AIRS No. 0570127-002-AC
REC'D 9-16-97

Application

City of Tampa, Florida
Environmental Services

McKay Bay Refuse-to-Energy Facility Air Pollution Control Equipment and Facility Improvements

Source Modification Construction Air Permit Application

Volume I

Permit Application Text

Prepared by:

Camp Dresser & McKee Inc.
Tampa, Florida

RTP Environmental Associates Inc.
Green Brook, New Jersey

September 1997

CDM Camp Dresser & McKee Inc.

consulting
engineering
construction
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1715 North Westshore Boulevard, Suite 875
Tampa, Florida 33607
Tel: 813 281-2900 Fax: 813 288-8787

50th Anniversary 1947-1997

September 12, 1997

Mr. Jerry Campbell, Senior Professional Engineer
Hillsborough County Environmental Protection Commission
1410 North 21st Street
Tampa, Florida 33605

Subject: City of Tampa McKay Bay Refuse to Energy Facility
Air Pollution Control (APC) Retrofit

Dear Mr. Campbell:

Accompanying this letter is 1 copy of Tampa's Source Modification Construction Air Permit Application to allow the construction of new APC equipment and other Facility improvements in order to meet the Emission Guidelines for Municipal Waste Combustors [pursuant to 40 CFR 60 Subpart Cb as adopted in FAC 62-204.800(8)]. Also enclosed is a check in the amount of eight hundred dollars ($800), the permit fee.

If you have any questions or comments, do not hesitate to contact me.

Sincerely,

CAMP DRESSER & McKEE INC.

Daniel E. Strobridge
Associate

c: C. Fancy, FDEP
N. McCann, City of Tampa
D. Elias, RTP
D. Dee, Landers and Parsons

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CITY OF TAMPA   TAMPA, FLORIDA   NO. 490775

ENVIRONMENTAL PROTECTION COM   2516942   08 05 97   0490775

INVOICE #	P/O NUMBER	FND	DEP	ACCT. NO.	OBJ.	GROSS AMOUNT	DISC. AMOUNT	NET AMOUNT
0000797	Y1806184	440	180	534101	4906	800.00		800.00
								800.00

DETACH HERE BEFORE DEPOSITING

CITY OF TAMPA   POOL CASH   NO. 490775

TAMPA, FLORIDA

VOID - 90 DAYS AFTER DATE OF ISSUE

05 AUG 97   FIRST UNION NATIONAL BANK OF FLORIDA   0490775 63-1012/632

PAY   EIGHT HUNDRED AND 00/100 DOLLARS-----------------

$800.00   AMOUNT

TO THE ORDER OF

ENVIRONMENTAL PROTECTION COM
MISSION OF HILLS CTY (EPC/HC
1900 9TH AVENUE
TAMPA   FL 33605

MAYOR

DIRECTOR OF FINANCE

[redacted]

CDM Camp Dresser & McKee Inc.

consulting
engineering
construction
operations

1715 North Westshore Boulevard, Suite 875
Tampa, Florida 33607
Tel: 813 281-2900 Fax: 813 288-8787

50th 1947-1997 Anniversary

September 12, 1997

Mr. Clair Fancy, Chief
Bureau of Air Regulation
Florida Department of Environmental Protection
MS 5505
2600 Blair Stone Road
Tallahassee, Florida 32399-2400

Subject: City of Tampa McKay Bay Refuse to Energy Facility
Air Pollution Control (APC) Retrofit

Dear Mr. Fancy:

Accompanying this letter are 5 copies of Tampa's Source Modification Construction Air Permit Application to allow the construction of new APC equipment and other Facility improvements in order to meet the Emission Guidelines for Municipal Waste Combustors [pursuant to 40 CFR 60 Subpart Cb as adopted in FAC 62-204.800(8)]. Also enclosed is a check in the amount of two hundred fifty dollars ($250), the permit fee quoted by Mr. Al Verona and Ms. Theresa Heron.

If you have any questions or comments, do not hesitate to contact me.

Sincerely,

CAMP DRESSER & McKEE INC.

Daniel E. Strobridge
Associate

c: J. Campbell, Hillsborough County EPC
N. McCann, City of Tampa
D. Elias, RTP
D. Dee, Landers and Parsons

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CITY OF TAMPA   TAMPA, FLORIDA   NO. 490894

DEPT. OF ENVIR. PROTECTION   3655245   08 05 97   C490894

INVOICE #	P/O NUMBER	FND	DEP	ACCT. NO.	OBJ.	GROSS AMOUNT	DISC. AMOUNT	NET AMOUNT
0000797	Y1806183	440	180	534101	4906	250.00		250.00
								250.00

DETACH HERE BEFORE DEPOSITING

CITY OF TAMPA   POOL CASH   NO. 490894

TAMPA, FLORIDA

FIRST UNION NATIONAL BANK OF FLORIDA

VOID - 90 DAYS AFTER DATE OF ISSUE

05 AUG 97   C490894   63-1012/632

PAY   TWO HUNDRED FIFTY AND 00/100 DOLLARS--------------

AMOUNT $250.00

TO THE ORDER OF

DEPT. OF ENVIR. PROTECTION
2600 BLAIRSTONE RD.
TALLAHASSEE   FL 32399

MAYOR

DIRECTOR OF FINANCE

⑈490894⑈ ⑆063210125⑆ 2079910007148⑈

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List of Abbreviations

AAQS	ambient air quality standards
ACI	activated carbon injection
APC	air pollution control
AQCR	Air Quality Control Region
ARCs	FDEP's Ambient Reference Concentrations
ASME	American Society of Mechanical Engineers
BBS	bulletin board system
Be	beryllium
BPIP	Building Profile Input Program
Btu	British thermal unit
BURN	a CDM proprietary combustion chemistry model
CAA	Clean Air Act
CAAA	Clean Air Act Amendments of 1990
$CaCl_2$	calcium chloride
CALPUFF	a dispersion model
CAM	compliance assurance monitoring
CaO	pebble lime
$CaSO_3$	calcium sulphite
$CaSO_4$	calcium sulphate
Cd	cadmium
CEM	continuous emission monitor

CEMS	continuous emission monitoring system
CFR	Code of Federal Regulations
CO	carbon monoxide
CO_2	carbon dioxide
COM	continuous opacity monitor
COMS	continuous opacity monitoring system
dscf	dry standard cubic foot
dscm	dry standard cubic meter
EG	Emission Guidelines for Municipal Waste Combustors (40 CFR 60 Subpart Cb)
EPA	United States Environmental Protection Agency
ESP	electrostatic precipitator
FAC	Florida Administrative Code
Facility	McKay Bay Refuse-to-Energy Facility
FDEP	Florida Department of Environmental Protection
FF	fabric filter
GCP	good combustion practice
GEP	good engineering practice
gr/dscf	grains per dry standard cubic foot
g/s	grams per second
Guideline	U. S. EPA Guideline on Air Quality Models (40 CFR 51, Appendix W)
H_2SO_4	sulfuric acid
HAP	hazardous air pollutants

HCl	hydrochloric acid
HF	hydrogen fluoride
Hg	mercury
ID	induced draft
ISC	Industrial Source Complex, a dispersion model
ISCST3	Industrial Source Complex, Short-Term, Version 3, a specific dispersion model that can compute pollutant concentrations for short averaging periods
J	joule
lb	pound
m	meter
m^3	cubic meter
MACT	maximum achievable control technology
mg	milligrams
Mg	megagram
MMBtu	million British thermal units
MSW	municipal solid waste
MWC	municipal waste combustor
NESHAP	National Emissions Standards for Hazardous Air Pollutants (40 CFR 61)
N_2	nitrogen
ng	nanograms
NH_3	ammonia
No_x	oxides of nitrogen
NPS/FWS	National Park Service / Fish and Wildlife Service

NSPS	New Source Performance Standards (40 CFR 60)
NSR	Nonattainment New Source Review
NWS	National Weather Service
O_2	oxygen
O_3	ozone
OAQPS	U.S. EPA Office of Air Quality Planning and Standards
Pb	lead
PM	particulate matter
PM_{10}	particulate matter with an aerodynamic diameter less than or equal to 10 microns
ppmdv	parts per million, dry, by volume
ppmv	parts per million, by volume
PPSA	Power Plant Siting Act
PSD	Prevention of Significant Deterioration
RACT	reasonably available control technology
Retrofit	all of the work included in the proposed upgrade of the Facility
SCRAM	Support Center for Regulatory Air Models
SCREEN3	a screening-level dispersion model
SDA	spray dryer absorber
SIA	significant impact area
SIL	U.S. EPA's significant impact levels
SIP	State Implementation Plan
SNCR	selective non-catalytic reduction

SO_2	sulfur dioxide
tpd	tons per day
tpy	tons per year
TSP	total suspended particulate matter
μg	microgram
UTM	universal transverse Mercator coordinates
VOC	volatile organic compounds

Section 1
Introduction

The City of Tampa (City) is proposing to install new air pollution control equipment and make other improvements to the City's McKay Bay Refuse-to-Energy Facility (Facility). The proposed improvements (collectively the "Retrofit") are designed to allow the Facility to meet the new air emissions control and monitoring requirements established by the United States Environmental Protection Agency's (EPA's) Emission Guidelines (EG) for "large" Municipal Waste Combustors (MWC), which are codified in 40 CFR 60 Subpart Cb, and adopted by the Florida Department of Environmental Protection (FDEP) in FAC 62-204.800(8). The Retrofit will result in a net reduction in air pollutant emissions from the Facility, and the addition of enhanced continuous emissions monitoring equipment.

The Facility consists of four mass-burn combustion units, each with a nominal feed rate of 250 tons per day (tpd), when burning solid waste with a heat content of 5,000 British thermal units (Btu) per pound (lb). The Facility, therefore, has a total guaranteed waste processing rate of 1,000 tpd of municipal solid waste (MSW), using MSW with 5,000 Btu/lb. The Facility generates electricity, and has a generator nameplate rating of 22.5 megawatts for the entire Facility. The main components of each existing combustion unit include a reciprocating grate furnace coupled to a rotary kiln, a waste heat boiler, and a two-field electrostatic precipitator (ESP) located downstream of the boiler outlet. The gases from the ESP outlet are drawn through an induced draft (ID) fan before being discharged through one of two steel stacks. Two combustion units are connected to a common flue in each stack.

Major advancements in refuse combustion technology have been made since the existing systems were installed at the Facility in 1985. These advancements offer greater combustion control and improved combustion efficiency over the system currently installed at the Facility. Accordingly, the City is planning to improve and upgrade each unit with a state-of-the-art system as part of the Retrofit project.

