

CITY OF GRETNA

U.S. Highway 90
Post Office Drawer A
Gretna, Florida 32332
Telephone (904) 856-5257
Fax No. (904) 856-5293

*See
4/27*

April 22, 1992

Mr. Ed Middleswart
Department of Environmental Regulation
Northwest District
160 Governmental Center
Pensacola, Florida 32501-5794

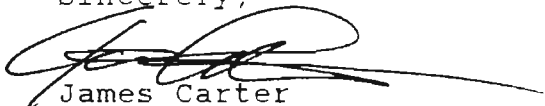
Dear Mr. Middleswart:

Enclosed herein are four (4) copies of the City of Gretna Solid Waste Combustor Air Permit Application, a hard printout and the computer disk copy of the modeling. Also enclosed herein is our check payable to Florida Department of Environmental Regulation in the amount of \$5,000.00 for our application fee.

If you have any technical questions concerning the Air Permit Application, please feel free to contact Mr. Tai Tang of KBN Engineering and Applied Sciences, Inc, Gainesville, Florida (904) 331-9000 or Mr. John Matthews of Florida Reduction Corporation, Dunnellon, Florida (904) 489-3711.

Thank you for a prompt reply.

Sincerely,



James Carter
City Manager

cc: J. Matthews
Tai Tang

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Evelyn Rollins
Mayor

A.W. Watson
Vice Mayor

Earnest O. Barkley, Jr. • Joshua Williams • Charles E. Bethea
Commissioners

James E. Carter
City Manager

Patricia Williams
City Clerk

Harold M. Knowles
City Attorney

City of Gretna - RRF

Contact Persons

1. Jan Rae Clark - Rm 430 I
922-6104
2. John Lara
303-969-~~25~~ 2957
3. Bob Beisel S.C. 695-8360 N.W. Dist.
4. John Matthews
Fla Reduction Corp.
219 Camp Dr. 904-489-3711
Dunnellon, FL 32630
5. O.C. Allen
Financing Mgr.
City of Gretna ofc: 668-3466
P.O. Box 10572
Tall Fl 32302 FAX 668-9092

STATE OF FLORIDA
DEPARTMENT OF ENVIRONMENTAL REGULATION



A020-212334
\$5000⁰⁰

APPLICATION TO OPERATE/CONSTRUCT AIR POLLUTION SOURCES

SOURCE TYPE: Solid Waste Combustor [x] New¹ [] Existing¹

APPLICATION TYPE: [x] Construction [] Operation [] Modification

COMPANY NAME: City of Gretna COUNTY: Gadsden

Identify the specific emission point source(s) addressed in this application (i.e., Lime Kiln No. 4 with Venturi Scrubber; Peaking Unit No. 2, Gas Fired) Combustor Stack

SOURCE LOCATION: Street at the City of Gretna Industrial Park City Gretna

UTM: East Zone 16: 724.55
on SR 12

North 3385.55

Latitude 30 ° 35 ' 00 "N

Longitude 84 ° 39 ' 30 "W

APPLICANT NAME AND TITLE: Evelyn Rollins, Mayor

APPLICANT ADDRESS: City Hall, the corner of Cedar and Beech, City of Gretna, FL 32332

SECTION I: STATEMENTS BY APPLICANT AND ENGINEER

A. APPLICANT

I am the undersigned owner or authorized representative* of the City of Gretna

I certify that the statements made in this application for a construction permit are true, correct and complete to the best of my knowledge and belief. Further, I agree to maintain and operate the pollution control source and pollution control facilities in such a manner as to comply with the provision of Chapter 403, Florida Statutes, and all the rules and regulations of the department and revisions thereof. I also understand that a permit, if granted by the department, will be non-transferable and I will promptly notify the department upon sale or legal transfer of the permitted establishment.

*Attach letter of authorization

Signed: [Signature]

Evelyn Rollins, Mayor

Name and Title (Please Type)

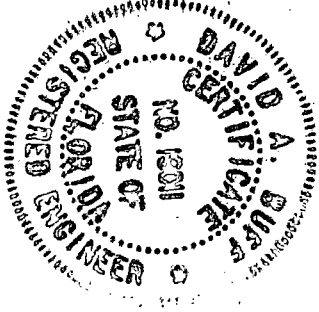
Date: 4/22/92 Telephone No. (904) 856-5257

B. PROFESSIONAL ENGINEER REGISTERED IN FLORIDA (where required by Chapter 471, F.S.) This is to certify that the engineering features of this pollution control project have been designed/examined by me and found to be in conformity with modern engineering principles applicable to the treatment and disposal of pollutants characterized in the permit application. There is reasonable assurance, in my professional judgement, that

¹See Florida Administration Code Rule 17-2.100(57) and (104)

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the pollution control facilities, when properly maintained and operated, will discharge an effluent that complies with all applicable statutes of the State of Florida and the rules and regulations of the department. It is also agreed that the undersigned will furnish, if authorized by the owner, the applicant a set of instructions for the proper maintenance and operation of the pollution control facilities and, if applicable, pollution sources.



Signed David A. Buff

David A. Buff
Name (Please Type)

KBN Engineering and Applied Sciences, Inc.
Company Name (Please Type)

1034 N.W. 57th Street, Gainesville, FL 32605
Mailing Address (Please Type)

Florida Registration No. 19011 Date: 4/20/92 Telephone No. (904) 331-9000

SECTION II: GENERAL PROJECT INFORMATION

A. Describe the nature and extent of the project. Refer to pollution control equipment, and expected improvements in source performance as a result of installation. State whether the project will result in full compliance. Attach additional sheet if necessary.

See Attachment A.

B. Schedule of project covered in this application (Construction Permit Application Only)
Start of Construction upon permit issuance Completion of Construction 18 months after permit issuance

C. Costs of pollution control system(s): (Note: Show breakdown of estimated costs only for individual components/units of the project serving pollution control purposes. Information on actual costs shall be furnished with the application for operation permit.)

Spray Dryer/Fabric Filter - approximately \$5.6 million

D. Indicate any previous DER permits, orders and notices associated with the emission point, including permit issuance and expiration dates.

None

E. Requested permitted equipment operating time: hrs/day 24; days/wk 7; wks/yr 52;
If power plant, hrs/yr _____; if seasonal, describe: _____

F. If this is a new source or major modification, answer the following questions.
(Yes or No)

1. Is this source in a non-attainment area for a particular pollutant? No
 - a. If yes, has "offset" been applied? _____
 - b. If yes, has "Lowest Achievable Emission Rate" been applied? _____
 - c. If yes, list non-attainment pollutants. _____
2. Does best available control technology (BACT) apply to this source?
If yes, see Section VI. No
3. Does the State "Prevention of Significant Deterioration" (PSD)
requirement apply to this source? If yes, see Sections VI and VII. No
4. Do "Standards of Performance for New Stationary Sources" (NSPS)
apply to this source? Yes
5. Do "National Emission Standards for Hazardous Air Pollutants"
(NESHAP) apply to this source? No

- H. Do "Reasonably Available Control Technology" (RACT) requirements apply
to this source? No
- a. If yes, for what pollutants? _____
 - b. If yes, in addition to the information required in this form, any information
requested in Rule 17-2.650 must be submitted.

Attach all supportive information related to any answer of "Yes". Attach any
justification for any answer of "No" that might be considered questionable.

*Applicable NSPS for the proposed source are listed under 40 CFR Subpart E (see
Attachment A, Section 3.2, for details).*

SECTION III: AIR POLLUTION SOURCES & CONTROL DEVICES (Other than Incinerators)

A. Raw Materials and Chemicals Used in your Process, if applicable:

Description	Contaminants		Utilization Rate - lbs/hr	Relate to Flow Diagram
	Type	% Wt		
	<i>See Attachment A</i>			

B. Process Rate, if applicable: (See Section V, Item 1)

1. Total Process Input Rate (lbs/hr): _____
2. Product Weight (lbs/hr): _____

C. Airborne Contaminants Emitted: (Information in this table must be submitted for each emission point, use additional sheets as necessary)

Name of Contaminant	Emission ¹		Allowed ² Emission Rate per Rule 17-2	Allowable ³ Emission lbs/hr	Potential ⁴ Emission		Relate to Flow Diagram
	Maximum lbs/hr	Actual T/yr			lbs/hr	T/yr	
	<i>See Attachment A</i>						

¹See Section V, Item 2.

²Reference applicable emission standards and units (e.g. Rule 17-2.600(5)(b)2. Table II, E. (1) - 0.1 pounds per million BTU heat input)

³Calculated from operating rate and applicable standard.

⁴Emission, if source operated without control (See Section V, Item 3).

D. Control Devices: (See Section V, Item 4)

Name and Type (Model & Serial No.)	Contaminant	Efficiency	Range of Particles Size Collected (in microns) (If applicable)	Basis for Efficiency (Section V Item 5)
<i>Spray Dryer/</i>	<i>Particulate</i>	<i>> 99%</i>	<i>> 1 μm</i>	<i>Design</i>
<i>Fabric Filler</i>	<i>SO₂</i>	<i>75%</i>	<i>N/A</i>	<i>Design</i>
	<i>HCl</i>	<i>80%</i>	<i>N/A</i>	<i>Design</i>
	<i>Metals</i>	<i>> 95%</i>	<i>N/A</i>	<i>Design</i>

E. Fuels

Type (Be Specific)	Consumption*		Maximum Heat Input (MMBTU/hr)
	avg/hr	max./hr	
<i>RDF/TDF-80/20 mixture</i>	<i>20,400</i>	<i>20,400</i>	<i>128.9</i>
<i>-75/25 mixture</i>	<i>19,660</i>	<i>19,660</i>	<i>128.9</i>
<i>(See Attachment A,</i>			
<i>Table 2-2)</i>			

*Units: Natural Gas--MMCF/hr; Fuel Oils--gallons/hr; Coal, wood, refuse, others--lbs/hr.

Fuel Analysis: (for RDF/TDF mixed fuel)

Percent Sulfur: 0.47% max Percent Ash: 11.7 - 11.9

Density: -- lbs/gal Typical Percent Nitrogen: 0.44

Heat Capacity: 6,319 - 6,556 BTU/lb BTU/gal

Other Fuel Contaminants (which may cause air pollution): _____

F. If applicable, indicate the percent of fuel used for space heating.

Annual Average N/A Maximum _____

G. Indicate liquid or solid wastes generated and method of disposal.

Dirt, sand, rock, broken glass, etc., from front end separation (approximately 10%) is sent to landfill. Ashes produced from the Auger combustion system will be processed by outside vendors for use in concrete aggregate and plastic encapsulated products.

H. Emission Stack Geometry and Flow Characteristics (Provide data for each stack):

Stack Height: 70 ft. Stack Diameter: 4.0 ft.
 Gas Flow Rate: 49,600 ACFM 34,600 DSCFM Gas Exit Temperature: 200 °F.
 Water Vapor Content: 12.9 % Velocity: 65.8 FPS

SECTION IV: INCINERATOR INFORMATION

Type of Waste	Type 0 (Plastics)	Type II (Rubbish)	Type III (Refuse)	Type IV (Garbage)	Type IV (Pathological)	Type V (Liq. & Gas By-prod.)	Type VI (Solid By-prod.)
Actual lb/hr Incinerated							
Uncontrolled (lbs/hr)							

Description of Waste Processed MSW (RDF) and shredded scrap tire (TDF)
 Total Weight Incinerated (lbs/hr) 20,400 max Design Capacity (lbs/hr) 19,660 - 20,400
 Approximate Number of Hours of Operation per day 24 day/wk 7 wks/yr. 52
 Manufacturer Environmental Incineration Systems, Inc.
 Date Constructed not yet constructed Model No. Auger Combustor

	Volume (ft) ³	Heat Release (BTU/hr)	Fuel		Temperature (°F)
			Type	BTU/hr	
Primary Chamber					
Secondary Chamber					

Stack Height: 70 ft. Stack Diameter: 4.0 Stack Temp. 200°F
 Gas Flow Rate: 49,600 ACFM 34,600 DSCFM* Velocity: 65.8 FPS

*If 50 or more tons per day design capacity, submit the emissions rate in grains per standard cubic foot dry gas corrected to 50% excess air.

Type of pollution control devices: Cyclone Wet Scrubber Afterburner
 Other (specify) Spray Dryer/Fabric Filter

Brief description of operating characteristics of control devices: See Attachment A

Ultimate disposal of any effluent other than that emitted from the stack (scrubber water, ash, etc.):

The ashes produced from the combustion process will be reprocessed by outside vendors for use in concrete aggregate and plastic encapsulated products. There will be no liquid effluence discharge associated with the combustion process.

NOTE: Items 2, 3, 4, 6, 7, 8, and 10 in Section V must be included where applicable.

SECTION V: SUPPLEMENTAL REQUIREMENTS
(see Attachment A)

Please provide the following supplements where required for this application.

1. Total process input rate and product weight -- show derivation [Rule 17-2.100(127)]
2. To a construction application, attach basis of emission estimate (e.g., design calculations, design drawings, pertinent manufacturer's test data, etc.) and attach proposed methods (e.g., FR Part 60 Methods, 1, 2, 3, 4, 5) to show proof of compliance with applicable standards. To an operation application, attach test results or methods used to show proof of compliance. Information provided when applying for an operation permit from a construction permit shall be indicative of the time at which the test was made.
3. Attach basis of potential discharge (e.g., emission factor, that is, AP42 test).
4. With construction permit application, include design details for all air pollution control systems (e.g., for baghouse include cloth to air ratio; for scrubber include cross-section sketch, design pressure drop, etc.)
5. With construction permit application, attach derivation of control device(s) efficiency. Include test or design data. Items 2, 3 and 5 should be consistent: actual emissions = potential (1-efficiency).
6. An 8 ½" x 11" flow diagram which will, without revealing trade secrets, identify the individual operations and/or processes. Indicate where raw materials enter, where solid and liquid waste exit, where gaseous emissions and/or airborne particles are evolved and where finished products are obtained.
7. An 8 ½" x 11" plot plan showing the location of the establishment, and points of airborne emissions, in relation to the surrounding area, residences and other permanent structures and roadways (Examples: Copy of relevant portion of USGS topographic map).
8. An 8 ½" x 11" plot plan of facility showing the location of manufacturing processes and outlets for airborne emissions. Relate all flows to the flow diagram.

- 9. The appropriate application fee in accordance with Rule 17-4.05. The check should be made payable to the Department of Environmental Regulation.
- 10. With an application for operation permit, attach a Certificate of Completion of Construction indicating that the source was constructed as shown in the construction permit.

