stainless steel, or other nonporous corrosion resistant material of suitable dimensions to: convey projected amounts of gases; withstand installation, static, and settlement forces; and withstand planned overburden or traffic loads. The collection system shall extend as necessary to comply with emission and migration standards. Collection devices such as wells and horizontal collectors shall be perforated to allow gas entry without head loss sufficient to impair performance across the intended extent of control. Perforations shall be situated with regard to the need to prevent excessive air infiltration.

(2) Vertical wells shall be placed so as not to endanger underlying liners and shall address the occurrence of water within the landfill. Holes and trenches constructed for piped wells and horizontal collectors shall be of sufficient cross-section so as to allow for their proper construction and completion including, for example, centering of pipes and placement of gravel backfill. Collection devices shall be designed so as not to allow indirect short circuiting of air into the cover or refuse into the collection system or gas into the air. Any gravel used around pipe perforations should be of a dimension so as not to penetrate or block perforations.

(3) Collection devices may be connected to the collection header pipes below or above the landfill surface. The connector assembly shall include a positive closing throttle valve, any necessary seals and couplings, access couplings and at least one sampling port. The collection devices shall be constructed of PVC, HDPE, fiberglass, stainless steel, or other nonporous material of suitable thickness.

(c) Each owner or operator seeking to comply with § 60.752(b)(2)(i)(A) shall convey the landfill gas to a control system in compliance with § 60.752(b)(2)(iii) through the collection header pipe(s). The gas mover equipment shall be sized to handle the maximum gas generation flow rate expected over the intended use period of the gas moving equipment using the following procedures:

(1) For existing collection systems, the flow data shall be used to project the maximum flow rate. If no flow data exists, the procedures in paragraph (c)(2) of this section shall be used.

(2) For new collection systems, the maximum flow rate shall be in accordance with § 60.755(a)(1).