The existing furnace grate, rotary kiln, ESP, and ID fan on each unit will be replaced. The existing waste heat boiler on each unit will be replaced or substantially improved to be compatible with the new combustion system. The new air pollution control (APC) equipment will consist of a spray dryer absorber (SDA), a fabric filter (FF), an activated carbon injection (ACI) system, and an ID fan installed downstream of each boiler. In addition, a selective non-catalytic reduction (SNCR) system and auxiliary fuel burners will be installed in the combustion zone of each furnace. Continuous emission monitors (CEMs) will be installed in the outlet ducts of the economizers/boilers and FFs. The two existing steel stacks will be replaced as part of the Retrofit. One (four-flue) replacement stack will be constructed. New bottom and fly ash handling systems will be installed to support the new combustion and APC systems. A new ash residue storage building will be constructed.

With this application, the City is requesting amendments to its existing air permit (No. AO29-206279) and authorization to proceed with the Retrofit, in compliance with the EG. The air emission limits requested in the application are the same as or lower than those in the existing permit. The City is requesting the deletion of one emission limitation for volatile organic compounds (VOC) in the existing permit that overlaps good combustion practice (GCP) and continuous carbon monoxide (CO) monitoring requirements in the EG. In addition, the City is requesting some new emission limits for pollutants that are not regulated under the existing permit. The emission limits requested by the City are appropriate because they are consistent with the stringent new requirements in the EG and because the Facility will perform much better after the Retrofit.

A comparison of existing and proposed air permit emission limits is presented in Table 1-1. The table also lists, by pollutant, the new equipment to be added that is targeted to reduce emissions of each pollutant. Table 1-1 shows substantial reductions in the proposed limits for particulate matter (PM), nitrogen oxides (NO_x), lead (Pb), and mercury (Hg); and new limits for the currently unregulated emissions of CO, cadmium (Cd), hydrogen chloride (HCl), and dioxins.

There are some cases shown in the table where the new regulatory limits are not necessarily more stringent than the existing permit limits (beryllium [Be] and hydrogen fluoride [HF]). However, the new APC equipment for those pollutants would result in actual emissions of those pollutants being less than they are currently.

In addition to more stringent emission limits and controls, the proposed air permit will:

- Contain a method for more precisely monitoring furnace loads, based on steam generation, consistent with the requirements of the EG.
- More accurately define the types of fuels to be processed at the Facility.
- More completely describe the range of operating conditions at the Facility.
- Contain more monitoring and reporting requirements, as specified in the EG.

This volume (Volume I) contains the text of the air permit application. Volume II contains the application forms. The applicable federal and state rules and regulations for the proposed project are discussed in Section 2. The proposed control technologies are discussed in Section 3. The emission estimates, based on the proposed control technologies, are presented in Section 4. The meteorology and existing air quality in the vicinity of the Facility are discussed in Section 5. The air quality impact analyses for the proposed Retrofit are discussed in Section 6. The compliance monitoring systems for the proposed Retrofit are discussed in Section 7.

Table 1-1
Existing and Proposed Air Permit Emission Limits
Tampa McKay Bay Refuse-to-Energy Facility

	Existing Facility		Retrofit		
Pollutant	***Existing Permit Emission Limit***	***Equivalent Annual Emission Rate [1] (tons/year)***	***Proposed Permit Emission Limit [2]***	***Equivalent Annual Emission Rate [1,3] (tons/year)***	***New Air Pollution Control Equipment***
Particulate matter (PM)[4]	27.9 lb/hr (all 4 units)	122	0.012 gr/dscf[5]	49	Fabric Filter (FF)
Sulfur dioxide (SO_2)	170.0 lb/hr (all 4 units)	745	29 ppmdv or	138	Spray Dryer Absorber (SDA)/FF
			75% removal[5,9]	716	
Nitrogen oxides (NO_x)	300.0 lb/hr (all 4 units)	1,314	205 ppmdv[5]	703	Selective Non-Catalytic Reduction
Carbon monoxide (CO)	No Limit	No Limit	100 ppmdv[5]	209	New Combustion System/
					Good Combustion Practices (GCP)
Volatile Organic Compounds (VOC)	9.0 lb/hr (all 4 units)	39	No Limit[6]	No Limit	New Combustion System/GCP
Lead (Pb)	3.1 lb/hr (all 4 units)	14	440 µg/dscm[5]	0.788	SDA/FF
Mercury (Hg)	0.6 lb/hr (all 4 units)	3	70 µg/dscm or	0.125	Activated Carbon Injection (ACI)/
					SDA/FF
			85% removal[5,9]	0.243	
Cadmium (Cd)	No Limit	No Limit	40 µg/dscm[5]	0.073	SDA/FF
Beryllium (Be)	0.00046 lb/hr (all 4 units)	0.002	0.000115 lb/hr/unit[7]	0.002	SDA/FF
Hydrogen chloride (HCl)	No Limit	No Limit	29 ppmdv or	79	SDA/FF
			95% removal[5,9]	272	
Hydrogen fluoride (HF)	6.0 lb/hr (all 4 units)	26	1.5 lb/hr/unit[7]	26	SDA/FF
Dioxin[8]	No Limit	No Limit	30 µg/dscm[5]	5.37E-05	ACI/SDA/FF/GCP
Ammonia (NH_3)	No Limit	No Limit	50 ppmdv[10]	63	

Notes:

[1] Estimated controlled emission rate for all MWC units combined (excludes miscellaneous sources), operating 24 hours a day, 365 days per year.
[2] Estimated controlled emission concentration for each MWC unit. Concentrations are corrected to 7% O_2.
[3] Based on 115 percent of the design heat release rate firing 958.4 tpd of reference waste at 6,000 Btu/lb. The modeled air flow rate for each of the four units at this load is 27,299 dscfm at 7% oxygen (12.9 dscm/sec).
[4] For purposes of analysis, PM10 is assumed equivalent to PM.
[5] Emissions Guidelines limit for large MWC units. The City requests that the NO_x limit of 205 ppmdv be approved prior to its implementation date of August 26, 2002.
[6] The EG limit for CO of 100 ppmdv, which will be monitored continuously, is a surrogate for VOC emissions and a measure of good combustion. Therefore, the City requests that the VOC limit be replaced by the EG CO limit and continuous CO monitoring.
[7] Current permit limits to be retained for Facility after proposed improvements.
[8] Total tetra through octa PCDD and PCDF.
[9] Whichever is less stringent.
[10] Ammonia is a possible reagent (urea is another possible reagent) in the selective non-catalytic reduction system. Limit is for unreacted ammonia "slip."

Section 2
Air Quality Regulations

2.1 Introduction

The proposed improvements to the APC and combustion systems at the City's Facility will be designed to meet or exceed all applicable federal and state rules and regulations. The APC system for each incineration unit will consist of an SDA, a FF, a powdered ACI system, and an SNCR system. In addition, combustion control and furnace upgrades will be performed for each incinerator. These systems and upgrades are described in Section 3, and will enable the Facility to meet the EPA EG for MWCs (40 CFR 60, Subpart Cb) and the Florida Mercury Rule (Section 62-296.416 FAC). The proposed project will result in either no change or a significant reduction in actual emissions from the Facility for all criteria pollutants. Therefore, the proposed project is not subject to the PSD or non-attainment New Source Review (NSR) requirements under 40 CFR 52.21 and 62-212 FAC.

This section discusses the air quality regulations promulgated by EPA and FDEP applicable to the Facility and the proposed upgrade. Section 2.2 discusses the pertinent air quality regulations. Section 2.3 discusses the existing air permits for the Facility.

2.2 Applicable Regulations

The proposed improvements in the APC system at the Facility have been reviewed for applicability to and compliance with the following requirements in the CFR and FAC:

40 CFR 50	-	National Primary and Secondary Ambient Air Quality Standards.
40 CFR 52	-	Subpart K - Approval and Promulgation of Implementation Plans, Florida.
40 CFR 60	-	Subpart Cb - Emission Guidelines for Existing Municipal Waste Combustors.
	-	Subpart Db - Standards of Performance for Industrial, Commercial, Institutional Steam Generating Units.
	-	Subpart E - Standards of Performance for Incinerators.
40 CFR 61	-	National Emission Standards for Hazardous Air Pollutants (NESHAP).
40 CFR 63	-	Subpart B - Requirements for MACT Determinations for Major Sources in Accordance with Clean Air Act Sections 112(g) and 112(j).
40 CFR 64	-	Compliance Assurance Monitoring Rule.
62-210 FAC	-	Stationary Sources - General Requirements.
62-212 FAC	-	Stationary Sources - Preconstruction Review.
62-296 FAC	-	Stationary Source - Emission Standards.
62-297 FAC	-	Stationary Source - Emissions Monitoring.

2.2.1 Florida State Program Authority

The State of Florida has been delegated full authority by EPA to administrate the State Implementation Plan (SIP). Additionally, the FDEP has accepted delegation from EPA to issue permits for new and modified sources, and thereby satisfy the requirements of the Prevention of Significant Deterioration (PSD) regulations (40 CFR Part 51.166). EPA's role in permitting a proposed source in Florida includes a review of assessment protocols for compliance with the SIP and guidance for policy decisions on an as-needed basis.

2.2.2 PSD/Non-Attainment NSR Applicability

The Clean Air Act (CAA) was amended in 1977 to incorporate a PSD program. To carry out the policies of the 1977 CAA amendments, EPA adopted revised PSD regulations on June 19, 1978. These revised regulations contained the PSD increments mandated by Congress and identified the types of emission sources subject to the PSD regulations (40 CFR 51.166).

For PSD purposes, a major stationary source is defined by EPA in two main ways. The primary definition of a major stationary source includes any source belonging to a list of 28 specified categories which has the potential to emit 100 tons per year (tpy) or more of any criteria pollutants regulated under the CAA. For PSD purposes, the Facility is classified as a municipal waste incinerator capable of charging more than 50 tons of refuse per day, which is one of the 28 major source categories identified in Section 169 of Title I of the CAA. Since the existing Facility has the potential to emit more than 100 tpy of at least one regulated pollutant, the Facility is an existing major stationary source for PSD purposes.

A modification to an existing major source is subject to PSD regulations if the source is located in a PSD attainment area and the changes to the source constitute a major modification. The project site and vicinity are currently considered to be in attainment with ambient air quality standards (AAQS) for all PSD pollutants (40 CFR 81.310 and FAC 62-204). In general, a major modification is a physical change or a change in the method of operation of a major source which would result in a significant net emissions increase of a regulated pollutant. Since the proposed improvements to the Facility will result in either no change to, or significant reductions in, emissions from the Facility for all PSD pollutants as discussed in Section 2.3, the proposed Retrofit is not a major modification and is not subject to PSD requirements.