SECTION VI: BEST AVAILABLE CONTROL TECHNOLOGY
Not Applicable

A. Are standards of performance for new stationary sources pursuant to 40 C.F.R. Part 60 applicable to the source?

Yes No

Contaminant	Rate or Concentration
_____	_____
_____	_____
_____	_____

B. Has EPA declared the best available control technology for this class of sources (If yes, attach copy)

Yes No

Contaminant	Rate or Concentration
_____	_____
_____	_____
_____	_____

C. What emission levels do you propose as best available control technology?

Contaminant	Rate or Concentration
_____	_____
_____	_____
_____	_____

D. Describe the existing control and treatment technology (if any).

- | | |
|---------------------------|--------------------------|
| 1. Control Device/System: | 2. Operating Principles: |
| 3. Efficiency:* | 4. Capital Costs: |

*Explain method of determining

5. Useful Life:

6. Operating Costs:

7. Energy:

8. Maintenance Cost:

9. Emissions:

Contaminant

Rate or Concentration

Contaminant	Rate or Concentration

10. Stack Parameters

a. Height: ft.

b. Diameter ft.

c. Flow Rate: ACFM

d. Temperature: °F.

e. Velocity: FPS

E. Describe the control and treatment technology available (As many types as applicable, use additional pages if necessary).

1.

a. Control Devices:

b. Operating Principles:

c. Efficiency:¹

d. Capital Cost:

e. Useful Life:

f. Operating Cost:

g. Energy:²

h. Maintenance Cost:

i. Availability of construction materials and process chemicals:

j. Applicability to manufacturing processes:

k. Ability to construct with control device, install in available space, and operate within proposed levels:

2.

a. Control Device:

b. Operating Principles:

c. Efficiency:¹

d. Capital Cost:

e. Useful Life:

f. Operating Cost:

g. Energy:²

h. Maintenance Cost:

i. Availability of construction materials and process chemicals:

¹Explain method of determining efficiency.

²Energy to be reported in units of electrical power - KWH design rate.

- j. Applicability to manufacturing processes:
- k. Ability to construct with control device, install in available space, and operate within proposed levels:

3.

- a. Control Device:
- b. Operating Principles:
- c. Efficiency:¹
- d. Capital Cost:
- e. Useful Life:
- f. Operating Cost:
- g. Energy:²
- h. Maintenance Cost:
- i. Availability of construction materials and process chemicals:
- j. Applicability to manufacturing processes:
- k. Ability to construct with control device, install in available space, and operate within proposed levels:

4.

- a. Control Device:
- b. Operating Principles:
- c. Efficiency:¹
- d. Capital Cost:
- e. Useful Life:
- f. Operating Cost:
- g. Energy:²
- h. Maintenance Cost:
- i. Availability of construction materials and process chemicals:
- j. Applicability to manufacturing processes:
- k. Ability to construct with control device, install in available space, and operate within proposed levels:

F. Describe the control technology selected:

- 1. Control Device:
- 2. Efficiency:¹
- 3. Capital Cost:
- 4. Useful Life:
- 5. Operating Cost:
- 6. Energy:²
- 7. Maintenance Cost:
- 8. Manufacturer:
- 9. Other locations where employed on similar processes:
- a. (1) Company:
- (2) Mailing Address:
- (3) City:
- (4) State:

¹Explain method of determining efficiency.

²Energy to be reported in units of electrical power - KWH design rate.

- (5) Environmental Manager:
- (6) Telephone No.:
- (7) Emissions:¹

Contaminant	Rate or Concentration

(8) Process Rate:¹

- b. (1) Company:
- (2) Mailing Address:
- (3) City: (4) State:
- (5) Environmental Manager:
- (6) Telephone No.:
- (7) Emissions:¹

Contaminant	Rate or Concentration

(8) Process Rate:¹

10. Reason for selection and description of systems:

¹Applicant must provide this information when available. Should this information not be available, applicant must state the reason(s) why.

SECTION VII - PREVENTION OF SIGNIFICANT DETERIORATION
Not Applicable

A. Company Monitored Data

1. _____ no. sites _____ TSP () SO²* _____ Wind spd/dir

Period of Monitoring _____ / _____ / _____ to _____ / _____ / _____
month day year month day year

Other data recorded _____

Attach all data or statistical summaries to this application.

*Specify bubbler (B) or continuous (C).

2. Instrumentation, Field and Laboratory

a. Was instrumentation EPA referenced or its equivalent? [] Yes [] No

b. Was instrumentation calibrated in accordance with Department procedures?

[] Yes [] No [] Unknown

B. Meteorological Data Used for Air Quality Modeling

1. _____ Year(s) of data from _____ / _____ / _____ to _____ / _____ / _____
month day year month day year

2. Surface data obtained from (location) _____

3. Upper air (mixing height) data obtained from (location) _____

4. Stability wind rose (STAR) data obtained from (location) _____

C. Computer Models Used

1. _____ Modified? If yes, attach description.

2. _____ Modified? If yes, attach description.

3. _____ Modified? If yes, attach description.

4. _____ Modified? If yes, attach description.

Attach copies of all final model runs showing input data, receptor locations, and principle output tables.

D. Applicants Maximum Allowable Emission Data

Pollutant	Emission Rate
TSP	_____ grams/sec
SO ²	_____ grams/sec

E. Emission Data Used in Modeling

Attach list of emission sources. Emission data required is source name, description of point source (on NEDS point number), UTM coordinates, stack data, allowable emissions, and normal operating time.

F. Attach all other information supportive to the PSD review.

G. Discuss the social and economic impact of the selected technology versus other applicable technologies (i.e, jobs, payroll, production, taxes, energy, etc.). Include assessment of the environmental impact of the sources.

H. Attach scientific, engineering, and technical material, reports, publications, journals, and other competent relevant information describing the theory and application of the requested best available control technology.

ATTACHMENT A

1.0 INTRODUCTION

The City of Gretna is proposing to construct and operate a resource recovery facility in Gadsden County. The proposed resource recovery facility will process municipal solid waste (MSW) and scrap tires into refuse-derived fuel (RDF) and tire-derived fuel (TDF), respectively. The combustible fuel mixture of RDF and TDF will be charged to an Auger combustor designed with a maximum heat input rate of 128.9 million British thermal units per hour (MMBtu/hr). Heat generated by this waste-to-energy combustor is used for producing steam to power a 7.4-megawatt (MW) generator. A maximum of 25 percent of the combustor heat input will be generated from tire-derived fuel (TDF).

The proposed resource recovery facility will reduce approximately 148,000 tons per year (TPY) of MSW that currently must be landfilled. The initial MSW brought to the tipping floor will be reduced by 90 percent. The scrap tires are processed separately through a de-beading operation first and then through a shredding operation. Approximately 60 percent by weight of the scrap tires will be processed into TDF; the remaining 40 percent of metal bead with a small amount of rubber will be hauled away by scrap metal vendors. The overall volume reduction for the proposed facility will be approximately 90 percent. Ashes produced from the proposed facility will be processed by outside vendors to make plastic encapsulated products. Some ashes will also be utilized as cementitious additive in concrete materials or cement products.

The facility will incorporate state-of-the-art air pollution equipment for controlling air emissions. The unique combustion system employed is inherently low in pollution potential, and a baghouse and an acid gas abatement process or device (dry lime injection or spray dryer) will be used to control emissions of particulate matter (PM) and acid gases.

Because of its overall potential to emit air pollutants and combustor charging rate [less than 250 TPY of any regulated pollutant and less than 250 tons per day (TPD) of solid waste burned, respectively], the proposed facility will be classified as a "minor" source under federal and State of Florida air pollution control regulations. As such, the facility will not be subject to the prevention of significant deterioration (PSD) provisions of the regulations. The facility will,

however, be subject to the federal New Source Performance Standards (NSPS) and State of Florida emission standards that limit emissions of PM from the combustor.

This report addresses the applicable air quality regulations for the Auger combustor to be constructed at the proposed resource recovery facility. Section 2.0 presents a detailed description of the facility layout, fuel characteristics, and air emissions. Section 3.0 presents the air quality review requirements and the applicability of those requirements. A description of the proposed control technology is presented in Section 4.0. The air dispersion modeling methodology and impact analysis are presented in Section 5.0.

2.0 PROJECT DESCRIPTION

2.1 PROCESS DESCRIPTION

The proposed resource recovery facility will be located in the Gretna Industrial Park on Highway 12 (see Figure 2-1). The facility consists of the solid waste processing plant, the boiler building, the cooling tower, the emission control structures, and other auxiliary buildings. The solid waste processing plant will be designed to process up to 500 TPD of MSW. The processing plant is also capable of de-beading and shredding tires to produce TDF. A plot plan of the facility is shown in Figure 2-2, and a process flow diagram for the facility is shown in Figure 2-3.

MSW will be brought to the proposed resource recovery facility and unloaded onto the tipping floor of the processing plant. Combustion air to the Auger combustor will be drawn from the tipping floor area in order to control potential odors. The pre-processed MSW will be visually screened for unacceptable wastes in the tipping floor area. Unacceptable wastes include non-recyclable, non-combustible materials such as dirt, sand, and rocks. Tires will also be separated from the other MSW at this point. The MSW will then be lifted onto a conveyor belt system and carried over to the hand-sorting area.

At the sorting platform, the MSW is first processed manually by recovering the recyclable materials (e.g., newspapers, plastics, aluminum cans, and glass bottles) and removing the large non-combustible materials (e.g., metal cans and glass). Then, the remaining waste is shredded by a magnetic shredder and other non-fuel items (e.g., ferrous metal, broken glass) are further removed or separated mechanically to produce RDF. The processing plant can process up to 500 TPD of MSW, and approximately 50 percent of the MSW is processed into Type 3 RDF (RDF-3). The proximate and ultimate analyses of RDF-3 are shown in Table 2-1.

Scrap rubber tire brought to the tipping floor will be separated immediately from the other solid waste. Through a unique handling process, 99 percent of the bead wire and 96 percent of all wire are removed from the tires to reduce the residual ash content in the combustion process. The fiber and rubber components of the tires are then shredded for easier handling. The tire processing operation can process up to 45 TPD of scrap tires of which approximately 60 percent by weight will become TDF. The proximate and ultimate analyses of TDF are also shown in Table 2-1.

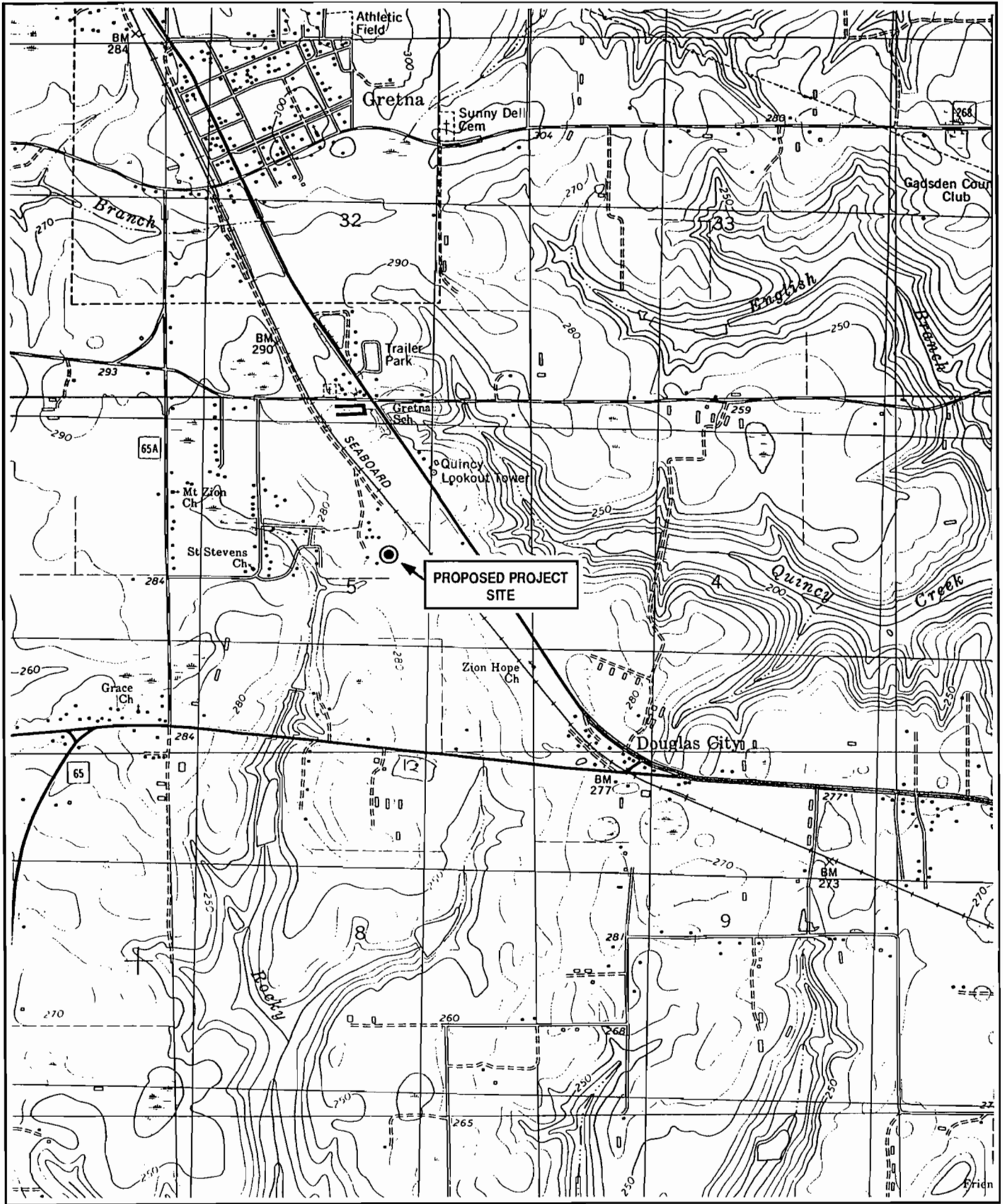
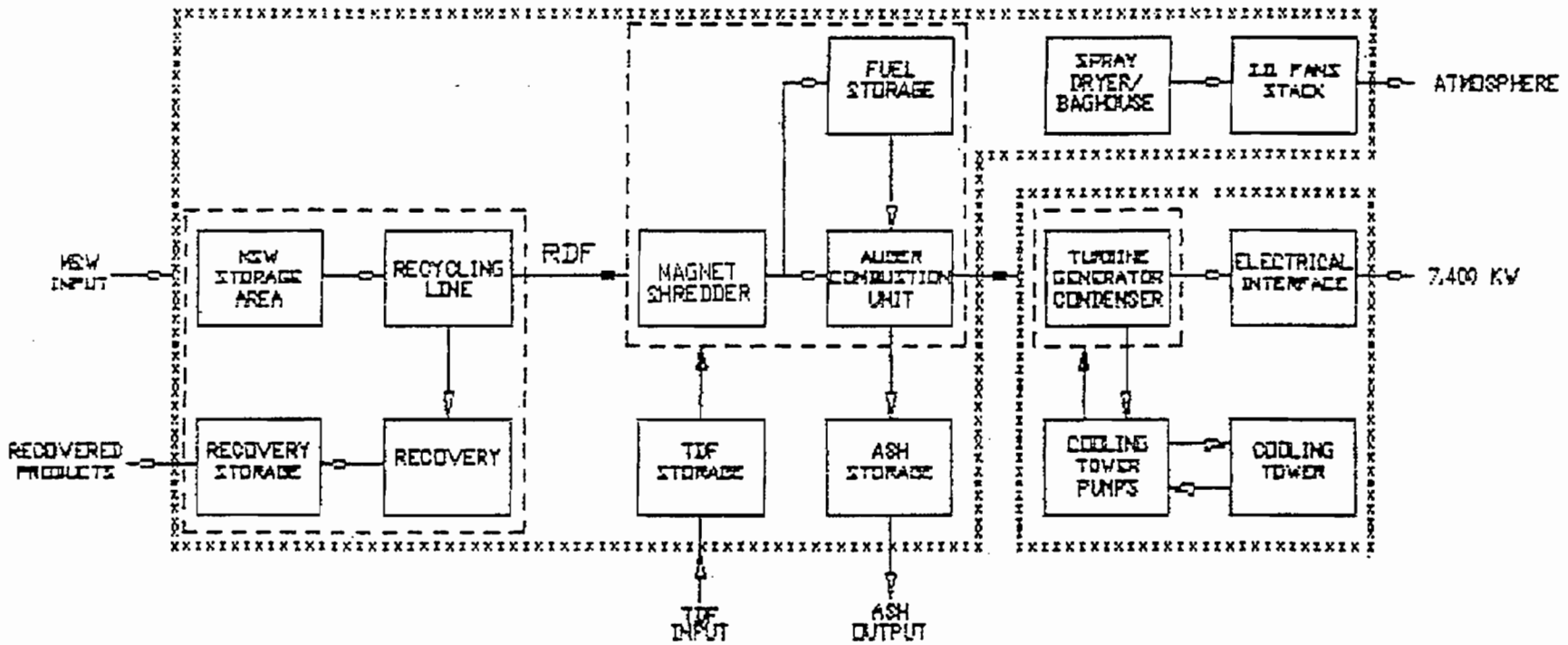


Figure 2-1 SITE LOCATION OF THE PROPOSED RESOURCE RECOVERY FACILITY CITY OF GRETTNA, FLORIDA.





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Figure 2-2 PROCESS FLOW DIAGRAM OF THE PROPOSED RESOURCE RECOVERY FACILITY FOR THE CITY OF GRETN, FLORIDA.



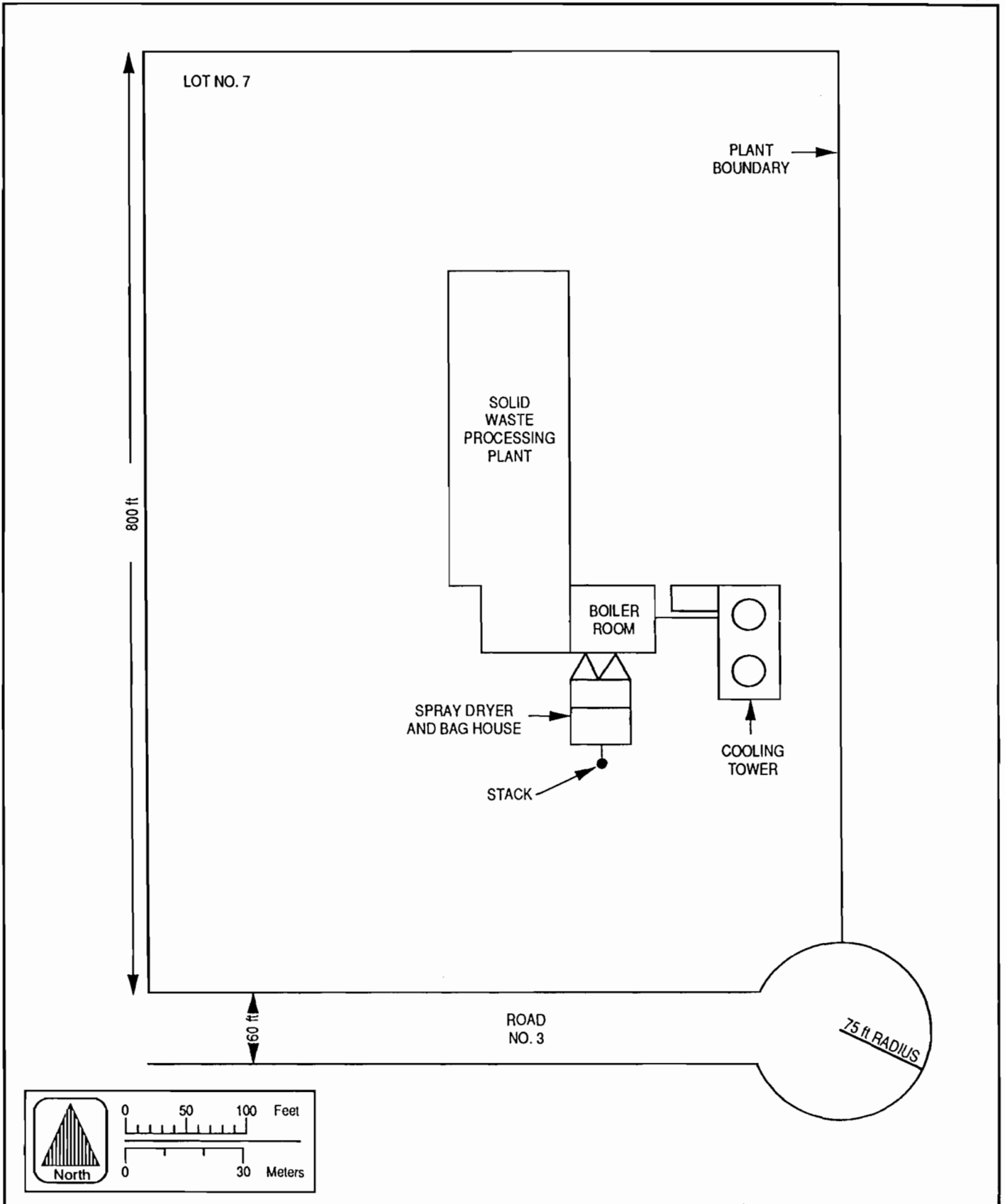


Figure 2-3 PLOT PLAN OF PROPOSED RESOURCE RECOVERY FACILITY CITY OF GRETN, FLORIDA.



Table 2-1. Analysis of RDF-3 and TDF Fuels

Parameter	RDF-3 ^a Percent by Weight	TDF ^b (%)
<u>Approximate Analysis</u>		
Moisture	29.84	0.62
Ash	12.48	4.78
Volatile Matter	48.37	66.64
Fixed Carbon	<u>9.31</u>	<u>27.96</u>
Total	100.00	100.00
<u>Ultimate Analysis</u>		
Moisture	29.84	0.62
Ash	12.48	4.78
Carbon	29.41	83.87
Hydrogen	6.91	7.09
Nitrogen	0.46	0.24
Sulfur	0.21	1.23
Oxygen (by difference)	20.43	2.03
Chlorine	<u>0.26</u>	<u>0.14</u>
Total	100.00	100.00
<u>Heating Value (20% Water)</u>		
HHV	6,000	16,250
HHV (average)	5,500	15,500

^aBased on Dade County Resource Recovery Facility, Florida, data on RDF-3 fuel analysis.

^bBased on Waste Recovery, Inc., Portland, Oregon, data on TDF fuel analysis.

Both RDF and TDF will then be combined and stored in the fuel storage area. The fuel mixture of RDF and TDF will vary with the TDF content ranging from 8.1 percent to 10.6 percent by weight. The fuel storage area will have a 2-day capacity. From the fuel storage area, the mixed RDF/TDF fuel will be conveyed to the plant surge bin. The fuel feed system will then feed the fuel load to the Auger combustor. The feed system automatically weighs and records the exact quantity of fuel burned, providing the operator with precise information on air-to-fuel ratio.

The proposed combustor is designed with a maximum heat input rate of 128.9 MMBtu/hr. The fuel mixture of RDF and TDF will have a total heat input ratio ranging from 80/20 to 75/25. For the 80/20 fuel mixture (i.e., 80 percent of the heat input is supplied by RDF and the remaining 20 percent of the heat input is supplied by TDF), the equivalent fuel charging rates are approximately 9.37 tons per hour (TPH) or 225.0 TPD of RDF and 0.83 TPH or 20.0 TPD of TDF. The maximum consumption of TDF will be limited to 25 percent of the total combustor heat input rate (32.23 MMBtu/hr: the equivalent to charging up to 1.04 TPH or 24.95 TPD of TDF). The maximum limit of TDF usage provides the basis of the 75/25 fuel mixture. Presented in Table 2-2 are the fuel-related parameters for the proposed Auger combustor.

The Auger Combustor system is a proprietary, two-stage incinerator capable of burning a wide variety of solid fuels. The first stage (primary chamber) is a gasifier that operates in a reduced atmosphere and starved-air condition, resulting in gasification of the fuel. Both underfired and overfired air are provided in three zones (primary, secondary, and tertiary) to provide precise regulation of the air-to-fuel ratio. Maximum temperature in the primary chamber is less than 1,700 degrees Fahrenheit (°F) and typically 1,500°F.

The fuel-rich combustion gases then enter the afterburner (secondary chamber). Final combustion is accomplished in the afterburner, where the gases are combined with controlled quantities of preheated air to result in complete combustion. Fuel gas enters the top of the afterburner and is evenly distributed. Initial portions of secondary air are introduced at the inlet. Tangential air injection ports, located around the circumference of the afterburner shell, provide the remaining secondary air necessary for complete combustion. The internal design of the afterburner provides the turbulence necessary for thorough mixing of fuel and air, resulting in high levels of combustion efficiency. The low excess air levels and low burn-out temperatures also reduce

Table 2-2. Fuel-Related Parameters for the Proposed Combustor

Parameter	Unit	Fuel Mixture Ratio ^a	
		80/20	75/25
Fuel Heating Value			
RDF-3 (from MSW)	Btu/lb	5,500	5,500
TDF (from Scrap Tires)	Btu/lb	15,500	15,500
Maximum Boiler Heat Input	MMBtu/hr	128.9	128.9
Fuel Mixture^a			
RDF	Percent Heat Input	80%	75%
TDF	Percent Heat Input	20%	25%
Heat From			
RDF	MMBtu/hr	103.12	96.675
TDF	MMBtu/hr	25.78	32.225
Fuel Quantity Required for Combustor			
RDF	TPH	9.37	8.79
TDF	TPH	0.83	1.04
Total Fuel Charged	TPH	10.20	9.83
RDF	TPD	224.99	210.93
TDF	TPD	19.96	24.95
Total Fuel Charged	TPD	244.95	235.88
Ash Content, Average			
RDF	Wt. Percent	12.48%	12.48%
TDF	Wt. Percent	4.78%	4.78%
Designed Maximum Ash Quantity			
From Combustion Process	TPD	29.03	27.52
From Acid Removal	TPD	6.38	6.38
Total	TPD	35.41	33.90
Preprocessed Fuel Requirement			
MSW	TPD	450.0	421.9
Scrap Tires	TPD	33.3	41.6
Overall Volume Reduction			
From MSW	Wt. Percent	90%	90%
	TPY	147,818	138,579

Note: Btu/lb = British thermal unit per pound. TDF = Tire-Derived Fuel.
MMBtu/hr = million Btu per hour. TPD = tons per day.
MSW = Municipal Solid Waste. TPH = tons per hour.
RDF = Refuse-Derived Fuel. TPY = tons per year.

^a Indicates the percentage heat input ratio of RDF and TDF (i.e., 80/20 ratio means 80 percent of heat input is contributed by RDF and 20 percent of heat input is contributed by TDF).

emissions of nitrogen oxides and carbon monoxide. The temperature in the afterburner is approximately 2,000°F.

Air emissions from the Auger combustor system are controlled in both combustion chambers (i.e., first-stage and second-stage chambers) by combustion design. Post-combustion control is achieved through an acid gas/particulate control system. A description of this control system is presented in Section 4.0.

Ash residue produced by the Auger combustor system, and the combined fly ash and fine solids collected in the fabric filter (baghouse) will be collected in large bins. All ashes (i.e., combustor residue, fly ash, and spray dryer solids) will be transferred to an ash storage area prior to being hauled away by outside vendors.

An auxiliary burner system is provided in the afterburner for flame stabilization and temperature control during periods of startup, shutdown, and system upset. This auxiliary system consists of four burners, each capable of supplying 1 MMBtu/hr heat input. Either natural gas or distillate oil will be used in the auxiliary burners.

2.2 AIR EMISSIONS

Air pollutant emissions from the proposed resource recovery facility will mainly consist of the emissions from a single stack serving the Auger combustor system. Operating data and stack parameters for the combustor are presented in Table 2-3. Maximum emissions from the combustor system were estimated based on test data from emission tests conducted on a prototype combustor in 1979 and published literature on RDF-fired units with similar emission controls. The basis for the emission rates of the regulated pollutants are presented in Appendix A. Maximum emissions of regulated pollutants from the proposed facility are presented in Table 2-4. Maximum emissions of other regulated pollutants and air toxic pollutants are presented in Table 2-5.

Some fugitive emissions are expected from the lime silo. The lime silo will hold approximately a standard truck load of calcium hydroxide lime. This will require a 2,000 cubic feet (ft³) silo, approximately 10 ft in diameter and 25 ft in height, which has a minimum of 35-day capacity for

Table 2-3. Stack Parameters and Operating Data for the Proposed Auger Combustor

Parameter	English Units	Metric Units
<u>STACK DATA</u>		
Stack Height	70 ft	21.34 m
Stack Diameter	4.0 ft	1.22 m
<u>OPERATING DATA</u>		
Flue Gas Flow Rate	49,600 acfm 39,680 scfm 34,600 dscfm	23.4 m ³ /s 18.7 Nm ³ /s (wet) 16.3 Nm ³ /s (dry)
Exit Temperature	200°F	366 K
Exit Velocity	65.8 ft/s	20.06 m/sec
Moisture Content	12.9%	12.9%

Nm³/s = Normal cubic meters per second.

Table 2-4. Estimated Maximum Regulated Pollutant Emissions for the Proposed Combustor.

Regulated Pollutant	Basis for Predicting Controlled Emissions	Ref.	Controlled Emission Factors (lb/ton)	Activity Factor	Hourly Emissions (lb/hr)	Annual Emissions (TPY)
Particulate (TSP)	0.08 gr/dscf @ 12% CO ₂	1	2.03	10.20 ton/hr of 80/20 Fuel	20.70	90.7
Particulate (PM10)	0.08 gr/dscf @ 12% CO ₂	1	2.03	10.20 ton/hr of 80/20 Fuel	20.70	90.7
Sulfur Dioxide						
1-Hour Maximum	234 ppm	2	9.40	9.83 ton/hr of 75/25 Fuel	92.4	-
Annual	117 ppm	3	4.70	9.83 ton/hr of 75/25 Fuel	46.2	202.4
Nitrogen Oxides						
1-Hour Maximum	400 ppm	2	11.14	10.20 ton/hr of 80/20 Fuel	113.6	-
Annual	200 ppm	4	5.57	10.20 ton/hr of 80/20 Fuel	56.8	248.8
Carbon Monoxide						
1-Hour/Annual	300 ppm	4	5.09	10.20 ton/hr of 80/20 Fuel	51.9	227.3
Volatile Org. Compds.						
1-Hour/Annual	90 ppm	4	0.87	10.20 ton/hr of 80/20 Fuel	8.88	38.9
Hydrogen Chloride						
1-Hour/Annual	91 ppm	5	1.98	10.20 ton/hr of 80/20 Fuel	20.2	88.5

Notes: Maximum heat input is 128.9 MMBtu/hr and 1.129x1E12 Btu/yr. Fuel heating values are: 5,500 Btu/lb for RDF-3 and 15,500 Btu/lb for TDF. All emission derivations are shown in Appendix A.