A source modification is subject to non-attainment NSR if the modification results in a significant net emission increase of a pollutant for which the source is major and for which the area is designated as non-attainment. Since the Facility site and all nearby areas are considered to be in attainment of the AAQS for all criteria pollutants, the non-attainment NSR requirements do not apply.

2.2.3 Ambient Air Quality Standards

The national and Florida AAQS are enumerated in the baseline air quality discussion in Section 5. As noted above and discussed in Section 5, ambient air quality in the Facility's vicinity is currently better than the AAQS for all pollutants. The Facility's compliance with AAQS after the proposed improvements is demonstrated in the air quality modeling analysis in Section 6.

2.2.4 Emission Guidelines for Existing Municipal Waste Combustors (MWC)

EPA promulgated EG for existing MWCs in Subpart Ca of 40 CFR 60 on February 11, 1991. The Clean Air Act (CAA) Amendments of 1990 required EPA to review and revise, as necessary, the Subpart Ca guidelines. Accordingly, EPA withdrew Subpart Ca and adopted a new set of MWC guidelines in Subpart Cb on December 19, 1995. The new Subpart Cb guidelines were developed under Sections 111(d) and 129 of the CAA. Under Section 129 of the CAA, the guidelines were revised to reflect Maximum Achievable Control Technology (MACT) and to specify emission levels for additional pollutants.

The Subpart Cb EG require states to develop regulations which would limit MWC emissions from existing MWCs to levels at least as stringent as the national requirements. The EPA EG establish emission limits for MWC metals PM, opacity, cadmium (Cd), lead (Pb), and mercury (Hg)], MWC acid gases [sulfur dioxide (SO_2), hydrogen chloride (HCl)], carbon monoxide (CO), nitrogen oxides (NO_X), and MWC organics (dioxins/furans). The emission limits for "large" MWC units are based on the utilization of Good Combustion Practices (GCP) and APC systems consisting of SDA/FF, SNCR, and ACI systems or SDA/electrostatic precipitator (ESP), SNCR, and ACI systems. The proposed Facility improvements would include the use of GCP, SDA/FF, SNCR, and ACI systems designed to meet the EPA EG, which are discussed below.

Florida adopted the Subpart Cb regulations by reference in FAC 62-204.800(8). In some instances, FDEP's mercury requirements in FAC 62-296.416 for MWCs are more stringent than the EPA requirements under the EG.

For the December 1995 Subpart Cb regulations, EPA developed different sets of emission limits under MACT procedures depending on the overall size of the MWC plant, rather than the size of the MWC units. Large MWC plants are defined as facilities that can process more than 225 Megagrams/day (Mg/day), or 248 tpd, of a 4,500 Btu/lb waste. Since the Facility consists of four units <u>each</u> capable of processing a nominal 250 tons of 5,000 Btu/lb municipal solid waste (MSW) per day (equivalent to about 278 tpd of 4,500 Btu/lb MSW), the Facility is a large MWC plant for purposes of the 1995 Subpart Cb guidelines.

The December 1995 Subpart Cb EG [and the related Subpart Eb New Source Performance Standards (NSPS)] were remanded to EPA for revision in a March 1997 ruling by the

United States Court of Appeals for the District of Columbia (see Davis County Solid Waste Management and Energy Recovery Special Service District, *et al.* v. U.S. EPA, Case 95-1611). The court ruled that EPA exceeded its statutory authority because EPA used aggregate plant capacity to establish categories of MWC units for the Subpart Cb EG. The CAA Section 129(a)(1) created two categories of MWC units for regulation (those with capacity greater than 250 tpd and those with capacity less than or equal to 250 tpd). Therefore, EPA must establish MWC categories based on the size of the unit, not the facility.

Under 40 CFR 60.58b(j) of the December 1995 NSPS in Subpart Eb, MWC unit "capacity" for continuous feed combustors is calculated "based on 24 hours of operation at the maximum charging rate." For MWC units "that are designed based on heat capacity, the maximum charging rate shall be the maximum design charging rate." The maximum design charging rate is calculated "based on the maximum design heat input capacity" and a heating value of 10,500 kilojoules per kilogram (approximately 4,500 Btu/lb) of MSW. The maximum design heat input capacity representative of 100 percent load for the existing McKay Bay MWC units is 104.167 MMBtu/lb, which is equivalent to 278 tpd of MSW at 4,500 Btu/lb. Thus, the McKay Bay MWC units are subject to the EG requirements for large MWC units at large plants.

On March 21, 1997, the court amended its opinion [see 108F.3d1454 (D.C. Cir. 1997)] and on April 8, 1997, the court vacated the December 1995 EG as they apply to MWC units with capacities less than or equal to 250 tpd. The EG have remained in effect for "large MWC units." In the August 25, 1997 Federal Register (62 FR 45115 and 62 FR 45123), EPA published a direct final rule which amended and revised the Subpart Cb EG consistent with the Davis County remand. The August 25, 1997 EG for large MWC units retained nearly all the December 1995 requirements for MWC units at large plants (the McKay Bay facility consists of four large MWC units subject to the August 1997 EG requirements). However, the August 1997 EG contain slightly more stringent Subpart Cb EG limits for Pb, SO_2, and HCl. Compliance with these revised Pb, SO_2, and HCl EG limits is delayed until August 26, 2002 or 3 years after approval of a state plan implementing these limits, whichever is first. By contrast, compliance with the December 1995 EG limits must be achieved by December 20, 2000 or 3 years after approval of a state plan implementing the December 1995 EG, whichever occurs first (expected to be October 2000 at the earliest).

In addition, the August 1997 EG contain a less stringent Subpart Cb limit for NO_x emissions of 205 ppmdv corrected to 7 percent oxygen (O_2) for mass burn waterwall combustors. EPA will approve state plans that include the less restrictive NO_x limit prior to the effective date of the August 1997 EG. It has been assumed that FDEP will adopt the less restrictive NO_x limit prior to completion of the Retrofit project. Therefore, the EG limits listed below are the December 1995 EG requirements with the August 1997 revised emission limits for Pb, SO_2, HCl, and NO_x.

Particulate Matter and Municipal Waste Combustor Metals

The EG require existing large MWC units to control PM to a level of 27 milligrams per dry standard cubic meter (mg/dscm) [0.012 grains/dry standard cubic foot (gr/dscf)] corrected to 7 percent O_2. Compliance must be verified annually by compliance stack tests using EPA Reference Method 5.

The EG also require existing large MWC units to meet an opacity level of 10 percent using a 6-minute block averaging time. Compliance must be verified both by continuous opacity monitors (COMs) and annually using EPA Reference Method 9.

The EG also establish specific emission levels for Cd, Pb, and Hg. Existing large MWC units are required to meet a Cd emission level of 0.040 mg/dscm (18 gr/million dscf) corrected to 7 percent O_2, a Pb emission level of 0.44 mg/dscm (190 gr/million dscf) corrected to 7 percent O_2, and an Hg emission level of 0.080 mg/dscm (35 gr/million dscf) or an 85 percent reduction in Hg emissions corrected to 7 percent O_2, whichever is less stringent. Compliance must be verified annually by compliance stack tests using EPA Method 29.

MWC Acid Gases

The EG for acid gases require existing large MWC units to control SO_2 emissions to a level of either 29 ppmdv or 75 percent reduction (corrected to 7 percent O_2, dry basis, 24-hour geometric mean) and HCl emissions to a level of 29 ppmdv or 95 percent reduction (corrected to 7 percent O_2, dry basis). Compliance with SO_2 emissions must be verified by CEMs, and compliance with HCl emissions must be verified annually by compliance stack tests using EPA Method 26.

MWC Organics

The EG require existing non-ESP large MWC units to meet a dioxin/furan emission level of 30 nanograms per dry standard cubic meter (ng/dscm) total mass corrected to 7 percent O_2. Compliance must be verified annually by compliance stack tests using EPA Reference Method 23. Alternatively, compliance with a 15 ng/dscm corrected to 7 percent O_2 emission limit can qualify the facility for less frequent dioxin/furan testing, as discussed in Section 7.8 [40 CFR 60.38b(b)].

NO_X Emissions

The EG require existing mass burn waterwall large MWC units to control NO_X emissions to a level of 205 ppmdv [corrected to 7 percent O_2, dry basis, on a daily (24-hour) block arithmetic mean basis]. Compliance must be verified by using CEMs. If the City reconstructs its existing mass burn refractory combustors, rather than replacing them with mass burn waterwall combustors, the EG would set no limit on NO_X emissions. However, the City intends to install SNCR and meet a 205 ppmdv NO_X limit, even if not strictly required.

Good Combustion Practice Emissions

The EG require all existing large MWC units to comply with specified operating practices that reflect GCP. These operating practices address CO levels, organic concentrations, combustor load levels, and flue gas temperatures. A complete discussion of GCP is contained in Section 3.3.1.

For existing mass burn waterwall and refractory large MWC units, the EG specify a CO emission limit of 100 ppmdv (at 7 percent O_2, dry basis) on a 4-hour block average basis. For existing mass burn waterwall rotary MWCs, the emission limit is 100 ppmdv (at 7 percent O_2, dry basis) on a 24-hour block averaged (*i.e.*, daily) basis. Compliance must be verified by using CEMs.

MWCs are allowed to operate at up to 110 percent of the unit's maximum capacity, as achieved during the most recent successful dioxin/furan compliance test. Maximum capacity is determined based on the steam or feedwater flow rate, which must be continuously monitored and recorded according to the American Society of Mechanical Engineers (ASME) methods (see Sections 3.3.1 and 7.9.2).

MWCs must establish a Facility-specific maximum flue gas temperature at the final PM control device inlet (*i.e.*, FF inlet for the proposed improved APC system). The maximum demonstrated PM control device inlet temperature is the maximum 4-hour block average temperature measured during the most recent successful dioxin/furan compliance test. The MWC must then be operated so that the temperature at the final PM control device inlet does not exceed this level by more than 17°C (30°F) (4-hour block basis).

Startup, Shutdown, and Malfunction Periods

The EG emission limits for the various pollutants do not apply during periods of startup, shutdown, or malfunction (S/S/M), which are limited to three hours per occurrence [40 CFR 60.58b(a)(1)]. The startup period commences when the combustor begins the continuous burning of MSW and does not include any warmup period when the unit is combusting only natural gas and MSW is not being introduced to the combustor. The use of MSW solely to provide thermal protection to the grate during the warmup period when MSW is not being fed to the combustor is not considered to be continuous burning.