References:

1. Based on NSPS limit of 0.08 gr/dscf at 12% CO₂.
2. 1-hour maximum value was based on doubling the average concentration from the estimated maximum annual emissions.
3. Based on sulfur contents of RDF and TDF reported in fuel analysis and SD/FF emission control efficiency of 75% for SO₂.
4. Engineering estimations based on stack gas concentrations measured from a prototype Auger combustor unit (1979).
5. Based on chlorine contents of RDF and TDF as reported in fuel analysis and SD/FF emission control efficiency of 80% for HCl gas.

Table 2-5. Estimated Maximum Emissions of HAPs for the Proposed Combustor.

Pollutants	Uncontrolled Referenced Concentrations							SD/FF Controlled Emission Factors			Emission Factors for Mixed Fuel (lb/ton)**	Hourly Emissions (lb/hr)	Annual Emissions (TPY)	
	Refuse Derived Fuel			Tire Derived Fuel				(a)	(b)	(c)				
	(ug/dscm)	Basis	Ref.	(lb/hr)	(percent)	Basis	Ref.	(lb/ton)	(lb/ton)	(lb/ton)				
Other Regulated Pollutants														
Beryllium	-	-	-	-	-	-	-	-	1.89E-06	-	-	1.70E-06	0.000017	0.000076
Fluorides	-	-	-	-	0.0010%	by weight	4	0.021	-	0.036	1.00E-03	0.0325	0.33	1.5
Lead	31.000	@ 7% O2	1	4.018	0.0065%	by weight	4	0.135	0.0172	-	6.50E-03	0.0161	0.164	0.72
Mercury	-	-	2	0.0036 *	-	-	-	-	3.85E-04	-	-	3.47E-04	0.0035	0.015
Sulfuric Acid Mist	-	-	-	-	-	-	-	-	-	0.0826	-	0.0743	0.76	3.3
Air Toxic Pollutants														
Arsenic	615	@ 7% O2	1	0.080	-	-	-	-	3.40E-04	9.32E-05	-	3.06E-04	0.0031	0.014
Cadmium	1,050	@ 7% O2	1	0.136	0.0006%	by weight	4	0.012	7.26E-04	1.65E-04	6.00E-04	7.14E-04	0.0073	0.032
Calcium	-	-	-	-	0.378%	by weight	4	7.862	-	-	0.378	0.0378	0.39	1.7
Chromium, hexavalent	436	@ 7% O2	3	0.057	0.0097%	by weight	5	0.081	6.03E-05	-	0.00078	0.00013	0.0013	0.0059
Dioxins/Furans	2	@ 7% O2	1	0.00026	-	-	-	-	1.38E-06	8.99E-06	-	8.09E-06	0.000082	0.00036
Iron	-	-	-	-	0.321%	by weight	4	6.677	-	-	0.321	0.0321	0.33	1.4
Nickel	443	@ 7% O2	1	0.057	-	-	-	-	3.06E-04	5.90E-05	-	2.76E-04	0.0028	0.012
Zinc	-	-	-	-	1.52%	by weight	4	31.62	-	-	1.52	0.152	1.55	6.8

Notes:

- (a) Calculated from uncontrolled referenced concentration, based on maximum RDF charging rate of 9.37 TPH and 95% removal efficiency for SD/FF.
- (b) Permit limits for a RDF-fired boiler with similar SD/FF emission controls, from Energy Resources of Henrico, Virginia (1989).
- (c) Calculated from uncontrolled referenced concentration, based on maximum TDF charging rate of 1.04 TPH and 95% removal efficiency for SD/FF.

* Reported here as controlled emission rate.

** Calculated as follows: 90% of the higher value of (a) and (b) combined with 10% of (c).

References:

1. Municipal Waste Combustors - Background Information for Proposed Standards on Post-Combustion Technology Performance (EPA-450/3-89-27c, 1989).
Each uncontrolled concentration (ug/dscm) reported is the maximum of three different RDF sites. Uncontrolled emission rates (lb/hr) were based on 34,500 dscfm or 976.9 dscm.
2. Based on average of two test values (3.50 E-5 lb of Hg/MMBtu) from Palm Beach County RDF facility controlled with SD/ESP (tested in October, 1989).
3. See reference 1 - - Uncontrolled concentration (ug/dscm) reported is the maximum of three modular units (i.e., similar combustion principal as the Auger combustor).
Reported controlling efficiency for chromium by a SD/FF system is 99% or greater.
4. Characteristics of Tire - Derived Fuel, Bulletin 20.20.1C, 1986, Waste Recovery, Inc., Portland, Oregon. Elemental analysis for metals is given in weight percent.
Uncontrolled emission rates (lb/hr) were based on maximum TDF requirement of 1.04 TPH (calculated from 25% of combustor heat input contributed by TDF).
5. See reference 4 - - Assumed that 40 percent of chromium is hexavalent.

the spray dryer acid scrubber. The lime silo will be fitted with a pneumatic truck loading spout for loading and screw feeder for dispensing to the spray dryer. Based on preliminary design, the lime feed rate will be 1.2 times the theoretical lime requirement for a total of 3.2 TPD or 55 ft³/day. The only emission point associated with the proposed lime system is a bin vent filter located on top of the silo. The bin vent filter is a static device. When the silo is being filled, the increase air pressure in the silo forces the dust laden air through the vent filter, where the dust is effectively removed. The collected dust is returned to the silo.

The ash storage area will receive approximately a combined maximum of 35.41 TPD of particulate solid and ash (i.e., 6.38 TPD of acid-lime reacted solids, calcium chloride and calcium sulfate; and 29.03 TPD of both combustor residue and fly ash). The ashes will be collected in large bins then carried from the collection points at the combustor and the fabric filter outlets to the ash storage area by fork lift. The ash storage area is also equipped with a bin vent filter. Small amount of fugitive emissions are also expected from the transporting and storage of the ashes. The estimate fugitive dust emissions from the lime silo, the ash storage area, and the ash handling process are presented in Table 2-6.

Table 2-6. Estimated Maximum Emissions from Lime Silo, Ash Storage Area, and Ash Handling Process^a

	Lime Silo	Ash Storage Area	Ash Handling
Emission Factor	0.02 grain/acfm ^b	0.02 grain/acfm ^b	0.0035 lb/ton ^c
Activity Factor	1,200 acfm of air ^d	200 acfm of air	43.04 TPD of ash
Hourly Emissions	0.21 lb/hr	0.034 lb/hr	0.0063 lb/hr
Total Annual Hours	1,000 hr/yr	1,000 hr/yr	1,000 hr/yr
Annual Emissions	0.10 TPY	0.02 TPY	0.0031 TPY

^a See calculations in Appendix A.

^b Outlet loading of the bin vent filter.

^c AP-42, Section 11.2.3, Aggregate Handling and Storage Piles.

^d Engineering estimates of air loading for the pneumatic system.

3.0 AIR QUALITY REVIEW REQUIREMENTS AND APPLICABILITY

3.1 SOURCE APPLICABILITY

3.1.1 Pollutant Applicability

The proposed resource recovery facility will have a municipal solid waste combustor designed with a maximum fuel-charging rate of 245 TPD of processed solid waste. (Composition of the solid waste fuel is discussed in Section 2). This rate is less than the 250 TPD charging rate threshold that would classify the facility as one of the 28 listed PSD source categories. The estimated maximum hourly and annual emission rates for the proposed facility are presented in Table 2-4. As shown in Table 2-4, the maximum emission of any single regulated pollutant will not exceed 250 TPY. As a result, the facility is classified as a "minor" new source and is not subject to PSD review.

The proposed site of the facility is located in an attainment area for all pollutants; therefore, nonattainment review is not required. In the south and south-southwest directions from the proposed site toward the Apalachee Bay, the zone of influence as defined by the 100-kilometer (km) radius from the proposed source includes the Bradwell Bay National Wildlife Refuge (NWR) and the St. Marks NWR areas. Thus, impacts to these two Class I areas will be investigated. PSD increments for both Class I and Class II areas will also be determined for the proposed source.

3.1.2 Emission Limiting Standards

The proposed solid waste combustor will be subject to the federal NSPS for incinerators [40 Code of Federal Regulations (CFR) Subpart E], since the unit will be capable of charging more than 50 TPD. The NSPS limits emissions of PM to 0.08 gr/dscf, corrected to 12 percent carbon dioxide (CO₂). There are no continuous monitoring requirements under the federal NSPS. The proposed combustor will meet the NSPS limit for PM, since maximum emissions will be limited to 0.08 gr/dscf, corrected to 12 percent CO₂. The State of Florida has adopted by reference the federal NSPS for municipal incinerators.

3.1.3 Good-Engineering-Practice (GEP) Stack Height

The GEP stack height regulations allow any stack to be at least 65 meters (213 ft) high. The proposed stack height for the combustor will be 70 ft and, therefore, will not exceed the GEP stack height.

3.2 NATIONAL AND STATE AMBIENT AIR QUALITY STANDARDS (AAQS)

The applicable national and Florida AAQS and PSD increments are presented in Table 3-1. The primary and secondary national AAQS were promulgated to protect the public health and welfare, respectively, from any known or potential adverse effects associated with the presence of pollutants in the ambient air. Although the proposed new source is not subject to PSD review, air dispersion modeling will be performed to determine that the concentrations contributed by the proposed source are below both AAQS and PSD increment values.

3.3 AIR TOXIC POLLUTANTS REVIEW

The Florida Department of Environmental Regulation (FDER) has proposed air toxic emissions guidelines (FDER, 1991) to define ambient levels of an air toxic pollutant that can pose a potential health risk to the public. The 1991 Florida Air Toxics Working List includes approximately 756 air toxics with proposed no-threat levels (NTL) for 8-hour, 24-hour, and annual averaging times.

All regulated pollutants for which individual ambient standard does not exist, as well as all nonregulated air toxic pollutants, can be compared to the corresponding NTL. If the maximum predicted concentration for any air toxic pollutant is below the corresponding NTL concentrations for each applicable averaging time, the potential impact of that air toxic pollutant is considered not to pose any health risk. The NTL for the regulated and air toxic pollutants applicable to the proposed project are presented in Table 3-2.

Table 3-1. National and State AAQS, Allowable PSD Increments, and Significant Impact Levels ($\mu\text{g}/\text{m}^3$)

Pollutant	Averaging Time	AAQS ^a			PSD Increments ^a	
		National		State of Florida	Class I	Class II
		Primary Standard	Secondary Standard			
Particulate Matter (TSP)	Annual Geometric Mean	NA	NA	NA	5	19
	24-Hour Maximum	NA	NA	NA	10	37
Particulate Matter (PM10)	Annual Arithmetic Mean	50	50	50	4 ^b	17 ^b
	24-Hour Maximum	150	150	150	8 ^b	30 ^b
Sulfur Dioxide	Annual Arithmetic Mean	80	NA	60	2	20
	24-Hour Maximum	365	NA	260	5	91
	3-Hour Maximum	NA	1,300	1,300	25	512
Carbon Monoxide	8-Hour Maximum	10,000	10,000	10,000	NA	NA
	1-Hour Maximum	40,000	40,000	40,000	NA	NA
Nitrogen Dioxide	Annual Arithmetic Mean	100	100	100	2.5	25
Lead	Calendar Quarter Arithmetic Mean	1.5	1.5	15	NA	NA

Note: Particulate matter (TSP) = total suspended particulate matter.

Particulate matter (PM10) = particulate matter with aerodynamic diameter less than or equal to 10 micrometers.

NA = Not applicable, i.e., no standard exists.

^aShort-term maximum concentrations are not to be exceeded more than once per year.

^bProposed October 5, 1989.

Sources: Federal Register, Vol. 43, No. 118, June 19, 1978.

40 CFR 50.

40 CFR 52.21.

Chapter 17-2.400, F.A.C.

Table 3-2. Summary of Florida No Threat Levels for Toxic Air Pollutants Potentially Emitted by the Proposed Facility

Pollutant	No Threat Level ($\mu\text{g}/\text{m}^3$)		
	8-Hour	24-Hour	Annual
Arsenic	2	0.48	0.00023
Beryllium	0.02	0.0048	0.00042
Cadmium	0.5	0.12	0.00056
Calcium ^a	20	4.8	NE
Chromium VI	0.5	0.12	0.000083
Fluorides	25	6	NE
Hydrogen Chloride	70	16.8	7
Iron ^a	50	12.0	NE
Lead	1.5	0.36	0.09
Magnesium ^a	100	24	NE
Mercury	0.5	0.12	0.3
Nickel	0.5	0.12	0.0042
Zinc ^a	50	12	NE

Note: NE = none established.

^a As oxides.

4.0 DESCRIPTION OF PROPOSED CONTROL TECHNOLOGY

4.1 PM(TSP) AND PM10

Emissions of PM(TSP) and PM10 from the proposed Auger combustor will be controlled by a fabric filter. The fabric filter collector is an integral part of the dry lime injection system or the spray dryer, that will be used for control of acid gas emissions. As a result, the fabric filter will be controlling particulates generated in the combustion process as well as the dry solid formed in the spray dryer. PM(TSP) and PM10 emissions are based upon an outlet grain loading from the fabric filter of 0.08 gr/dscf corrected to 12% CO₂. This results in emissions of 20.7 pounds per hour (lb/hr) and 90.7 TPY. PM emission calculations for the proposed combustor are presented in Appendix A. Particulate emissions from a fabric filter are almost entirely below 10 μm particle size diameter (aerodynamic). Therefore, it is assumed that PM(TSP) and PM10 emissions from the combustor will be the same.

A Wheelabrator Air Pollution Control (WAPC) JET III fabric filter, or equivalent, will be employed to control particulate emissions from the combustor. This is a multi-module, pulse-jet type fabric filter which utilizes woven glass filter bags and off-line cleaning (i.e., a portion of the filter is taken off-line for cleaning). The fabric filter is designed for a gross air-to-cloth ratio of less than 3.7:1 and a net air-to-cloth ratio (one module off-line for maintenance) of less than 4.2:1.

4.2 SULFUR DIOXIDE (SO₂)

The proposed control technology for SO₂ is the dry lime injection/fabric filter (DLI/FF) or the spray dryer/fabric filter (SD/FF) combination to achieve 75-percent control of SO₂ emissions and allow a maximum emission rate of 92.4 lb/hr and 202.4 TPY. (The annual emission rate is based on 46.2 lb/hr of SO₂ emissions.)

The DLI/FF and SD/FF are similar SO₂ control technologies. The DLI/FF system is based on the injection of dry lime in the ductwork ahead of the FF. The dry lime reacts with SO₂ to form calcium sulfite and calcium sulfate. Additional SO₂ removal is achieved in the FF as the flue gases pass through the filter cake on the bags.

In the SD system, the lime slurry droplets will react with the SO₂ to form calcium sulfite and calcium sulfate. Evaporation of the water in the droplets occurs simultaneously with these reactions, producing a dry product. The absorption of SO₂ continues after the droplet has dried and a solid particle is formed. Additional SO₂ removal is achieved in the fabric filter, as the flue gases pass through the filter cake.

In either case, lime receiving, storage, and preparation facilities will be constructed. The lime will be fed to the DLI or processed into a slurry and delivered to the SD absorber vessel. Control of fugitive emissions from this operation will be addressed in Section 4.8.

4.3 NITROGEN OXIDES NO_x

The proposed Auger combustor is a staged combustion system which utilizes a "starved-air" method of combustion in the primary chamber [17 to 18 percent of oxygen (O₂)] and low excess air in the secondary combustion chamber (8 percent O₂ and 9 percent CO₂). This low-excess-air method of firing, coupled with the low combustion temperature in the primary chamber (averaging 1,500°F), results in low emissions of NO_x. The proposed emission rate for NO_x is 113.6 lb/hr and 248.8 TPY, based upon an NO_x 1-hour average concentration of 400 parts per million (ppm) and an annual average of 200 ppm at the outlet of the combustor, respectively.

4.4 CARBON MONOXIDE (CO) AND VOLATILE ORGANIC COMPOUNDS (VOC)

CO and VOC are products of incomplete combustion. The only feasible means of control of these pollutants at MSW facilities is to maximize efficient combustion. Techniques that promote good combustion consist of high combustion temperatures, good mixing of air and fuel, and proper air/fuel ratio. These control techniques also act to minimize emissions of trace organics. The proposed combustor has demonstrated extremely good combustion characteristics in the prototype testing.

The proposed CO emission rates are based upon 300 ppm, 1-hour average as measured at the outlet of the combustor. The proposed VOC emission rate is based upon 90 ppm, 1-hour average, at the combustor outlet.

4.5 METALS

Emissions of regulated trace metals from firing mixed RDF/TDF fuel the proposed combustor include beryllium, fluorides, lead, and mercury. Other trace metal emission may include arsenic, cadmium, calcium, chromium, iron, nickel, and zinc. The proven control equipment for these compounds is any device with high removal efficiency of submicron PM and the operation of the particulate control equipment at temperatures below 500°F. Designed operations at less than 500°F allows condensation of some gaseous metals and subsequent absorption onto fly ash particles, providing an additional 20- to 30-percent removal of these metals. The combination of acid and particulate abatement system provides the most effective control for trace metals which are mostly fine particulates.

Mercury is the only metal from the above list which will likely remain in the vapor phase at the temperatures encountered in the air pollution control equipment. However, the DLI/FF or SD/FF system used by the proposed facility will result in some reduction in mercury emissions. Actual emission of mercury is expected to be small based on the proposed fuel system. Since RDF is a processed fuel, mercury contaminated waste (i.e., used battery cells, light fixtures, etc.) would already be eliminated from the solid waste prior to the shredding operation.

Emissions of metals from the proposed Auger combustor are based on calculations for both RDF and TDF fuels (see Table 2-5). The RDF/metal emission rates are based on the estimated SD/FF control efficiencies applied to the average uncontrolled emission rates from three RDF facilities (EPA, 1989). The TDF/metal emission rates are also based on estimated SD/FF control efficiencies applied to the total metal content in TDF. The control efficiencies that were used for estimating the emission rates ranged from 95 percent for fluorides, calcium, iron, nickel, and zinc to 99 percent for hexavalent chromium. Even so, these proposed emission rates for trace metals were overestimated by using the above control efficiency, and future actual emissions are expected to be much lower. Then, the emission rates of common metal are combined according to the RDF to TDF fuel mixing ratio to obtain the emission factors in pounds per ton (lb/ton) of fuel for the mixed fuel. Based on the background information for proposing standards for municipal waste combustors, EPA (1989) has reported a control efficiency of 99 percent or greater for the spray dryer/fabric filter system.

4.6 HYDROGEN CHLORIDE (HCl) GAS

HCl will be controlled by the SD/FF or DLI/FF control technology, much in the same manner as SO₂ gas is removed. The SD/FF or DLI/FF combination affords the best control technology currently available for HCl. HCl will be controlled at 80-percent efficiency; thus, the maximum estimated emissions are 20.2 lb/hr and 88.5 TPY. Actual HCl gas emissions from the combustor are expected to be much lower than this level, because the MSW pre-processing operation will remove much of the plastics in the RDF that contribute to HCl emissions.

4.7 SULFURIC ACID MIST

The SD/FF or DLI/FF combination employed by the proposed source will minimize sulfuric acid mist emissions because of the absorbent nature of the process, wherein the flue gas temperature is maintained above the dew point and the flue gas stream is not saturated with water.

4.8 FUGITIVE EMISSIONS

Fugitive emissions of particulate dust from the lime silo and the ash storage area will be controlled by bin vent fillers. Based on a controlled emission factor of 0.02 grain per cubic feet (gr/ft³), the fugitive emissions from a 2,000-ft³ lime silo will be about 0.21 lb/hr when loading is taken place. Maximum fugitive emissions from the lime silo is approximately 210 lb/yr based on a total 1,000 hr/yr of lime silo loading activity from truck. The fugitive emissions from the ash storage area are estimated at 0.034 lb/hr and 34 lb/yr or 0.017 TPY.

Ash handling by hauling the ash bins from the collection points at the combustor and the fabric filter outlets to the ash storage area will generate small amount of fugitive emissions. The predicted amount is based on emission factor of 0.0035 lb/ton of ash derived from AP-42. The fugitive emissions from ash handling are estimated at approximately 0.005 lb/hr and 5 lb/yr or 0.003 TPY. All fugitive emission calculations are shown in Appendix A.

5.0 AIR QUALITY MODELING APPROACH AND RESULTS

5.1 ANALYSIS APPROACH AND ASSUMPTIONS

5.1.1 GENERAL MODELING APPROACH

The general modeling approach follows modeling guidelines of the U.S. Environmental Protection Agency (EPA) and the Florida Department of Environmental Regulation (FDER). Current policies stipulate that the highest annual average and highest-second-highest (HSH) short-term (i.e., 24 hours or less) concentrations be compared with AAQS and PSD increments when 5 years of meteorological data are used. The HSH concentration is calculated for a receptor field by:

1. Eliminating the highest concentration predicted at each receptor,
2. Identifying the second-highest concentration at each receptor, and
3. Selecting the highest concentration among these second-highest concentrations.

This approach is consistent with the air quality standards, which permit a short-term average concentration to be exceeded once per year at each receptor. For comparison to FDER's proposed No Threat Levels (NTL) for air toxic pollutants, it is recommended that the overall highest concentration be used.

To develop the maximum short-term concentrations for the proposed facility, the general modeling approach was divided into screening and refined phases to reduce the computation time required to perform the modeling analysis. The basic difference between the two phases is the scale of the receptor grid used for predicting impact concentrations.

The predicted concentrations for the screening phase were produced from a coarse receptor grid using five years of meteorological record. After a final list of maximum short-term concentrations was developed, the refined phase of the modeling analysis was conducted by predicting concentrations for a refined receptor grid centered on the receptor at which the HSH concentration from the screening phase was obtained. The air dispersion model then was executed for the entire year during which HSH concentrations were predicted. This approach was used to ensure that valid HSH concentrations were obtained. More detailed descriptions of the emission inventory and receptor grids used in the screening and refined phases of the analysis are presented in the following sections.

5.1.2 MODEL SELECTION

The selection of the appropriate air dispersion model was based on its ability to simulate impacts in areas surrounding the plant site. Within 50 km of the site, the terrain can be described as simple (i.e., flat to gently rolling). As defined in the EPA modeling guidelines, simple terrain is considered to be an area where the terrain features are all lower in elevation than the top of the stack(s) under evaluation. Therefore, a simple terrain model was selected to predict maximum ground-level concentrations.

The Industrial Source Complex Short Term (ISCST2-Version 92062) dispersion model (EPA, 1992a) was selected to evaluate the pollutant emissions from the proposed source. This model is contained in EPA's User's Network for Applied Modeling of Air Pollution (UNAMAP), Version 6, (EPA, 1988b). The ISCST2 model is part of an effort to restructure and reprogram the original ISC models. The ISCST2 model is applicable to sources located in either flat or rolling terrain where terrain heights do not exceed stack heights.

In this analysis, the ISCST2 model was used to calculate both short-term and annual average concentrations because these concentrations can be readily obtained from the model output. Major features of the ISCST2 model are presented in Table 5-1. Concentrations caused by stack and volume sources are calculated by the ISCST2 model using the steady-state Gaussian plume equation for a continuous source. The area source equation in the ISCST2 model is based on the equation for a continuous and finite crosswind line source. The ISCST2 model has both rural and urban options that affect the wind speed profile exponent law, dispersion rates, and mixing-height formulations used in performing calculations of ground-level concentrations. The criteria used to determine when the rural or urban mode is appropriate are based on land use in the surrounding vicinity of the proposed site (Auer, 1978). If the land use of the area within a 3-km radius of the proposed source is classified as heavy industrial, light-moderate industrial, commercial, or compact residential for more than 50 percent, the urban option should be selected. Otherwise, the rural option is more appropriate.

For modeling analyses that will undergo regulatory review, such as PSD permit applications, the following model features are recommended by EPA (1992a) and are referred to as the regulatory options in the ISCST2 model:

Table 5-1. Major Features of the ISCST2 Model

ISCST2 Model Features
<ul style="list-style-type: none">• Polar or Cartesian coordinate systems for receptor locations• Rural or one of three urban options that affect wind speed profile exponent, dispersion rates, and mixing height calculations• Plume rise as a result of momentum and buoyancy as a function of downwind distance for stack emissions (Briggs, 1969, 1971, 1972, and 1975)• Procedures suggested by Huber and Snyder (1976); Huber (1977); Schulmann and Hanna (1986); and Schulmann and Scire (1980) for evaluating building wake effects• Procedures suggested by Briggs (1974) for evaluating stack-tip downwash• Separation of multiple-point sources• Consideration of the effects of gravitational settling and dry deposition on ambient particulate concentrations• Capability of simulating point, line, volume, and area sources• Capability to calculate dry deposition• Variation with height of wind speed (wind speed-profile exponent law)• Concentration estimates for 1-hour to annual average• Terrain-adjustment procedures for elevated terrain, including a terrain truncation algorithm• Receptors located above local terrain (i.e., "flagpole" receptors)• Consideration of time-dependent exponential decay of pollutants• The method of Pasquill (1976) to account for buoyancy-induced dispersion• A regulatory default option to set various model options and parameters to EPA recommended values (see text for regulatory options used)• Procedure for calm-wind processing• Wind speeds less than 1 m/s are set to 1 m/s.

Source: EPA, 1992a.

1. Final plume rise at all receptor locations,
2. Stack-tip downwash,
3. Buoyancy-induced dispersion,
4. Default wind speed profile coefficients for rural or urban option,
5. Default vertical potential temperature gradients,
6. Calm wind processing, and
7. Reducing calculated SO₂ concentrations in urban areas by using a decay half-life of 4 hours (i.e., reduce the SO₂ concentration emitted by 50 percent for every 4 hours of plume travel time).

In this screening analysis, the EPA regulatory options were used to address maximum impacts. Based on a review of the land use around the facility, the rural mode was selected because of the lack of residential, industrial, and commercial developments within 3 km of the plant site.

5.2 METEOROLOGICAL DATA

Meteorological data used in the ISCST2 modeling consisted of a concurrent 5-year period of hourly surface weather observations and twice-daily upper air soundings from the National Weather Service (NWS) station located at the Tallahassee Municipal Airport. The 5-year period of meteorological data was from 1982 through 1986. The NWS station in Tallahassee, located approximately 35 km to the southeast of the site, was selected for use in the study because it is the closest primary weather station to the project site. The meteorological data collected at this NWS station is considered to be representative of the area under evaluation.

The surface observations included wind direction, wind speed, temperature, cloud cover, and cloud ceiling height. The wind speed, cloud cover, and cloud ceiling values were used in the ISCST2 meteorological preprocessor program to determine atmospheric stability using the Turner stability scheme. Based on the temperature measurements at morning and afternoon, mixing heights were calculated from the radiosonde data at Tallahassee using the Holzworth approach (Holzworth, 1972). Hourly mixing heights were derived from the morning and afternoon mixing heights using the interpolation method developed by EPA (Holzworth, 1972). The hourly surface data and mixing heights were used to develop a sequential series of hourly meteorological data (i.e., wind direction, wind speed, temperature, stability, and mixing heights). Because the

observed hourly wind directions at the NWS station are classified into one of thirty-six 10-degree sectors, the wind directions were randomized within each sector to account for the expected variability in air flow. These calculations were performed using the EPA RAMMET meteorological preprocessor program.

5.3 PROPOSED FACILITY EMISSIONS

The stack parameters and operating data for the proposed facility used in the modeling analysis are presented in Table 2-3. The proposed pollutant emission rates are shown in Tables 2-4 and 2-5. The modeling input used a generic emission rate of 10 g/sec to produce generic impact concentrations for all short-terms and annual averaging times. Subsequently, predicted impacts concentrations were obtained by ratioing the estimated emission concentrations to the generic impact concentrations for all pollutants of concerns.

5.4 RECEPTOR LOCATIONS

As discussed in Section 5.1.1, the general modeling approach considered screening and refined phases to address compliance with AAQS and PSD increments. For the screening phase, concentrations were predicted for the following receptor locations:

1. For the AAQS, PSD Class II, and air toxic pollutant analysis, 308 total receptors located in a radial grid centered at the proposed stack location. These receptors were classified into two main groups:
 - a. 92 plant property receptors placed at the nearest plant boundary and beyond along 36 radials spaced at 10-degree increments. These receptors are presented in Table 5-2.
 - b. 216 general grid receptors located at distances of 500; 1,000; 2,000; 3,000; 4,000; and 5,000 m along 36 radials with each radial spaced at 10-degree increments.