The City of Tampa hereby requests the Department to allow warmup and S/S/M periods in the Facility's permit conditions that are consistent with the EG requirements. Specifically, the City requests the Department to authorize S/S/M periods of up to three hours per occurrence as allowed by the EG, rather than two hours per day, as suggested by FAC 62-210.700(1). This request should be granted because EPA's EG reflect MACT requirements for MWCs nationwide. The EPA MACT standards were developed after years of study by EPA and they reflect the best and most current operating practices for facilities like the McKay Bay RRF.

For malfunction periods, the Facility would still be required to meet the Department's requirements under FAC 62-210.700 that:

- Excess emissions resulting from startup, shutdown, or malfunction shall be permitted providing best operational practices to minimize emissions are adhered to [FAC 62-210.700(1)].
- Excess emissions which are caused entirely or in part by poor maintenance, poor operation, or any other equipment or process failure which may reasonably be prevented during startup, shutdown, or malfunction shall be prohibited [FAC 62-210.700(4)].
- In case of excess emissions resulting from malfunctions, the Facility shall notify the Department in accordance with FAC 62-4.130 and, if so requested by the Department, a full written report on the malfunctions shall be submitted in a quarterly report [FAC 62-210.700(6)].

Operator Certification and Training

The EG will require eventual full certification of all MWC shift supervisors and MWC chief facility operators by the ASME or an equivalent state-approved certification program. The EG also require that at least one of the following persons be on duty at the MWC at all times during which the MWC is combusting waste: a fully or provisionally certified MWC chief facility operator or a fully or provisionally certified shift supervisor. A provisionally certified control room operator is allowed to "stand-in" during times that a fully or provisionally certified facility chief operator/shift supervisor are off site. All chief facility operators, shift supervisors, and control room operators must also complete the EPA or state-approved operator training course.

In addition, the EG require each MWC owner or operator to develop and maintain a site-specific operating manual and to review it with all employees associated with the operation of the MWC (including MWC maintenance personnel, crane/load operators, and ash handlers). The manual and training must be updated annually. A complete discussion of certification and training requirements is contained in Section 7.9.4.

Fly Ash or Bottom Ash Fugitive Emissions

The EG for fugitive ash emissions restrict visible emissions from ash conveyor systems, transfer points, buildings, or enclosures of ash conveying systems to 5 percent or less of the time during the observation period. Compliance will be verified annually by EPA Reference Method 22 observations. The visible emission limits do not apply during periods of maintenance or repair to ash conveying systems. As described in Section 2.2.9, the City of Tampa is requesting the EG fugitive opacity limits and Method 22 testing requirements in lieu of reasonably available control technology (RACT) requirements at

FAC 62-296.711(2)(a) and Method 9 testing requirements at FAC 62-296.711(3)(a), respectively.

2.2.5 New Source Performance Standards

Applicability of the EPA New Source Performance Standards (NSPS) in Title 40, Part 60, CFR (40 CFR 60) to the Facility was reviewed and is summarized below. These federal NSPS were adopted by FDEP by reference in FAC 62-204.800(7)(b).

Incinerator NSPS (Subpart E)

The existing Facility is subject to Standards of Performance for Incinerators (NSPS Subpart E at 40 CFR 60.50 et. seq.), which is applicable to each incinerator capable of charging more than 45 metric tpd (50 tpd) of MSW and that commenced construction or modification after August 17, 1971. Subpart E requirements are:

- PM emissions limited to 0.18 grams per dry standard cubic meter (g/dscm), which is equivalent to 0.08 gr/dscf, corrected to 12 percent carbon dioxide (12% CO_2) [40 CFR 60.52(a)].
- Daily charging rates and hours of operation shall be recorded [40 CFR 60.53(a)].
- Compliance with the PM emission limit shall be demonstrated by conducting a performance test as required in 40 CFR 60.8 (40 CFR 60.54).

The Facility will be subject to these requirements after the proposed Retrofit. The Subpart Cb EG, as discussed above, are more restrictive than the Subpart E NSPS requirements. The City requests that compliance with the requirement to record the daily charging rate be based on using the Facility's truck scale weight data for a calendar month and MWC operating data for the same calendar month to compute an average daily MSW charge rate to each MWC for that month.

Municipal Waste Combustor NSPS (Subparts Ea/Eb)

The Facility Retrofit is <u>not</u> subject to the Standards of Performance for Municipal Waste Combustors (NSPS Subparts Ea and Eb - 40 CFR 60.50a and 60.50b et. seq., respectively) because nearly all of the proposed improvements to the Facility are being made primarily or exclusively to comply with the EG. At 40 CFR 60.32b(c), the EG explain that such changes do not trigger the NSPS requirements at Subparts Ea and Eb:

> *Physical or operational changes made to an existing municipal waste combustor unit primarily for the purpose of complying with emission guidelines under this subpart are not considered in determining whether the unit is a modified or reconstructed facility under subpart Ea or subpart Eb of this part.*

EPA Region IV has concurred with this determination (letter to David S. Dee, Landers and Parsons, from Winston A. Smith, Director, Air Pesticides and Toxics Management Division, EPA Region IV, August 20, 1996, correspondence no. 4APT-AEB).

Industrial-Commercial-Institutional Steam Generating Unit NSPS (Subpart Db)

The Standards of Performance for Industrial-Commercial-Institutional Steam Generating Units (NSPS Subpart Db - 40 CFR 60.40b et. seq.) apply to steam generating units that commenced construction, modification, or reconstruction after June 19, 1984 and have a total heat input capacity of greater than 100 million British thermal units per hour (MMBtu/hr). The existing Facility is not subject to this NSPS because construction on the existing units began in 1983, before the June 19, 1984 applicability date for Subpart Db.

As noted above, the MWC units have a nominal capacity of 104.167 MMBtu/hour each. Therefore, the Facility units will have a maximum capacity of greater than 100 MMBtu/hour each. Since the proposed Retrofit would be considered a reconstruction under 40 CFR 60.15 for Subpart Db (*i.e.*, the EG exemption from reconstruction cited above applies only to NSPS Subparts Ea and Eb), the Facility after the proposed Retrofit will be subject to NSPS Subpart Db.

Subpart Db requirements potentially applicable to the Facility after the proposed Retrofit are:

- PM emissions are limited to 43 nanograms/joule (ng/J), equivalent to 0.10 pound per MMBtu (lb/MMBtu), for facilities that combust only MSW or MSW and other fuels if the annual capacity factor for fuels other than MSW is 10 percent or less. This standard applies at all times except during periods of startup, shutdown or malfunction [40 CFR 60.43b(d)].

- NO_x emissions are limited to 130 ng/J (0.30 lb/MMBtu) for facilities that simultaneously combust natural gas with MSW unless the facility is subject to a federally enforceable requirement that limits the annual capacity for natural gas to 10 percent or less. This standard is a 30-day rolling average which applies at all times including periods of startup, shutdown, and malfunction [40 CFR 60.44b(d) and (h)].

- Compliance with the PM and NO_x emission limits shall be determined through performance testing as required in 40 CFR 60.8 (40 CFR 60.46b).

- If subject to a NO_x emission standard in 40 CFR 60.44b, continuous emission monitoring for NO_x shall be performed, with emission measurements recorded in units of ng/J or lb/MMBtu (40 CFR 60.48b).

- Reporting and recordkeeping requirements include recording the amounts of each fuel combusted during each day and calculating annual capacity factors individually for each fuel (40 CFR 60.49b).

The City of Tampa hereby requests FDEP to limit the annual capacity for natural gas used by the Facility's auxiliary burners to 10 percent of the total annual capacity for each unit, in accordance with Subpart Db, so that the Facility after the proposed Retrofit will not be subject to emission limits, emission monitoring, or other reporting requirements for NO_x under Subpart Db. The PM emission limit under Subpart Db of 0.10 lb/MMBtu is equal to 12.0 lbs/hour/unit at the maximum heat input rate of 119.8 MMBtu/hour/unit. This emission limit for PM is less restrictive (*i.e.*, greater) than the proposed EG limit of 0.012 gr/dscf at 7 percent O_2 (2.8 lb/hour/unit).

Other NSPS Subparts

The existing Facility, or the Facility after the Retrofit, would not be subject to any other NSPS requirements, since there are no other NSPS subparts potentially applicable to the Facility's MWCs.

2.2.6 National Emission Standards for Hazardous Air Pollutants

The applicability of the EPA National Emission Standards for Hazardous Air Pollutants (NESHAPs) to the Facility was reviewed and is summarized below. The NESHAPS, in 40 CFR 61, were adopted by FDEP by reference in FAC 62-204.800(9)(b). There are two NESHAPs which might be applicable to incinerators or MWCs.

Beryllium NESHAP

The National Emission Standard for Beryllium (NESHAP Subpart C at 40 CFR 61.30 et. seq.) is applicable to incinerators which process beryllium-containing wastes. Since there are minute quantities of beryllium in MSW, the Facility may be subject to NESHAP Subpart C. Requirements under Subpart C applicable to the Facility are:

- Beryllium emissions limited to 10 grams over a 24-hour period [40 CFR 61.32(a)].

- Compliance with the emission limit shall be demonstrated by conducting a performance test (40 CFR 61.33).

The beryllium emission limit under NESHAP Subpart C is less restrictive (*i.e.*, greater) than the existing emission limit for the Facility of 5 grams per 24-hour period or 0.00046 lbs/hr (for the entire Facility, combined units 1 through 4) contained in Specific Condition No. 2 of the Facility's air operating permit (FDEP Permit No. A029-206279). The same beryllium emission limit is proposed for the Facility after the proposed improvements.

Mercury NESHAP

The National Emission Standard for Mercury (NESHAP Subpart E at 40 CFR 61.50 et. seq.) is applicable to plants that process wastewater treatment plant sludges. Since the existing Facility as well as the Facility after the proposed improvements is and will be prohibited from accepting sewage sludge wastes, the Facility is not subject to Subpart E.

2.2.7 Maximum Achievable Control Technology Requirements

The Clean Air Act (CAA) Amendments of 1990 contained changes to Section 112 of the act to control hazardous air pollutant (HAP) emissions from major sources of HAPs. A major source of HAPs is one that has the potential to emit 10 tons per year of a single HAP, or 25 tons per year of any combination of HAPs. The Facility is an existing major source of HAPs. Of the pollutants listed in Table 1-1 in Section 1, the following are defined in Section 112(b) as HAPs: mercury, cadmium, beryllium, hydrogen chloride, hydrogen fluoride, dioxin, and ammonia. Table 1-1 shows that the existing Facility has the potential to emit 26 tons per year of hydrogen fluoride.