After the screening modeling was completed, refined modeling was conducted using a receptor grid centered on the receptor that had the highest concentration obtained from the screening analysis. These refined receptors were located at intervals of 100 m between the distances considered in the screening phase, along 9 radials spaced at 2-degree increments, centered on the radial along which the maximum concentration was produced. For example, if the maximum

Table 5-2. Plant Property and Near Field Receptors Used in the Screening Modeling Analysis

Receptor Location		Receptor Location	
Direction (degrees)	Distances (meters)	Direction (degrees)	Distances (meters)
10	187/250	190	58/100/250
20	139/250	200	60/100/250
30	103/250	210	64/100/250
40	83/100/250	220	72/100/250
50	72/100/250	230	83/100/250
60	65/100/250	240	104/250
70	61/100/250	250	117/250
80	59/100/250	260	114/250
90	59/100/250	270	113/250
100	59/100/250	280	114/250
110	61/100/250	290	118/250
120	65/100/250	300	126/250
130	73/100/250	310	140/250
140	71/200/250	320	163/250
150	64/100/250	330	203/250
160	60/100/250	340	192/250
170	58/100/250	350	187/250
180	58/100/250	360	186/250

Note: Direction and distance are relative to the proposed stack.
First distance represents the minimum distance to the plant boundary within the 10-degree sector. All other distances represent near-field receptors located between the plant boundary and the general polar grid.

concentration was produced along the 90-degree radial at a distance of 0.5 km, the refined receptor grid would consist of receptors at the following locations:

<u>Directions (degrees)</u>	<u>Distance (km)</u>
82, 84, 86, 88, 90, 92, 94, 96, 98	0.3, 0.4, 0.5, 0.6, 0.7, 0.8, and 0.9 per direction

To ensure that a valid maximum concentration was calculated, concentrations were predicted using the refined grid for the entire year that produced the highest concentration from the screening receptor grid.

Refined modeling analysis was not performed for the annual averaging period because the spatial distribution of annual average concentrations are not expected to vary significantly from those produced from the screening analysis.

The maximum PSD increment consumption at the St. Marks National Wildlife Refuge (NWR) and Bradwell Bay NWR due to sole contribution from the proposed source was determined using 33 discrete receptors located along the boundaries of these Class I areas. The highest predicted concentrations for the proposed facility for the 5 years of meteorological data were compared with the proposed PSD Class I increment values for SO₂, PM, and NO₂ (see Section 5.7.2).

5.5 BUILDING DOWNWASH EFFECTS

Based on the dimensions of the buildings and structures planned for the proposed facility, the proposed stack height will be less than GEP. Therefore, the potential for building downwash to occur was considered in the modeling analysis.

The procedures used for addressing the effects of building downwash are those recommended in the ISC Dispersion Model User's Guide. For short stacks (i.e., physical stack height is less than $H_b + 0.5 l_b$, where H_b is the building height and l_b is the lesser of the building height or projected width), the Schulman and Scire (1980) method is used. For cases where the physical stack is greater than $H_b + 0.5 l_b$ but less than GEP, the Huber-Snyder method is used. For both methods, the new ISCST2 model uses direction-specific building dimensions for the 36 radial

directions, with each direction representing a 10-degree sector. The building dimensions considered in the modeling analysis are presented in Table 5-3.

5.6 BACKGROUND CONCENTRATIONS

Background concentrations for all pollutants with any AAQS were taken from recent monitoring data. If a monitor was located near (i.e., in the same county or in a surrounding county) the proposed facility, the highest-second-highest monitored values were taken as background. If there was no nearby monitor for a particular pollutant, an approximate average HSH value was taken from all monitors in the state for that pollutant. Background values were added to the modeling results for comparison to AAQS.

For SO₂, 1990 monitoring data recorded from Gadsden County (Monitor No. 0540-002-J01) were used. The 3-hour, 24-hour, and annual concentrations considered for background values were 151 µg/m³, 80 µg/m³, and 5 µg/m³, respectively. Since this is a source-specific monitor, it is not a true representation of SO₂ background concentrations in the surrounding area of the proposed facility and thus is expected to produce conservative estimates of SO₂ ambient air impacts.

For NO₂, 1990 monitoring data collected from Gadsden county (Monitor No. 0540-002-J02) were used. The annual concentration considered for the NO_x background concentration was 7 µg/m³.

For PM₁₀, there were no monitoring sites near the proposed facility. An examination of statewide 1991 PM₁₀ monitoring data indicates that approximate average values of 35 and 25 µg/m³ for the 24-hour and annual averaging periods respectively was reported. Therefore, these values were used as background concentrations.

For Pb background values, there were no monitoring sites near the proposed facility. An examination of statewide lead monitoring values indicates that lead concentrations are less than 0.1 µg/m³ on a quarterly basis for the majority of the state. Since the proposed facility lies in a rural area away from areas of major industry, no background concentration was added to the predicted Pb impacts.

The use of average statewide background values is expected to be conservative, since the proposed facility will be located in an area of the state that is not highly industrialized.

Table 5-3. Building Dimensions Used in the ISCST2 Modeling Analysis

Source	Direction-Specific Building Dimensions		
	Building Direction (degrees)	Building Height (meters)	Width (meters)
Proposed Stack	10	9.15	15.72
	20	9.15	16.67
	30	9.15	17.11
	40	9.15	17.14
	50	9.15	16.99
	60	9.15	16.35
	70	9.15	15.20
	80	9.15	13.60
	90	0.00	0.00
	100	9.15	13.78
	110	9.15	15.34
	120	9.15	16.43
	130	9.15	17.03
	140	9.15	17.14
	150	9.15	17.09
	160	9.15	26.76
	170	9.15	25.10
	180	9.15	22.82
	190	9.15	25.32
	200	9.15	27.05
	210	12.20	29.64
	220	12.20	31.84
	230	12.20	33.08
	240	12.20	33.34
	250	12.20	33.27
	260	12.20	32.39
	270	0.00	0.00
	280	9.15	13.78
	290	9.15	15.34
	300	9.15	16.43
	310	9.15	17.03
	320	9.15	17.14
	330	9.15	17.09
	340	9.15	16.59
	350	9.15	15.60
	360	9.15	14.29

Note: Direction-specific building data developed using the Breezewake program.

5.7 AIR QUALITY MODELING RESULTS

5.7.1 AAQS and PSD Class II Analysis

A summary of the highest and highest-second-highest impacts based on the 10 g/sec generic emission rate are presented in Appendix A, Tables A-1 and A-2, respectively. The maximum short-term impacts were refined as described in Section 5-4. The refined concentrations are presented in Table A-3. The ratio of the estimated emission rates to the generic emission rates for all pollutants were applied to the maximum generic impact concentrations to determine the predicted impact concentration of these pollutants for the proposed facility.

A summary of the maximum refined concentrations are presented in Table 5-4. These results are presented for the regulated pollutants which have PSD Class II increment values. Because the maximum predicted impact concentrations for the proposed facility occur at the plant property boundary and there are no nearby major facilities, the predicted impact concentrations from the proposed source alone were compared to the PSD Class II increment values. Based on these results, all predicted impacts from the proposed facility are below the PSD Class II increment values.

A summary of the predicted impacts from the refined analysis are presented in Table 5-5 for comparison to AAQS. Based on these results, all predicted impacts from the proposed facility are below the allowable AAQS.

5.7.2 PSD Class I Analysis

The proposed facility is located approximately 45 km from the nearest portions of the Bradwell Bay NWR and the St. Marks NWR Class I areas. A summary of the generic impact for the Class I areas are presented in Appendix A, Table A-4. Maximum predicted concentrations predicted for SO₂, NO₂, and PM based on sole contribution from the proposed facility are presented in Table 5-6 for comparison to PSD Class I increment values.

As the results indicate, the predicted impacts for all pollutants from the proposed facility are below the Class I increment values for all averaging periods.

Table 5-4. Maximum Predicted Refined Impacts for Regulated Pollutants for the Proposed Project for Comparison to PSD Class II Increment Values

Pollutant	Averaging Period	Maximum Concentration ($\mu\text{g}/\text{m}^3$) ^a	PSD Class II Increment ($\mu\text{g}/\text{m}^3$)
Sulfur Dioxide	3-hour	177	512
	24-hour	73.1	91
	Annual	2.71	20
Particulate Matter (TSP)	24-hour	16.4	19
	Annual	1.21	37
Nitrogen Dioxide	Annual	3.33	25

^a Highest-second-highest concentrations reported for all short-term averaging periods.

Table 5-5. Summary of Maximum Regulated Pollutant Concentrations Due to the Proposed Project for Comparison to AAQS

Pollutant	Averaging Period	Total Concentration ($\mu\text{g}/\text{m}^3$) ^a	Total ($\mu\text{g}/\text{m}^3$) Due To		State of Florida AAQS ($\mu\text{g}/\text{m}^3$)
			Modeled Sources	Background	
Sulfur Dioxide	3-hour	328	177	283	151
	24-hour	105	73.1	80	32
	Annual	8	2.71	7	5
Particulate Matter (PM10)	24-hour	51	16.4	35	150
	Annual	26	1.21	25	50
Nitrogen Dioxide	Annual	10	3.33	7	100
Carbon Monoxide	1-hour	7,068	168	6,900	40,000
	8-hour	4,665	65.1	4,600	10,000
Lead	Quarter (24-hour)	0.2	0.19	0	1.5

^a Highest, second-highest concentrations reported for all short-term averaging periods.

Table 5-6. Maximum Predicted Pollutant Concentrations Due to the Proposed Project at the St. Marks NWA and Bradwell Bay NWA for Comparison to PSD Class I Increment Values

Pollutant	Averaging Period	Maximum Concentration ($\mu\text{g}/\text{m}^3$) ^a	Receptor Location ^b		Time Period			Class I Value ($\mu\text{g}/\text{m}^3$)
			Direction (degrees)	Distance (meters)	Julian Day	Hour Ending	Increment Year	
Sulfur Dioxide	3-hour	5.64	728000	3343000	314	6	1986	25
	24-hour	1.19	728000	3343000	363	24	1986	5
	Annual	0.04	728000	3343000	NA	NA	1986	2
Particulate Matter (TSP)	24-hour	.27	728000	3343000	363	24	1986	10
	Annual	.02	728000	3343000	NA	NA	1986	5
Nitrogen Dioxide	Annual	.05	728000	3343000	NA	NA	1986	2.5

Note: NA = not applicable.

^a Highest, second-highest concentrations reported for all short-term averaging periods.

^b In UTM coordinates. Proposed facility location is zone 16, 724.7 km east and 3387.4 km north.

5.7.3. TOXIC POLLUTANT ANALYSIS

The maximum impacts of regulated pollutants and other nonregulated air toxic pollutants emitted from the proposed facility are presented in Table 5-7 for comparison to the Florida NTLs . These predicted impact concentrations were obtained from ratioing the highest generic concentration from the refined analysis with the estimated emission rate for each pollutant (see Table A-3 in Appendix A).

As shown, the predicted impacts are below the corresponding NTL for all pollutants and averaging times. Therefore, the emissions of air toxic pollutants from the proposed facility are not expected to pose a health risk to the general public.

Table 5-7. Summary of Maximum Concentrations Due to the Proposed Facility for the Air Toxic Modeling Analysis (Page 1 of 2)

Pollutant	Averaging Period	Maximum Concentration ($\mu\text{g}/\text{m}^3$) ^a	Florida No Threat Level ($\mu\text{g}/\text{m}^3$)
Arsenic	8-hour	0.0048	2
	24-hour	0.0024	0.48
	Annual	0.00018	0.00023
Beryllium	8-hour	0.00003	0.02
	24-hour	0.00001	0.0048
	Annual	0.000001	0.00042
Cadmium	8-hour	0.014	0.5
	24-hour	0.0066	0.12
	Annual	0.00051	0.00056
Calcium ^b	8-hour	0.6	20
	24-hour	0.3	4.8
	Annual	0.023	NE
Chromium VI	8-hour	0.0021	5
	24-hour	0.0010	0.12
	Annual	0.000079	0.000083
Fluoride	8-hour	0.53	25
	24-hour	0.26	6
	Annual	0.02	NE
Hydrogen Chloride	8-hour	31	70
	24-hour	15.3	16.8
	Annual	1.2	7
Iron ^c	8-hour	0.5	50
	24-hour	0.24	12
	Annual	0.019	NE
Lead	8-hour	0.4	1.5
	24-hour	0.19	0.36
	Annual	0.014	0.09
Mercury	8-hour	0.0053	0.5
	24-hour	0.0026	0.12
	Annual	0.0002	0.3

Table 5-7. Summary of Maximum Concentrations Due to the Proposed Facility for the Air Toxic Modeling Analysis (Page 2 of 2)

Pollutant	Averaging Period	Maximum Concentration ($\mu\text{g}/\text{m}^3$) ^a	Florida No Threat Level ($\mu\text{g}/\text{m}^3$)
Nickel	8-hour	0.0053	0.5
	24-hour	0.0026	0.12
	Annual	0.00020	0.0042
Sulfuric Acid Mist ^d	8-hour	1.2	10
	24-hour	0.6	2.38
	Annual	0.044	NE
Zinc ^e	8-hour	2.4	50
	24-hour	1.2	12
	Annual	0.091	NE

Note: NE = none established.

^a Highest concentrations reported for all averaging periods.

^b As calcium oxide.

^c As iron oxide.

^d Not in current FDER NTL list. NTL in table is based on dividing the time-weighted average by 100 and 420 for the 8-hour and 24-hour NTL, respectively.

^e As zinc oxide.

Source: FDER, 1991.

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APPENDIX A
BACKUP CALCULATIONS

APPENDIX A

Backup Calculations for the Proposed
Auger Combustor with Spray Dryer and Fabric Filter

A.1 Operating Parameters

Combustor Maximum Heat Input Value: 128.9 MMBtu/hr.

Fuel Type: Mixed RDF and TDF, between 20% to 25% of the heat input is contributed by TDF.

Fuel Average Heating Value:

RDF: 5,500 Btu/lb (average)

TDF: 15,500 Btu/lb (average)

Fuel Usage Rate Based on RDF/TDF Heat Input Ratio:

* 80/20 Ratio: RDF = $103.12 \times 10^6 \text{ Btu/hr} \div 5,500 \text{ Btu/hr} \div 2,000 = 9.37 \text{ TPH}$
TDF = $25.78 \times 10^6 \text{ Btu/hr} \div 15,500 \text{ Btu/hr} \div 2,000 = 0.83 \text{ TPH}$
RDF + TDF = $9.37 + 0.83 = 10.20 \text{ TPH}$

* 75/25 Ratio: RDF = $96.675 \times 10^6 \text{ Btu/hr} \div 5,500 \text{ Btu/hr} \div 2,000 = 8.79 \text{ TPH}$
TDF = $32.23 \times 10^6 \text{ Btu/hr} \div 15,500 \text{ Btu/hr} \div 2,000 = 1.04 \text{ TPH}$
RDF + TDF = $8.79 + 1.04 = 9.83 \text{ TPH}$

Afterburner Outlet: $170,500 \text{ acfm}$ @ $1,810^\circ\text{F}$
 $39,680 \text{ scfm}$
 $34,600 \text{ dscfm}$

Stack Outlet: $49,600 \text{ acfm}$ @ 200°F
Molecular weight = 28.5
Moisture = 12.9% by volume
CO₂ = 9.1% by volume

A.2 Emission Calculations

A.2.1 PM Emissions

Based on 0.08 gr/dscf @ 12% CO₂ (NSPS).

Convert Standard to Actual CO₂ Concentration in Gas Stream:

$$C_{12} = C_{ACT} (12/\%CO_2)$$

where: C_{12} = Concentration at 12% CO₂
 C_{ACT} = Actual concentration

Actual CO₂ is 9.1%, wet basis, thus %CO₂ must be on dry basis

$$CO_2 \text{ (dry)} = CO_2(\text{wet})/[1-(\%H_2O/100)] \\ = 9.1/(1-0.129)$$

$$CO_2 \text{ (dry)} = 10.45\%$$

$$0.08 \text{ gr/dscf} = C_{ACT} (12/10.45)$$

$$C_{ACT} = 0.08/(12/10.45) = 0.08/1.148 \\ = 0.070 \text{ gr/dscf}$$

Flow rate is 34,500 dscfm

$$34,500 \text{ dscfm} \times 0.070 \text{ gr/dscf} \times 60 \text{ min/hr} + 7,000 \text{ gr/lb} \\ = 20.7 \text{ lb/hr}$$

$$20.7 \text{ lb/hr} \times 8,760 \text{ hr/yr} / 2,000 \text{ lb/ton} = 90.67 \text{ TPY}$$

$$20.7 \text{ lb/hr} / 10.2 \text{ TPH} = 2.03 \text{ lb/ton}$$

A.2.2 SO₂ Emissions

Sulfur contents in RDF and TDF are 0.21% and 1.23%, respectively. Thus, more SO₂ emissions are produced by the 75/25 fuel mixture. Assuming that all sulfur in the fuel is converted to SO₂. The overall sulfur content is 0.47%.

Uncontrolled SO₂ emissions:

$$0.0047 \text{ lb S} \times 2 \text{ lb SO}_2/\text{lb S} \times 9.83 \text{ TPH} \times 2,000 \text{ lb/ton} \\ = 184.8 \text{ lb/hr}$$

Controlled SO₂ emissions:

SO₂ emissions are controlled by a spray dryer designed with a 75% removal efficiency.

$$\text{Annual SO}_2 \text{ Emissions: } 184.8 \text{ lb/hr} \times (1-0.75 \text{ Eff}) = 46.2 \text{ lb/hr}$$

$$46.2 \text{ lb/hr} \times 8,760 + 2,000 = 202.4 \text{ TPY}$$

$$46.2 \text{ lb/hr} + 9.83 \text{ TPH} = 4.7 \text{ lb/ton}$$

Calculate concentration (ppm) in gas stream:

$$\begin{aligned}
 PV &= nRT; V = nRT/P \\
 \text{Volume of SO}_2 &= \frac{46.2 \text{ lb}_m}{\text{hr}} \frac{1,545 \text{ ft-lb}_f}{64 \text{ lb}_m\text{-}^\circ\text{R}} (200+460)^\circ\text{R} \frac{\text{ft}^2}{2,116.8 \text{ lb}_f} \\
 &= 347.7 \text{ ft}^3/\text{hr} = 5.80 \text{ ft}^3/\text{min} \\
 \text{ppm SO}_2 &= 5.80/49,600 \times 10^6 = 116.9 \text{ ppm}
 \end{aligned}$$

Maximum short term:

Assume maximum hourly SO₂ emissions are twice typical value

$$\begin{aligned}
 46.2 \text{ lb/hr} \times 2 &= 92.4 \text{ lb/hr} \\
 92.4 \text{ lb/hr} / 9.83 \text{ TPH} &= 9.40 \text{ lb/ton}
 \end{aligned}$$

A.2.3 HCl

Chlorine content in RDF and TDF are 0.26% and 0.14%, respectively. Higher potential HCl emissions are estimated based on the 80/20 fuel mixture which has a chlorine content of 0.24%. Assume all chlorine is converted into HCl based on the 80/20 fuel mixture.

Uncontrolled emissions:

$$\begin{aligned}
 0.0024 \text{ lb Cl/lb RDF} \times 36 \text{ lb HCl/35 lb Cl} \times 10.2 \text{ TPH} \times 2,000 \text{ lb/ton} \\
 = 50.4 \text{ lb/hr}
 \end{aligned}$$

Controlled emissions: Spray dryer designed for 80% removal of HCl.

$$50.4 \text{ lb/hr} \times (1-80\% \text{ Efficiency}) = 10.08 \text{ lb/hr}$$

Assume maximum emissions are twice typical level:

$$\begin{aligned}
 10.08 \text{ lb/hr} \times 2 &= 20.16 \text{ lb/hr} \\
 \text{Annual: } 20.16 \text{ lb/hr} \times 8,760 \text{ hr/yr} + 2,000 \text{ lb/ton} &= 88.3 \text{ TPY} \\
 20.16 \text{ lb/hr} / 10.2 \text{ TPH} &= 1.98 \text{ lb/ton}
 \end{aligned}$$

Calculate concentration (ppm) in stack gas:

$$\begin{aligned}
 PV &= nRT; V = nRT/P \\
 \text{Volume of HCl} &= \frac{20.16 \text{ lb}_m}{\text{hr}} \frac{1,545 \text{ ft-lb}_f}{36 \text{ lb}_m\text{-}^\circ\text{R}} (200+460)^\circ\text{R} \frac{\text{ft}^2}{2,116.8 \text{ lb}_f} \\
 &= 269.8 \text{ ft}^3/\text{hr} = 4.50 \text{ ft}^3/\text{min} \\
 \text{ppm HCl} &= 4.50/49,600 \times 10^6 = 90.7 \text{ ppm}
 \end{aligned}$$

A.2.4 **NO_x**

Annual: Based on 200 ppm at the outlet of combustor (as NO₂)

$$PV = nRT; n = PV/RT$$

$$\text{NOx} = \frac{(2,116.8 \text{ lb}_f/\text{ft}^2)(49,600 \text{ ft}^3/\text{min})}{1,545 \text{ ft-lb}_f \times (200+460)^\circ\text{R}}$$

$$\frac{46 \text{ lb}_m}{^\circ\text{R}} \times (60 \text{ min/hr})(200/10^6)$$

$$= 56.8 \text{ lb/hr} = 248.8 \text{ TPY}$$

$$56.8 \text{ lb/hr} / 10.2 \text{ TPH} = 5.57 \text{ lb/ton}$$

Maximum Short Term: Based on twice typical value

$$56.8 \text{ lb/hr} \times 2 = 113.6 \text{ lb/hr}$$

$$113.6 \text{ lb/hr} / 10.2 \text{ TPH} = 11.14 \text{ lb/ton}$$

A.2.5 **CO**

Maximum emissions: Based on 300 ppm at outlet of combustor

$$PV = nRT; n = PV/RT$$

$$\text{CO} = \frac{(2,116.8)(49,600)}{1,545 \times (200+460)}$$

$$\frac{28}{}$$

$$\times (60 \text{ min/hr})(300/10^6)$$

$$= 51.9 \text{ lb/hr} = 227.3 \text{ TPY}$$

$$51.9 \text{ lb/hr} / 10.2 \text{ TPH} = 5.09 \text{ lb/ton}$$

A.2.6 **VOC**

Maximum emissions: Based on 90 ppm at outlet of combustor (as CH₄)

$$PV = nRT; n = PV/RT$$

$$\text{VOC} = \frac{(2,116.8 \text{ lb}_f/\text{ft}^2)(49,600 \text{ ft}^3/\text{min})}{1,545 \text{ ft-lb}_f \times (200+460)^\circ\text{R}}$$

$$\frac{16 \text{ lb}_m}{^\circ\text{R}}$$

$$\times (60 \text{ min/hr})(90/10^6)$$

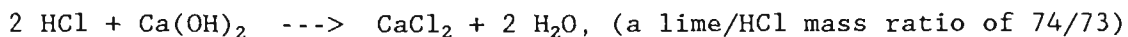
$$= 8.88 \text{ lb/hr} = 38.9 \text{ TPY}$$

$$8.88 \text{ lb/hr} / 10.2 = 0.87 \text{ lb/ton.}$$

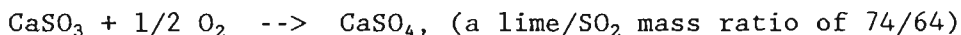
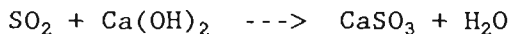
A.3 **Lime Requirements** for Acid Gas Scrubbing

The acid gas reacts with lime based on the following reactions:

For HCl acid gas:



For SO₂ gas:



Theoretical amount of lime required for HCl removal:

$$50.4 \text{ lb/hr of HCl}_{\text{Uncontrolled}} \times (74/72) = 51.09 \text{ lb/hr of lime.}$$

Theoretical amount of lime required for SO₂ removal:

$$184.8 \text{ lb/hr of SO}_{2,\text{Uncontrolled}} \times (74/64) = 213.68 \text{ lb/hr of lime.}$$

Total theoretical amount of lime required:

$$51.09 \text{ lb/hr} + 213.68 \text{ lb/hr} = 264.77 \text{ lb/hr or}$$

$$264.77 \text{ lb/hr} \times 24 \text{ hr/day} = 6,354.48 \text{ lb/day or}$$

$$6,354.48 \text{ lb/day} \times (1 \text{ ft}^3 \text{ of lime}/140 \text{ lb}) = 45.39 \text{ ft}^3/\text{day.}$$

By design, the amount of lime requirement will be 1.2 times the theoretical requirement:

$$6,354.48 \text{ lb/day} \times 1.2 = 7,625.38 \text{ lb/day or } 3.81 \text{ TPD of lime or}$$

$$45.4 \text{ ft}^3/\text{day} \times 1.2 = 54.5 \text{ ft}^3/\text{day.}$$

A.4 Proposed Lime Silo Design and Associated Fugitive Emissions

Based on preliminary design, the lime silo will have a capacity of 2,000 cubic feet of storage capacity for lime or approximately 1 1/5 standard truck loads of lime. The silo dimension is approximately 10 ft in diameter and 25 ft high. The silo is equipped with pneumatic truck loading spout and a bin vent filter for fugitive dust control.

Fugitive dust emissions from the lime silo will mainly occur when the silo is being loaded pneumatically with forced air dispensing the lime from the truck to the silo. Estimate emissions are based on the output loading of 0.02 grains/acfm for the bin vent filter; an average of 1,200 acfm of force air during the loading operation, and a total of 1,000 hours per year.

Hourly emissions: $0.02 \text{ gr/acfm} \times 1,200 \text{ acfm} + 7,000 \text{ gr/lb} \times 60 \text{ min/hr}$
 $= 0.21 \text{ lb/hr}$ (when loading takes place).

Annual emissions: $0.21 \text{ lb/hr} \times 1,000 \text{ hr/yr} = 210 \text{ lb/yr}$ or 0.11 TPY.

A.5 Fugitive Emissions from Ash Storage Area and Ash Handling Process

The ash storage area is also controlled by a bin vent filter with a maximum outlet dust loading of 0.02 gr/acfm. Assumed a volume of disturbance to be 200 acfm (i.e., the assumption is made because no mechanical convective force is applied in the ash storage area to generate any air movement) and a maximum activity factor of 1,000 hr/yr, the fugitive emissions from the ash storage area are estimated as follows:

Hourly emissions: $0.02 \text{ gr/acfm} \times 200 \text{ acfm} + 7,000 \text{ gr/lb} \times 60 \text{ min/hr}$
 $= 0.034 \text{ lb/hr}$.

Annual emissions: $0.034 \text{ lb/hr} \times 1,000 \text{ hr/yr} = 34 \text{ lb/yr}$ or 0.017 TPY.

Ash handling by hauling the ash bins from the collection points at the combustor and the fabric filter outlets to the ash storage area will generate small amount of fugitive emissions. The predicted amount is based on emission factor of 0.0035 lb/ton of ash derived from AP-42.

Hourly emissions: $0.0035 \text{ lb/ton} \times 35.41 \text{ TPD} \times 24 \text{ hr/day} = 0.005 \text{ lb/hr}$

Annual emissions: $0.005 \text{ lb/hr} \times 1,000 \text{ hr/yr} = 5 \text{ lb/yr}$ or 0.003 TPY.

A.6 Solids Produced from Acid Removal Process

Based on a design of using a lime spray dryer for acid gas removal, typical solids produced by this process include the byproducts and the unreacted lime. As a design parameter, the amount of lime feed to the spray dryer will equal to 1.2 times the theoretical lime requirement.

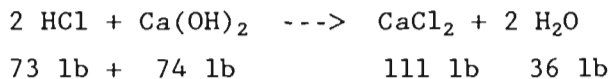
Amount of HCl removed by design:

$50.4 \text{ lb/hr HCl}_{\text{Uncontrolled}}$ (from A.2.3) $\times 80\% = 40.32 \text{ lb/hr HCl removed}$.

Amount of SO₂ removed by design:

$$184.8 \text{ lb/hr SO}_{2,\text{Uncontrolled}} \text{ (from A.2.2)} \times 75\% = 138.6 \text{ lb/hr SO}_2 \text{ removed.}$$

For HCl removal:



$$\text{Ca(OH)}_2 \text{ consumed} = 40.32 \text{ lb/hr} \times (74/73) = 40.87 \text{ lb/hr lime.}$$

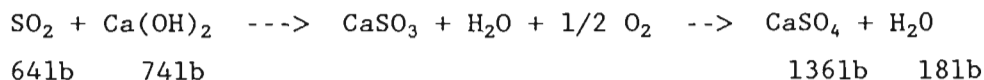
$$\text{Ca(OH)}_2 \text{ unconsumed} = (51.09 \text{ lb/hr} \times 1.2) - 40.87 = 20.44 \text{ lb/hr.}$$

$$\text{CaCl}_2 \text{ produced} = 40.32 \text{ lb/hr} \times (111/73) = 61.31 \text{ lb/hr.}$$

$$\text{H}_2\text{O produced} = 40.32 \text{ lb/hr} \times (36.73) = 19.88 \text{ lb/hr.}$$

$$\text{Total solid produced} = 20.44 + 61.31 + 19.88 = 101.63 \text{ lb/hr.}$$

For SO₂ gas removal:



$$\text{Ca(OH)}_2 \text{ consumed} = 138.6 \text{ lb/hr} \times (74/64) = 160.26 \text{ lb/hr lime.}$$

$$\text{Ca(OH)}_2 \text{ unconsumed} = (213.68 \text{ lb/hr} \times 1.2) - 160.26 = 96.16 \text{ lb/hr.}$$

$$\text{CaSO}_4 \text{ produced} = 138.6 \text{ lb/hr} \times (111/73) = 294.53 \text{ lb/hr.}$$

$$\text{H}_2\text{O produced} = 138.6 \text{ lb/hr} \times (36.73) = 38.98 \text{ lb/hr.}$$

$$\text{Total solid produced} = 96.16 + 294.53 + 38.98 = 429.67 \text{ lb/hr.}$$

Total solid produced by the acid removal process are:

$$\begin{aligned} & 101.63 \text{ lb/hr from HCl removal} + 429.67 \text{ lb/hr from SO}_2 \text{ removal} \\ & = 531.30 \text{ lb/hr} \times 24 \text{ hr/day} = 12,751.2 \text{ lb/day or } 6.38 \text{ TPD.} \end{aligned}$$

These solids produced in the spray dryer are mixed with the fly ash and collectively removed at the fabric filter down stream. Solids collected by the fabric filter are initially captured in large bin, then transferred to the ash stage area, and finally hauled away by outside vendors. The vendors will use these ashes to produce aggregate for cement products or the encapsulated the ash with recycled plastics and extrude the mixture into construction materials.