On December 27, 1996, EPA promulgated rules in 40 CFR 63 Subpart B requiring case-by-case control technology determinations, in accordance with CAA Section 112(g)(2)(B), for constructed or reconstructed major sources of HAPs, unless an emission limitation established under CAA Section 112 will be met. FDEP is making changes to FAC 62-204, 62-210, and 62-212 to implement these requirements.

The Facility Retrofit meets the definition of a reconstructed major source in 40 CFR 63.41, and there is no emission limitation set under CAA Section 112 that applies to the Facility. However, 40 CFR 60 Subpart Cb EG for MWCs, described above, were developed under Section 129 of the CAA specifically to require MACT for HAPs, and the criteria established in the CAA for emission limitations under Section 129 [in Section 129(a)(2)] are essentially identical to the criteria established in the CAA Section 112(d)(1) and 112(d)(2) for MACT. Therefore, because the facility will be meeting a MACT standard, no case-by-case MACT determination is necessary.

2.2.8 Compliance Assurance Monitoring Rule

EPA proposed the latest draft of the Compliance Assurance Monitoring (CAM) rule in August 1996. The rule will require some sources to install enhanced monitoring systems to prove compliance with the CAM standards. EPA expects to publish the final CAM rule in late 1997. The City of Tampa will implement the applicable requirements of the final rule at the Facility whenever it is promulgated.

2.2.9 Florida Air Regulations

Florida's air regulations concerning the Facility Retrofit are contained in Section 62-210 FAC. Specifically, Section 62-210.300 FAC, requires appropriate permits prior to modification "to any source which emits or can reasonably be expected to emit any air pollutant...unless exempted pursuant to Department rules or statutes."

This air permit application is being submitted to FDEP as required by FAC 62-210.300(1) for an air construction permit. The information contained herein satisfies the general preconstruction review requirements for a source modification that is not subject to the PSD or non-attainment NSR requirements as delineated by FAC 62-212.300.
As discussed above, NSPS and EG requirements for MWCs are adopted, mostly by reference, in the Florida Administrative Code under 62-204.800(7)(b) and 62-204.800(8)(b), respectively. Other air quality requirements in the FAC applicable to the Facility after the proposed improvements are discussed below. These requirements are contained either in FAC 62-296, which contains Emission Standards for Stationary Sources, or FAC 62-297, which contains Emission Monitoring Requirements for Stationary Sources.

The existing Facility and the Facility after the proposed improvements must meet the Florida General Pollutant Emission Limiting Standards in FAC 62-296.320(1), 62-296.320(2), 62-296.320(3), 62-296.320(4)(b), and 62-296.320(4)(c). The particulate and opacity emission limiting standards of FAC 62-296.320(4)(a) do not apply to any emission units at the Facility because the MWC units are subject to PM standards at FAC 62-296.401, and the other emission units do not produce a finished product through a chemical or physical change.

Emission standards for incinerators are set forth in FAC 62-296.401. Since the Facility after the proposed improvements will need to meet the EG limits for PM of 0.012 gr/dscf corrected to 7 percent O_2, the Facility will also comply with the FAC 62-296.401(3)(a) requirement of 0.08 gr/dscf corrected to 50 percent excess air. Both the existing Facility and the Facility after the proposed improvements will also comply with the FAC 62-296.401(3)(b) requirement of no objectionable odor. Emission monitoring requirements for incinerators are described in FAC 62-297.330. The proposed improvements to the Facility will meet the more stringent monitoring requirements under the EPA EG for MWCs.

As discussed in Section 5.0, the entire State of Florida is either classified as attainment or considered to be in attainment (*i.e.*, unclassifiable) with respect to the national AAQS for all pollutants. However, the Facility is located in maintenance areas for lead, ozone, and PM. Therefore, the Facility is potentially subject to RACT requirements for these pollutants.

The lead maintenance area is described in FAC 62-204.340(4)(c) and is associated with a battery recycling facility. Lead RACT requirements are given in FAC 62-206.600 to 62-296.605. There are no RACT requirements in these sections applicable to either the existing Facility or the Facility after the proposed improvements.

The ozone maintenance area, as described in FAC 62-204.340(4)(a), encompasses both Hillsborough and Pinellas Counties. VOC RACT requirements are given in FAC 62-296.500 to 62-296.516 and FAC 62-296.401 to 62-296.415. There are no VOC RACT requirements in these sections which would apply to the Facility after the proposed improvements. The VOC and NO_x RACT requirements in FAC 62-296.570 are not applicable since these requirements apply only to Broward, Dade, and Palm Beach Counties, as described at FAC 62-296.500(1)(b).

The PM maintenance area, as described in FAC 62-204.340(4)(b), subjects the Facility to a number of potential PM RACT requirements as described in FAC 62-296.700. Emission units at the Facility with total allowable emissions of PM less than one ton per year are exempt from RACT requirements by FAC 62-296.700(1)(c). Unconfined PM emissions from open stockpiling of materials, vehicular traffic, and other emissions from roads and plant grounds, or construction activities, are also exempt from RACT requirements by FAC 62-296.700(1)(e). Non-exempt emission units are subject to the RACT requirements in FAC 62-296.700(4) for permit content, FAC 62-296.700(5) for circumvention, and FAC 62296.700(6) for operation and maintenance plans.

Specific emission limiting RACT requirements for PM are given in FAC 62-296.700 to 62-296.712 and FAC 62-296.401 to 62-296.415. As noted earlier, the Facility MWC units after the proposed improvements will perform better than the Florida PM requirements for incinerators given in FAC 62-296.401(3). Emission units at the Facility other than the MWC units would be subject to the specific PM emission limiting standards given in FAC 62-296.711 for materials handling, sizing, screening, crushing, and grinding operations. These PM RACT requirements are applicable to:

- Loading/unloading of materials to/from containers such as trucks and storage structures [FAC 62-296.711(1)(a)].
- Non-portable conveyor systems [FAC 62-296.711(1)(b)].
- Storage of materials in silos or enclosed bins with capacities of 50 cubic yards or greater [FAC 62-296.711(1)(c)].

Thus, these RACT requirements would be applicable to fugitive PM emissions and PM from the lime and activated carbon storage silos unless exempted by virtue of PM emissions being less than one ton per year [FAC 62-296.700(1)(c)].

The specific PM RACT emission limitations are:

- No visible emissions (*i.e.*, five percent opacity) [FAC 62-296.711(2)(a)].
- Emissions exhausted through a stack or vent shall be limited to 0.03 gr/dscf or less for operations totally or partially enclosed to comply with the RACT visible emissions limits [FAC 62-296.711(2)(b)].

The lime and activated carbon storage silos at the Facility will be equipped with dust collectors (*i.e.*, baghouses) to control PM emissions during filling operations. As part of the bid specifications for the Facility improvements, dust collectors with design outlet loadings of 0.015 gr/dscf for silos and ash building ventilation systems will be specified. This proposed emission limitation exceeds FDEP's RACT requirements.

Pursuant to FAC 62-296.711(3)(c), the City requests that compliance for these minor sources equipped with baghouses (i.e., the lime and carbon storage silos) be determined using Method 9 visible emission tests indicating no visible emissions (five percent opacity) in lieu of particulate stack tests.

Pursuant to FAC 62-296.711(2)(c) and FAC 62-279.620, the City is requesting FDEP to approve the following alternative limitations as RACT for fugitive Facility PM emissions based on the EG requirements in Subpart Cb. Ash conveyors and ash storage, handling, and transfer facilities will be enclosed to minimize fugitive emissions. However, some fugitive emissions may still occur from small openings in the enclosure, from seams around access hatches, from building doors, etc. Also, maintenance and repair activities may require opening of an enclosure, which could generate short-term fugitive emissions.

EPA recognized in the EG that it is not possible to eliminate all visible emissions of ash at all times. EPA's EG standards in 40 CFR 60.55b(a) do not allow visible emissions "in excess of 5% of the observation period (*i.e.*, nine minutes per three-hour period), as determined by EPA Reference Method 22...." Stated differently, visible emissions are allowed up to 9 minutes per 3-hour observation period. As noted in 40 CFR 60.55b(b), this standard applies to both fugitive emissions and emissions from buildings or enclosures of ash conveying systems. The standard for visible emissions does not apply during maintenance and repair activities of ash conveying systems [40 CFR 60.55b(c)]. The EG were developed by EPA after spending several years studying MWCs in the United States and these limits are based on the use of MACT, which represents the level of performance that is attained by the best 12 percent of all existing facilities. In light of these facts, the City requests that FDEP approve under FAC 62-296.711(2)(c) the EG limitations for fugitive ash emissions as RACT for the Facility.

The City also requests, in accordance with FAC 62-297.620, that compliance for fugitive ash emissions be determined using Method 22, rather than Method 9, as specified in FAC 62-296.711(3)(a). Both EPA methods are incorporated by reference in FAC 62-204.800 and 62-297.401. Since Method 22 is more appropriate for determining the frequency of visible emissions from fugitive sources when there is no need to determine the opacity level, Method 22 is more suitable to the fugitive ash emission sources.

2.2.10 Florida Mercury Rule

Section 62-296.416 FAC (the Florida Mercury Rule) establishes standards for mercury emissions from all MWC facilities with charging rates equal to or greater than 40 tpd. The City of Tampa is proposing to meet the Florida standards for mercury using post-combustion control equipment. This equipment, consisting of a powdered ACI system for each unit, is included in this permit application as part of the proposed improvements to meet the EG. Therefore, the emission standards of FAC 62-296.416(3)(a) will apply, which are that all mercury emissions shall not exceed 70 μg/dscm corrected to 7 percent O_2, or 80 percent control shall be achieved, whichever occurs first.

After the Retrofit is completed, the Facility shall be operating to comply with the more stringent of the Florida Mercury Rule or the EG: 70 μg/dscm (Florida Rule) or 85 percent control (EPA EG), whichever is less restrictive. Like the EPA EG, the Florida Mercury Rule for post-combustion control also contains flue gas temperature and carbon usage rate requirements. Since the existing Facility does not use acid gas control equipment (*i.e.*, scrubbers), compliance with the Florida Mercury Rule is not required for the existing Facility until the date the Facility is required to demonstrate compliance with the EG for acid gases. Compliance shall be determined by annual EPA Method 29 stack tests. The existing Facility has already been required to perform annual mercury tests since 1993 for emissions inventory purposes pursuant to FAC 62-296.416(3)(c).