A.7 Generic Impact Concentrations

The ISCST2 modeling was performed for a single stack (i.e., an emission point) for the proposed source. Therefore, a generic emission rate of 10 g/sec was assumed for the computer run to reduce computing time. The predicted concentrations then will be calculated by multiplying the generic concentrations with a ratio of the estimated emissions to the 10 g/sec for all pollutants. All generic impact concentrations for the screening modeling run, the refined modeling run, and the Class I impact modeling run are summarized in Tables A-1 to A-4.

Table A-1. Summary of Highest Screening Impacts for the Proposed Facility at the Generic Emission Rate of 10 g/s

Averaging Period	Highest Concentration ($\mu\text{g}/\text{m}^3$)*	Receptor Location**		Time Period		
		Direction (degrees)	Distance (meters)	Julian Day	Hour Ending	Year
1-hour	214.7	260	114	291	4	1982
	338.7	260	114	303	22	1983
	256.6	260	114	57	8	1984
	237.1	250	117	244	13	1985
	210.8	240	104	67	7	1986
3-hour	129.4	260	114	291	6	1982
	166.2	250	117	58	21	1983
	133.7	240	104	264	12	1984
	156.3	240	104	244	6	1985
	150.4	240	104	8	15	1986
8-hour	76.1	250	117	113	16	1982
	103.5	250	117	58	24	1983
	83.2	230	100	261	24	1984
	112.9	250	117	244	16	1985
	114.3	240	104	8	16	1986
24-hour	59.6	240	104	57	24	1982
	59.2	250	117	58	24	1983
	53.8	240	104	261	24	1984
	60.8	230	100	243	24	1985
	55.2	240	104	8	24	1986
Annual	3.76	0	1000	NA	NA	1982
	3.36	0	500	NA	NA	1983
	3.71	0	500	NA	NA	1984
	3.05	0	1000	NA	NA	1985
	4.65	190	1000	NA	NA	1986

Note: NA = not applicable.
Highest concentrations reported for all averaging periods.

* Based on modeling at a generic emission rate of 10.0 g/s.

** Relative to the proposed stack.

Table A-2. Summary of Highest, Second-Highest Screening Impacts for the Proposed Facility at the Generic Emission Rate of 10 g/s

Averaging Period	Maximum Concentration ($\mu\text{g}/\text{m}^3$)*	Receptor Location**		Time Period		
		Direction (degrees)	Distance (meters)	Julian Day	Hour Ending	Year
1-hour	204.3	260	114	242	11	1982
	215.3	260	114	210	24	1983
	255.9	260	114	304	22	1984
	217.0	240	104	257	5	1985
	193.9	210	100	155	13	1986
3-hour	105.7	260	114	272	12	1982
	130.5	250	117	58	18	1983
	115.0	240	104	361	18	1984
	139.8	260	114	244	15	1985
	104.4	230	100	8	18	1986
8-hour	71.0	250	117	57	16	1982
	86.8	250	117	20	8	1983
	65.2	240	104	264	16	1984
	91.0	260	114	243	8	1985
	69.0	320	500	210	16	1986
24-hour	31.8	250	117	113	24	1982
	59.0	250	117	20	24	1983
	36.4	230	100	271	24	1984
	37.1	230	100	257	24	1985
	41.5	210	100	241	24	1986
Annual	3.76	0	1000	NA	NA	1982
	3.36	0	500	NA	NA	1983
	3.71	0	500	NA	NA	1984
	3.05	0	1000	NA	NA	1985
	4.65	190	1000	NA	NA	1986

Note: NA = not applicable.
Highest, second-highest concentrations reported for all short-term averaging periods.

* Based on modeling at a generic emission rate of 10.0 g/s.

** Relative to the proposed stack.

Table A-3. Summary of Refined Highest and Highest, Second-Highest Impacts for the Proposed Facility at the Generic Emission Rate of 10 g/s

Averaging Period	Maximum Concentration ($\mu\text{g}/\text{m}^3$)*	Receptor Location**		Time Period		
		Direction (degrees)	Distance (meters)	Julian Day	Hour Ending	Year
HIGHEST CONCENTRATIONS						
8-hour	122.5	242	123	8	16	1986
24-hour	60.1	228	100	243	24	1985
Annual	4.65	190	1000	NA	NA	1986
HIGHEST, SECOND-HIGHEST CONCENTRATIONS						
1-hour	256.4	262	114	57	8	1984
3-hour	152.2	256	117	243	9	1985
8-hour	99.6	256	117	243	8	1985
24-hour	62.8	246	124	20	24	1983

Note: NA = not applicable.
 Highest refined concentrations used for toxic pollutant analysis. Highest, second-highest concentrations used for AAQS and PSD Class II analysis.

* Based on modeling at a generic emission rate of 10.0 g/s.

** Relative to the proposed stack.

Table A-4. Summary of Impacts for the Proposed Facility at the Bradwell Bay NWA and the St. Marks NWA at the Generic Emission Rate of 10 g/s

Averaging Period	Highest Concentration ($\mu\text{g}/\text{m}^3$)*	Receptor Location		Time Period		
		East UTM (meters)	North UTM (meters)	Julian Day	Hour Ending	Year
3-hour	4.12	731000	3343000	94	3	1982
	4.33	733000	3343000	270	6	1983
	4.72	736000	3343000	120	3	1984
	3.52	731000	3343000	154	6	1985
	4.84	728000	3343000	314	6	1986
24-hour	0.94	733000	3343000	157	24	1982
	0.77	733000	3343000	270	24	1983
	0.70	736000	3343000	361	24	1984
	0.69	731000	3341000	283	24	1985
	1.02	728000	3343000	363	24	1986
Annual	0.049	733000	3343000	NA	NA	1982
	0.048	728000	3343000	NA	NA	1983
	0.052	736000	3341000	NA	NA	1984
	0.048	731000	3343000	NA	NA	1985
	0.073	728000	3343000	NA	NA	1986

Note: NA = not applicable.
Highest, second-highest concentrations reported for all short-term averaging periods.

* Based on modeling at a generic emission rate of 10.0 g/s.

APPENDIX B
REFERENCES

United States
Environmental Protection
Agency

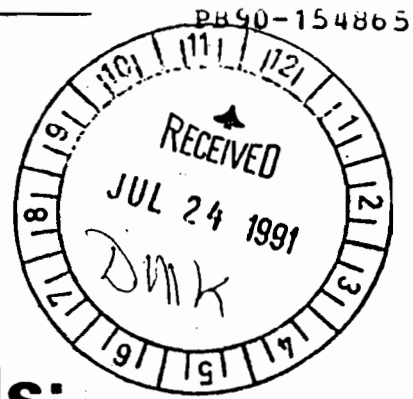
Office of Air Quality
Planning and Standards
Research Triangle Park, NC 27711

EPA-450/3-89-27c
August 1989

Air



Municipal Waste Combustors- Background Information for Proposed Standards: Post-Combustion Technology Performance



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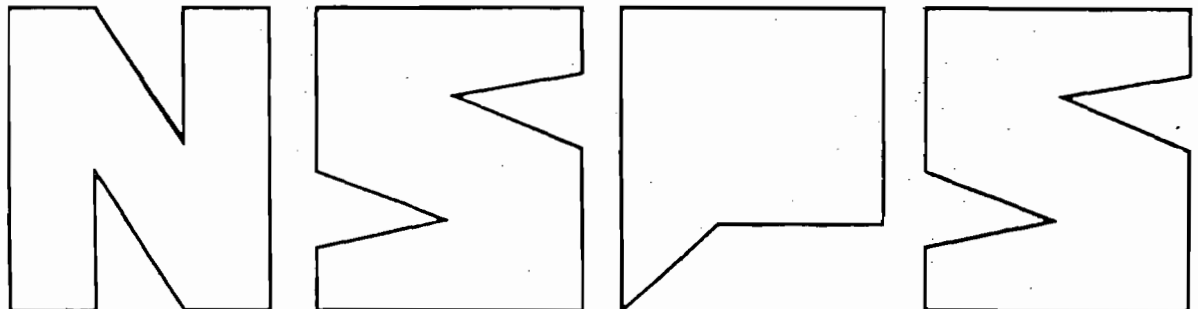


TABLE 1-2. SUMMARY OF UNCONTROLLED METALS CONCENTRATIONS

Site	Concentration (ug/dscm at 7% O ₂)						Reference
	As	Cd	Cr	Pb	Hg	Ni	
Mass Burn							
Baltimore RESCO	226	NM ^a	2,960	NM	NM	NM	2
Commerce (1987) ^b	220	2,700	730	50,000	450	680	3
Commerce (1988) ^b	74	1,600	3,450	17,200	450	4,000	4
Dayton	234	1,550	185	38,400	1,030	94	5
Gallatin	422	3,130	1,040	36,300	248	NM	6
Marion County	NM	1,120	422	20,500	NM	12	7
Quebec City (pilot)	128	1,220	1,870	34,700	373	1,300	8
Average	216	1,890	1,520	32,800	510	1,220	
Modular							
Cattaraugus County	34	1,090	1,210	20,400	1,130	1,260	9
Prince Edward Island	14	1,120	71	18,400	921	553	10
Tuscaloosa	99	NM	34	NM	NM	NM	11
Average	49	1,110	436	19,400	1,020	905	
RDF							
Biddeford	583	1,280	3,170	31,300	440	NM	12
Mid-Connecticut	1,060	1,070	927	37,400	1,010	541	13
NSP Red Wing	203	805	381	24,300	140	344	14
Average	615	1,050	1,490	31,000	530	443	

^aNM = Not measured.

^bTests conducted firing a mixture of residential and commercial refuse. Tests firing only commercial refuse yielded similar emissions, but are not reported here.

nickel are associated with particulate and are consistently removed to relatively low levels across a particulate control device. Thus, the estimated removal efficiency is probably a reasonable approximation of the actual removal efficiency. For mercury, however, with the relatively wide variation in uncontrolled mercury concentrations and the general understanding that mercury is not associated with particulate, a realistic mercury removal efficiency cannot be estimated with the available data unless the outlet mercury concentration is substantially lower than the lowest reported uncontrolled mercury concentration. Thus, outlet mercury emissions data in this document are only compared to the range in uncontrolled mercury concentrations in Table 1-2 to indicate whether mercury removal may have occurred.

1.2.3 CDD/CDF

Uncontrolled CDD/CDF emission levels are summarized in "Municipal Waste Combustion Assessment: Combustion Control at Existing Facilities" and are presented in Table 1-3. All concentrations reflect the sum of the tetra-through octa-chlorinated CDD/CDF homologues and are presented in nanograms per dry, standard cubic meter (ng/dscm) normalized to 7 percent O₂. From mass burn refractory combustors, typical uncontrolled CDD/CDF concentrations

TABLE 1-3. SUMMARY OF UNCONTROLLED CDD/CDF CONCENTRATIONS¹⁵

Combustor Type	Concentration (ng/dscm at 7% O ₂)
Mass burn refractory	4,000
Mass burn waterwall - large	500
Mass burn waterwall - midsize; Modular excess air	200
Mass burn waterwall - small; Refuse-derived fuel fired; Mass burn rotary waterwall	2,000
Modular starved air	400



Waste Recovery, Inc.

"Making Waste A Resource"[®]

Characteristics Of TDF (Tire-Derived Fuel)

Bulletin 20.20.1C December, 1986

Overview

Waste Recovery, Inc. (WRI) manufactures a uniform, high quality Tire-Derived Fuel (TDF) from scrap rubber tires.

TDF has been successfully used as a fuel supplement by major companies in a wide range of existing combustion equipment since 1974.

In its unique production process, WRI removes 99+% of the heavy bead wire and 96+% of all wire from tires to lower the residual ash content and improve handling characteristics.

Benefits

WRI's TDF offers users the following specific benefits.

- **Efficient storage:** Clean, dust-free and non-absorbent for outdoor storage; 41° angle of repose with an average bulk density of 34-37 lb/ft³ allows efficient stockpiling.
- **Easy handling:** Readily flowable with excellent pneumatic and mechanical handling characteristics.
- **Safety:** High ignition point; not subject to spontaneous combustion.

- **Combustion efficiency:** High heat content (15,500 BTU/lb) and high volatility (>66%) enhance combustion in a cost-effective manner.
- **Equipment compatibility:** Feasible for stoker-fired boilers, kilns, fluid beds and fuel cells.

Representative Analysis of TDF Produced By WRI
(Source: TDF Produced From Scrap Tires with 96+% Wire Removed)

Description	% By Wt, As Received	% By Wt, Dry Basis
Proximate Analysis		
Moisture	0.62	----
Ash	4.78	4.81
Volatile Matter	66.64	67.06
Fixed Carbon	27.96	28.13
Total	100.00	100.00
Ultimate Analysis		
Moisture	0.62	----
Ash	4.78	4.81
Carbon	83.87	84.39
Hydrogen	7.09	7.13
Nitrogen	0.24	0.24
Sulfur	1.23	1.24
Oxygen (by difference)	2.17	2.19
Total	100.00	100.00
Elemental Mineral Analysis (Oxide Form)		
Zinc	1.52	1.53
Calcium	0.378	0.380
Iron	0.321	0.323
Chlorine	0.149	0.150
Chromium	0.0097	0.0098
Fluoride	0.0010	0.0010
Cadmium	0.0006	0.0006
Lead	0.0065	0.0065
Others below detectable limits		
Heat Value		
HHV	BTU/lb	kJ/kg
	16,250	37,798
HV _{ave}	15,500	36,053
TDF Combustion Characteristics		
	°F	°C
Tires ignite (flash point)	550 - 650	288 - 343
Carbon begins to burn	842	450
Carbon completely burnt	1202	650

Sieve Analysis, Random Sample Of WRI's Minus 2" TDF (Analysis Performed to TAPPI & ASTM Standards)

Sieve Opening	% Retained By Wt.
3"	0.0
2"	0.2
1-1/2"	5.8
1"	26.2
5/8"	47.6
1/2"	5.4
3/8"	2.4
-3/8"	2.4
Total	100

Additional Properties

Angle of repose:	41°
Particle specific gravity:	1.05 - 1.15
Bulk density,	
Loose:	34 - 37 lbs/ft ³
Settled:	41 - 44 lbs/ft ³
Typical wire content:	<0.4% by wt.
Volatile/fixed carbon ratio:	2.4 : 1