2.3 Permit Requirements

2.3.1 Existing Permits

The Facility was originally constructed in 1967 as a solid waste incinerator without heat recovery. The Facility had three 250-tpd units, and operated from 1967 until it was closed in 1979. On July 23, 1981, the City of Tampa submitted a PSD application for construction of a new refuse-to-energy facility with four 250-tpd units on the site of the closed incinerator. A final PSD determination was issued by the Florida Department of Environmental Regulation (now FDEP) on May 28, 1982, and the permit was issued by EPA Region IV on July 2, 1982 (PSD-FL-086). The McKay Bay Refuse-to-Energy Facility has a current state air operating permit (AO29-206279) which includes the following emission limits listed below. Appendix A contains current air permits.

Combined Emission Limit - Units 1-4

PM	-	0.025 gr/dscf at 12% CO_2 and 27.9 lb/hr
SO_2	-	170.0 lb/hr
NO_X	-	300.0 lb/hr
VOC	-	9.0 lb/hr
Lead	-	3.1 lb/hr

Fluorides	-	6.0 lb/hr
Mercury	-	0.6 lb/hr
Beryllium	-	5 grams per 24 hours and 0.00046 lb/hr

Fly Ash Silo Emission Limit

PM	-	0.025 gr/dscf, up to 0.36 lb/hr

The City has applied (June 1996) for a Title V Major Source Operating Permit, as required under FAC 62-213.

2.3.2 Proposed Revisions to Permit

The City would like FDEP to amend the Facility's permit to allow construction, testing, and temporary operation of the Retrofit, as described in Section 3, below. In addition, the City would like FDEP to amend the permit in the manner described in the following parts of this section.

Definition of Allowable Fuels

Current permit conditions for the Facility allow the incineration of MSW and waste oil from spills cleaned up by the Tampa Port Authority (waste oil up to 10,000 gallons per day from tanker trucks or 10 tpd from fiber drums allowed). MSW is defined in the permit as any solid waste, except sludge, resulting from the operation of residential, commercial, governmental, or institutional establishments that would normally be collected, processed, and disposed of through a public or private solid waste management service. As defined in the permit, MSW includes yard trash, but does not include solid waste from industrial, mining, or agricultural operations. MSW accepted at the Facility may be generated outside the City limits. MSW includes waste tires provided they are collected as part of the normal waste stream (not segregated) and do not exceed more than three percent of the total charge at any given time. Certain materials cannot be charged at the facility, including water treatment plant sludges, biomedical waste, radiological waste, and hazardous waste.

The Facility currently can accept a wide variety of materials that fit within the broad definition of MSW. These materials may be received either as a mixture or as a single-item stream of household, commercial, or institutional discards.

Federal regulations concerning MWCs use different definitions for MSW and allow different materials. For example, Section 129(g)(5) of the Clean Air Act defines "Municipal Waste" as:

> *refuse (and refuse-derived fuel) collected from the general public and from residential, commercial, institutional, and industrial sources consisting of paper, wood, yard wastes, food wastes, plastic, leather, rubber, and other combustible materials and non-*

combustible materials such as metals, glass and rock...[but] does not include industrial process wastes or medical wastes that are segregated from such other wastes.

An equally broad definition of MSW is included in EPA's EG for MWCs (40 CFR 60.51b):

Municipal solid waste or municipal-type solid waste or MSW means household, commercial/ retail, and/or institutional waste. Household waste includes material discarded by single and multiple residential dwellings, hotels, motels, and other similar permanent or temporary housing establishments or facilities. Commercial/retail waste includes material discarded by stores, offices, restaurants, warehouses, nonmanufacturing activities at industrial facilities, and other similar establishments or facilities. Institutional waste includes material discarded by schools, nonmedical waste discarded by hospitals, material discarded by nonmanufacturing activities at prisons and government facilities, and material discarded by other similar establishments or facilities. Household, commercial/retail, and institutional waste does not include used oil; sewage sludge; wood pallets; construction, renovation, and demolition wastes (which includes but is not limited to railroad ties and telephone poles); clean wood; industrial process or manufacturing wastes; medical waste; or motor vehicles (including motor vehicle parts or vehicle fluff). Household, commercial/retail, and institutional wastes include: (1) Yard wastes; (2) Refuse-derived fuel; and (3) Motor vehicle maintenance materials limited to vehicle batteries and tires...

In the EG preamble (60 FR 65392), the MSW definition is further clarified to include either a mixture or a single-item waste stream of household, commercial, and/or institutional discards. Although the definition of MSW does not include used oil, sewage sludge, wood pallets, medical waste, etc., these wastes can be intermixed and combusted with MSW (*i.e.*, the regulations do not prohibit their combustion).

In the near future, the City of Tampa will spend $80 million or more to install new APC equipment and make other improvements at the Facility. These improvements will ensure that the Facility can meet the stringent new EG limitations, at all times, under a wide range of operating conditions. In light of the improvements that will be made to the Facility, the City requests that the permit conditions for the Facility be amended to ensure that the City is allowed to accept and process all of the non-hazardous solid wastes that are delivered to the Facility for disposal. The City requests that the permit be consistent with the new EG requirements for MWCs, and consistent with industry practice at newer facilities in Florida. Specifically, the City requests that the permit for the Facility state:

The authorized fuels for the facility are non-hazardous solid wastes including municipal solid waste (MSW) as defined at 40 CFR 60.51b, except those materials that are prohibited by state or federal law or otherwise prohibited below. Non-hazardous solid waste materials acceptable for processing together with municipal solid waste include the following:

- *Wood pallets; construction, renovation, and demolition wastes; clean wood; industrial process or manufacturing wastes; yard wastes; refuse-derived fuel; and motor vehicle maintenance materials.*

- *Items or materials suitable for human, plant or domesticated animal use, consumption and/or application whose shelf-life has expired or which the generator wishes to remove from the market and ensure the proper destruction of such as, but not limited to: off-specification or expired consumer-packaged products and pharmaceuticals, non-prescription medications, health care products, toothpaste, hand creams, cosmetics, shampoos, foodstuffs, nutritional supplements, returned goods, controlled substances, etc.*

- *Consumer-packaged products intended for human or domesticated animal use and/or application but not consumption, such as, but not limited to: carpet cleaners, household or bathroom cleaners, polishes, waxes, detergents, etc.*

- *Waste materials generated in the manufacture of items in the categories above that are functionally or commercially useless (expired, rejected or spent), or finished products not yet formed or packaged for commercial distribution.*

- *Packaging materials, natural and synthetic fibers, clothing, floor coverings of all types, fabric remnants, empty containers, debris items such as, but not limited to: aprons, gloves, floor sweepings and paints.*

- *Waste materials that contain oil from routine cleanup of industrial or commercial establishments and machinery (such as, but not limited to non-terne or specialty oil filters) or the oil-contaminated materials used in the cleanup of spills of used or virgin petroleum products (including, but not limited to items such as: rags, lints, and adsorbents).*

- *Waste materials generated by manufacturing, industrial, commercial or agricultural activities including, but not limited to items such as: filtercake from the manufacture of synthetic oil, paint overspray, or other filtration materials from industrial processes and systems.*

- *Confidential documents (including, but not limited to business records, lottery tickets, event tickets and microfilm).*

- *Contraband which may be disposed of at the request of appropriately authorized local, state, or federal governmental agencies.*

The authorized fuels may be received either as a mixture or as a single-item stream of household, commercial, institutional, agricultural or industrial discards. The facility may receive oil spill debris. Waste tires may be accepted, but may not exceed 3% of the facility's fuel. The authorized fuels shall be well mixed with MSW, or alternately charged with MSW. The facility owner and operator shall not knowingly burn prohibited fuels, such as lead acid batteries, nuclear wastes, and sewage sludge from Publicly Owned Treatment Works.

All of the allowable materials can be safely combusted at the Facility because the units are designed to handle a wide range of operating conditions. The combustion of these materials will not adversely affect the Facility's ability to comply with permit requirements. The Facility will be equipped with SDAs, FFs, SNCR, and ACI systems, which are designed to handle all of the operating conditions that are likely to occur while combusting the normal fuels, including all of the fuels described herein. These APC systems perform well, even when there are fluctuations in the Facility's operating conditions. The waste oil and waste tires will be mixed with the MSW to minimize these fluctuations. Further, the Facility will have CEMs, which will monitor the Facility's performance at all times and under all operating conditions.

Operating Conditions

Although the physical capacity of the Facility will not be changed as part of the proposed Retrofit, the City is requesting that the Facility's operating window be redefined consistent with current industry practices to allow operation under a wide range of MSW heat contents. The Facility consists of four MWCs and each MWC is capable of incinerating a nominal 250 tpd of waste. Each unit is currently permitted to combust up to 250 tpd of MSW.

MSW is a heterogenous material and the estimated heat content of MSW ranges from 3,800 to 6,000 Btu/lb, based on the amount of moisture and non-combustible materials present (average estimated to be 5,000 Btu/lb based on recent data). Since emissions and other combustion parameters are related to the incineration of combustible materials, recent industry practice has been to rate MWC units on gross heat input, similar to fossil fuel boilers and other types of combustion equipment, rather than MSW tonnage. As a practical matter, it is impossible to accurately weigh the amount of MSW combusted during short time intervals, but compliance with permitted heat input rates can be determined from steam or feedwater flow measurements, which are directly related to heat input based on the unit's efficiency.

In the 1991 EG for MWCs (40 CFR 60 Subpart Ca), EPA recognized that MWCs are "heat input devices" and that actual capacity should be determined by heat input rather than by the weight of MSW charged, due to the varying heat content of MSW. As a result, EPA promulgated maximum capacity requirements based on steam or feedwater flow measurements, which have been retained in the current EG (40 CFR 60 Subpart Cb). The measurement of steam or feedwater flow, based on ASME methods, gives a practical method to continuously measure facility load and, together with particulate device temperature and flue gas CO measurements, demonstrate GCP. It is EPA's position that MSW throughput measurements based on weight are not accurate, and that all correlations with emission rates should be based on steam or feedwater flow rates. It is also EPA's opinion that measuring MSW throughput by weight, in addition to measuring steam or feedwater flow rates, is redundant (James Kilgroe, EPA Office of Air Quality Planning and Standards, telephone conversation, April 30, 1997).

Therefore, the City of Tampa requests that the current permit limits for MSW throughput by weight be deleted and the permit limits modified to be consistent with EG requirements. Requirements for the monitoring and reporting of solid waste throughput would be retained, although modified, consistent with 40 CFR Subpart E. Maximum unit capacity will be determined by steam or feedwater flow, based on annual compliance tests and continuous steam flow measurements (averaged over 4 hours), as required by the EG. The maximum demonstrated MWC unit load is defined in 40 CFR 60.51b as the highest 4-hour arithmetic average steam or feedwater flow, measured in accordance with 40 CFR 60.58b(i)(6), during the most recent dioxin stack test which demonstrated compliance. After the maximum unit capacity is established during the annual stack test, the unit will be operationally limited by 40 CFR 60.53b(b) to a load level of 110 percent or less of the maximum demonstrated MWC unit load. Compliance with this limit is based on continuous steam or feedwater flow measurements calculated in 4-hour block arithmetic averages. Including these EG requirements for steam or feedwater flow as permit conditions will effectively limit the Facility's capacity in a manner that is consistent with the EG requirements and current industry practice.

While there might be a slight increase in Facility emissions due to an expanded operating window (*i.e.*, allowing up to 115 percent of a nominal load of 250 tpd/unit vs. the currently permitted 250 tpd/unit), this is more than offset by decreases in emissions due to the additional APC equipment and other design improvements. The Facility currently has no acid gas controls, while the SDA/FF combination after the proposed improvements will result in a minimum reduction in acid gas emissions of 75 percent for SO_2 and 95 percent for HCl. Similarly, the SNCR is expected to reduce NO_x emissions on average by about 50 percent. For PM, the current permit limit is for 0.025 gr/dscf at 12 percent CO_2 while the EG limit is 0.012 gr/dscf at 7 percent O_2, a reduction of about 50 percent in the permitted emission limit. A similar reduction in actual facility PM and MWC metal emissions (other than mercury) is expected after the proposed SDA/FF systems are installed. The SDA/FF/ACI combination will decrease mercury emissions by greater than 85 percent. Actual emissions of MWC organics (*i.e.*, total dioxins and furans) will be decreased far more due to the proposed improvements (increased combustion controls to minimize combustion formation, reduced PM control device operating temperatures to minimize post-combustion formation, and ACI for additional removal of MWC organics) than a slight increase due to the operating window. The improved combustion controls should also result in a decrease in actual CO and VOC facility emissions. However, even if there were a 15 percent increase in currently permitted VOC or potential CO emissions (currently facility emissions of 39.4 and 178.4 tons per year, respectively) due to an expanded operating window, the increases would not be significant for PSD purposes. Thus, the facility improvements including the proposed change in the definition of the operating window, will not result in any emissions increases greater than the PSD significant emission rates for all PSD pollutants. In fact, substantial decreases in actual facility emissions due to the proposed improvements are expected, which should more than offset any slight increases due to an expanded operating window.

VOC Emission Limit

The City requests that the VOC emission limit in the current air operating permit be deleted, because it is redundant with other requirements in the EG. EPA chose not to include a VOC limit in the EG. Rather, the EG require GCP for the control of both VOC and CO. The EG require continuous monitoring of CO, steam or feedwater flow, and FF inlet temperature, in order to ensure GCP. CO monitoring and control is a good surrogate for VOC monitoring and control, because their formation mechanisms are the same. The continuous monitoring requirements for GCP are more stringent than a stack test requirement for VOC.

Stack tests were performed for VOC emissions from the Facility in September, 1985, and in August, 1991. The results showed that the four-unit total results of 2.7 lb/hr and 1.21 lb/hr, respectively, were both well below the permit limit of 9.0 lb/hr. After completion of the retrofit, including upgrading of combustions systems and controls, and initiation of continuous monitoring of GCP, it is likely that VOC emissions will remain at or below these levels. Appendix E contains stack test result summaries for the Facility.

For all of these reasons, the City requests that the VOC limit be dropped as unnecessary and redundant.

2.4 Conclusions

The proposed improvements to the APC system at the Facility will comply with the EPA EG (40 CFR 60, Subpart Cb), Florida Mercury Rule (Section 62-296.416 FAC), and other Florida air regulations for permits and certificates (Sections 62-210 and 62-212 FAC). Since the proposed project will result in no change to, or significant reductions in, emissions of PSD criteria pollutants (40 CFR 52.21), the APC improvements are not subject to PSD requirements.

The EG limits are more stringent than the emission limits listed in the existing air operating permit, except for HF and Be, which are not regulated by the EG. The proposed project will comply with the Facility's current permit limits for HF and Be after the proposed Retrofit.

Section 3
Control Technology

3.1 Overview of Retrofit Project

3.1.1 Background

The City is proposing to undertake certain improvements to the Facility. As discussed in Section 1, the proposed improvements (Retrofit) are designed to allow the Facility to meet new air emission control and monitoring requirements established by EPA's EG. The overall impact of the Retrofit will be a net reduction in the current air pollutant emissions from the Facility and enhanced monitoring. The current physical capacity of the Facility to process MSW will not be changed as a result of the Retrofit.

The Facility consists of four mass-burn combustion units, each operating independently of one another. The main components of each combustion unit include a reciprocating grate furnace coupled to a rotary kiln, a waste heat boiler, and a two-field ESP located downstream of the boiler outlet. The gases from the ESP outlet pass through an ID fan before being discharged through one of two steel stacks. Two combustion units are connected to a common flue in each stack (i.e., there are two stacks serving the four MWC units).

3.1.2 Existing Combustion System

The existing combustion system installed on each unit consists of a refractory lined furnace coupled to a rotary kiln. The furnace section was intended to be the primary combustion zone and incorporates a reciprocating grate. Final burnout of the residue was intended to be accomplished in the rotary kiln section. The majority of the combustion gases from the furnace area were designed to bypass the rotary kiln through an overhead bypass duct. Primary combustion air is supplied from beneath the grate as underfire air. The flue gases from the bypass duct and discharge end of the kiln are recombined prior to passing through a waste heat boiler.

Major advancements in refuse combustion technology have been made since the existing systems were installed in 1985. These advancements offer greater combustion control and improved combustion efficiency over the system currently installed at the Facility. The City is planning to completely replace the combustion system on each unit with a state-of-the-art system as part of the Retrofit. The existing boilers will also be replaced or substantially improved as part of the Retrofit.

3.1.3 Existing Air Pollution Control Equipment

The existing APC equipment installed on each unit consists of a two-field ESP. The ESPs are installed at the boiler outlets and are designed to remove PM from the flue gas stream prior to discharge to the atmosphere. The ESPs were originally designed for an outlet loading of 0.025 gr/dscf (57.2 mg/dscm). Data from periodic stack tests conducted at the Facility since it began commercial operation in 1985 show that actual particulate emissions from the ESPs have been generally below 0.020 gr/dscf (45.8 mg/dscm). While the ESPs have performed satisfactorily to date, the City has decided to replace these devices as part of the Retrofit with FFs for PM control. This decision was based in part on the anticipated age of the ESPs at the time the Retrofit is expected to be completed, and the inherent ability of FFs to provide additional control of other pollutants.

3.2 Overall Limits of Work

The Retrofit involves substantial improvements to most of the major systems at the Facility. The existing grate furnace, rotary kiln, ESP, and ID fan on each unit will be completely replaced. The existing waste heat boiler on each unit will be replaced or substantially improved to be compatible with the new combustion system. A new SDA, FF, powdered ACI system, and ID fan will be installed downstream of each boiler. In addition, an SNCR system [an ammonia (or urea) injection system] and auxiliary fuel burners will be installed in the combustion zone of each furnace. CEMs will be installed in the outlet ducts of the boiler and the outlet of the FF. The two existing steel stacks will also be replaced as part of the Retrofit. One four-flue replacement stack will be constructed. The new stack is anticipated to have a concrete shell with dedicated flues for each unit. New bottom and fly ash handling systems will be installed to support the new combustion and APC systems, and a new residue storage building will be constructed. The only areas of the Facility which will not be substantially changed as part of the Retrofit are the refuse receiving and charging area and the power generation area.

3.3 Proposed Combustion and Air Pollution Control Equipment/ System Improvements

The proposed Retrofit will include the removal of the existing grate furnaces, rotary kilns, ESPs, and ID fans. The existing waste heat boiler on each unit will be removed or substantially improved. A new combustion system will be installed. Improvements to the air pollution control systems will be designed to reduce overall air emissions from the Facility including fugitive dust. The type and configuration of equipment proposed under the Retrofit will be similar to that currently employed on new MWCs, and collectively will provide a high degree of emissions control. Descriptions of the primary improvements to be undertaken as part of the Retrofit are provided below.

3.3.1 Combustion System/Good Combustion Practices

The following combustion controls will be included as part of the new combustion system to be installed during the Retrofit. The new combustion system will be designed to minimize the type and amount of pollutants generated.

Waste Feeding - The rate and characteristics (*e.g.*, moisture content, heating value, volatile content) of the refuse being fed to the combustion unit can have a significant impact on the quality and stability of the combustion process. Major swings in the feed rate and/or waste characteristics can reduce the combustion efficiency resulting in increased pollutant levels. Several systems will be used at the Facility to maintain a reasonably uniform refuse feed rate and composition. The existing refuse pit will be used in combination with the existing overhead bridge cranes to continue to mix the different loads of waste and thereby provide a more uniform fuel composition. A consistent feed rate to each unit will be obtained through a computer controlled feed system.

Combustion Air/Combustion Products Mixing - The availability of sufficient combustion air at the appropriate locations is essential to efficient combustion. Combustion air fans will be installed as part of the new combustion system to supply the appropriate amounts of underfire and overfire air. A computer based furnace control system will be used to control the distribution of total overfire and underfire air. The proper mixing of combustion air with the combustion products is required to achieve the desired combustion efficiency. Proper mixing will be provided within the new furnace/combustor through the use of strategically positioned front and rear wall overfire air ports. The configuration of the new furnace will also be designed to enhance the mixing of combustion air and combustion products.

Particulate Matter Carryover - The level of pollutants released from the combustion unit is affected by the amount of PM that is entrained in the flue gases and carried out of the combustor. The solid particles, or particulate, include both organic and inorganic materials. PM carryover will be minimized at the Facility through a combination of consistent feed rate, proper combustion air levels, and controlled gas velocities.

Combustion Monitoring/Good Combustion Practices - To ensure consistent combustion efficiency, it is necessary to monitor key operating data. GCP were selected by EPA as the best demonstrated technology for controlling MWC organic emissions (*e.g.*, dioxins/furans). GCP include the proper design and operation of an MWC as described above. The use of GCP reduces MWC organic emissions by promoting more thorough combustion. The format selected by EPA for ensuring GCP is a mix of operational and work practice standards that can be readily monitored. Since measurement technologies for continuously monitoring MWC organic emissions are not available or are not practical, standards for GCP ensure that MWC organic emissions are minimized on a continuous basis. The EG specify three operating parameters to be continuously monitored to ensure GCP: (1) carbon monoxide (CO) emissions; (2) combustor load levels; and (3) flue gas temperature at the inlet to the PM control device. Operator certification and training are also required because EPA considers operator training to be an integral part of GCP implementation.

CO concentrations are a good indicator of combustion efficiency, and high MWC organic emissions are associated with poor combustion. Techniques used to minimize CO emissions to comply with the EG will also minimize MWC organic emissions. Thus, the EG contain CO emission limitations, which vary according to MWC design. For mass burn waterwall and refractory MWCs, the CO emission limit is 100 ppmdv corrected to 7 percent O_2 on a 4-hour block-averaged basis. For mass burn waterwall rotary MWCs, the emission limit is 100 ppmdv corrected to 7 percent O_2 on a 24-hour block-averaged (*i.e.*, daily) basis.

Combustor load is also related to MWC organic emissions. At loads significantly above maximum capacity, PM carryover would increase and furnace residence time would decrease, contributing to increased MWC organic emissions at high loads. The EG define the "maximum demonstrated MWC unit load" as the highest 4-hour arithmetic average unit load achieved during 4 consecutive hours during the most recent dioxin/furan compliance tests which demonstrates compliance with the dioxin/furan EG limit. Subsequent operations of the MWC unit are then limited to load levels of 110 percent or less of this level based on 4-hour block-averaged measurements. Steam flow or feedwater flow were determined by EPA to be the only practical methods to measure load.

MWC organics can form on fly ash in the presence of excess oxygen at temperatures above 450°F. Therefore, the EG require operating the PM control device at temperatures which prevent the formation of MWC organics, and monitoring the flue gas temperature at the inlet to the PM control device. The EG define the "maximum demonstrated PM control device temperature" as the highest 4-hour arithmetic average flue gas temperature measured at the PM control device inlet during 4 consecutive hours during the most recent dioxin/furan compliance tests which demonstrates compliance with the dioxin/furan EG limit. Subsequent operations of the MWC unit must maintain the PM control device inlet temperature, on a 4-hour block-averaged basis, to the maximum demonstrated temperature plus 17°C (30°F).

The control system upgrades will continuously monitor compliance with GCP as described above. The instrumentation and control system upgrades at the Facility will provide for routine monitoring and recording in the control room of key GCP parameters for each MWC unit, including: CO concentration, steam flow or feedwater flow, and flue gas temperature at the inlet to the FF. In addition, the chief facility operator, shift supervisors, and control room operators will complete the training and certification requirements of the EG. An operating manual and training program will also be developed for all applicable employees associated with MWC operation as required by the EG. The certification and training requirements are discussed in more detail in Section 7.9.4.

3.3.2 Spray Dryer Absorber

The proposed Retrofit includes the installation of an SDA at the outlet of each economizer/boiler. The SDA will be specifically designed to control acid gas emissions. The SDA will also provide a measure of control for organics and volatile metal emissions by cooling the flue gases. This will cause a significant percentage of these pollutants to condense on PM, which can be captured downstream by the particulate control device. Since the SDA rapidly cools the flue gases, it also minimizes the formation of MWC organics in the PM control device.

Pebble lime (CaO) will likely be used as the alkaline reagent in the SDA. The CaO for all four SDAs will be stored in two silos. Lime slakers will be used to hydrate the CaO with water to form a calcium hydroxide [$CaO + H_2O \rightarrow Ca(OH)_2$] slurry. The slurry will be stored in slurry tank(s) and transferred to each SDA by transfer pump. The slurry and additional dilution/cooling water will be pumped to rotary atomizer(s) or dual fluid nozzle(s) located at the top of the SDA. The rotary atomizer or dual fluid nozzles will reduce the slurry to fine particles which will be sprayed into the absorption chamber with the flue gas flow. The amount of lime slurry and dilution water added will be closely controlled, in response to the data provided by the SO_2 CEM installed in each FF outlet duct, and the thermocouples installed in each SDA outlet duct, respectively.

The SDA process will produce a dry, relatively free-flowing powder consisting of unreacted lime, salts, and fly ash. The most prevalent salts will be calcium chloride ($CaCl_2$), calcium sulphite ($CaSO_3$), and calcium sulphate ($CaSO_4$).

The proposed SDAs will be designed to provide a very high level of acid gas control. Emission test data from other MWCs employing similar SDAs indicate that this technology is capable of achieving the EG requirement of 75 percent removal of SO_2 and 95 percent removal of HCl on a routine basis.

3.3.3 Fabric Filter

The proposed Retrofit includes the use of a FF downstream of each new SDA. The FF, commonly referred to as a baghouse, will be designed to control particulate emissions, including trace heavy metals. The FF will also provide a measure of additional acid gas control as the flue gases pass through the unreacted lime caught on the outside of the filter bags.

The FFs will contain a number of fabric bags. Particulate laden gas from the SDA outlet will enter the FF inlet plenum where dampers will distribute the flue gas to each compartment. PM is filtered from the flue gas as the gas passes through the combination of the accumulated dust cake and the bag fabric. The layer of dust cake which accumulates on the bags will be periodically removed using either a pulse jet, reverse air, or mechanical shaker process. The released dust will then fall into the ash collection hoppers located at the bottom of the FF.

The proposed FFs will be designed to provide a very high level of particulate removal. Emission test data from other MWCs employing similar FFs indicate that particulate emissions can be reduced to the EG requirement of 0.012 gr/dscf (27 mg/dscm) on a routine basis. The use of FFs in combination with SDAs will also improve the collection efficiency of trace organic compounds and heavy metals by promoting condensation of the gaseous compounds into a solid form where they can then be collected as particulate. Enhanced acid gas control will also be realized in the FF since the acid gases have the opportunity to contact unreacted lime that is adhering to the fabric bags.

3.3.4 Activated Carbon Injection

The proposed Retrofit will include the use of a system to store, convey, and inject dry or slurried activated carbon into the flue gas stream immediately upstream of the SDA inlet or within the SDA chamber. The carbon injection system will be designed specifically to control mercury emissions. The carbon injection system will also provide an additional measure of dioxin/furan control.

The carbon injection system will consist of a common storage silo with separate discharge hoppers for each unit. Carbon will be metered from each hopper and either pneumatically conveyed to the SDA inlet duct through a dedicated blower, or mixed with water and pumped to the top of each SDA chamber similar to the lime slurry. The system will be designed to add a measured amount of carbon to each combustion line.

The proposed carbon injection system will be designed to provide a high degree of mercury control. The carbon physically adsorbs mercury and dioxin/furan compounds which are collected downstream in the FF. Emission data from other MWCs employing similar injection systems in conjunction with a SDA and FF indicate that mercury removal efficiencies greater than the EG requirement of 85 percent are achievable on a routine basis.

3.3.5 Selective Non-Catalytic Reduction System

The proposed Retrofit will include the use of an SNCR system to store, convey, and inject aqueous ammonia (NH_3) or urea into the first pass of each boiler immediately above the combustion zone. The SNCR system will be designed to specifically control NO_X emissions.

The SNCR system will consist of storage tanks and feed pumps. The NH_3 (or urea) will be pumped from the storage tank to injection manifolds located along the side and front walls of the first boiler pass. The NH_3 (or urea) will be injected into the boiler through a series of injection ports. The rate of NH_3 (or urea) injected will be controlled closely using the NO_X CEM to be installed in the FF outlet duct from each unit.

The proposed SNCR system will be designed to provide a high degree of NO_X control while minimizing the amount of NH_3 (or urea) that could potentially escape from the stack. The NH_3 (or urea) reacts with NO_X compounds to form nitrogen (N_2). Emission data from other MWCs injecting NH_3 (or urea) into the first pass of the boiler indicate that NO_X emissions can be reduced below the EG requirement of 205 parts per million on a routine basis. Although the EG do not require NO_x control for existing refractory MWCs at large plants, the City plans to include SNCR control regardless of the MWC technology selected. The ammonia "slip" limit for this level of NO_X control is proposed to be 50 ppmdv at 7 percent O_2 or less, based on experience at other facilities.

3.3.6 Auxiliary Burners

The proposed Retrofit will include the installation of auxiliary burner(s) in the combustion zone. The auxiliary burner(s) will be designed to raise the furnace temperatures during startup events before refuse is introduced into the furnace, during shutdown events to maintain furnace temperatures until all of the refuse remaining on the furnace grate is combusted, and during routine operations as necessary to maintain adequate furnace temperatures (*e.g.*, wet refuse). The use of auxiliary burners during these periods will promote improved combustion efficiency.

*Startup and shutdown periods are discussed in Section 2.2.4. Startup and shutdown periods are limited to 3 hours per occurrence. The duration of warmup periods (*i.e.*, when only natural gas is being combusted and no MSW is being introduced into the combustor) is not limited by the EG requirements. As discussed in Section 2.2.5, the City of Tampa is requesting permit limits which restrict the annual use of natural gas to less than 10 percent of the total annual capacity for each unit so that the NSPS Subpart Db requirements for NO_x do not apply.

3.3.7 Continuous Monitors

The proposed Retrofit will include the installation of CEMs for SO_2, NO_X, CO, and O_2 after the FF outlet of each combustion unit. CEMs for SO_2 and O_2 will also be installed at the economizer/boiler outlet (inlet to SDA) to allow calculation of SO_2 removal efficiency. A continuous opacity monitor (COM) will also be installed after the FF outlet on each unit. Continuous monitoring and recording of steam flow or feedwater flow and flue gas temperature at the inlet to the fabric filter will also occur in the control room.

Flue gas samples will be taken continuously at the economizer/boiler outlet (for SO_2 and O_2) and after the FF outlet (for SO_2, NO_X, CO, and O_2). The sample lines will be connected to a climate controlled CEM trailer located adjacent to the stack. The CEM trailer will contain the sample preparation equipment and analyzers. Data collected from the CEM analyzers will be transmitted to the Facility's main control room and collected with data loggers.

3.3.8 Enclosed Ash Conveyors

The proposed Retrofit will include the installation of new fly ash conveyors to collect fly ash from the new SDAs and FFs. The new ash conveyors will be totally enclosed. A new bottom ash handling system will also be provided to support the new combustion system. Ash storage and loadout will occur inside a new, totally enclosed ash storage building to be constructed as part of the Retrofit. The combination of enclosed conveyors and an enclosed storage and loadout building will minimize the release of fugitive dust from the Facility. The ash will be quenched, and stored and handled when wet. This will minimize the potential for fugitive ash emissions.

3.4 Sequence of Construction

Implementation of the proposed Retrofit will require a temporary reduction in the processing capacity of the Facility. To minimize the impact on processing capacity, it is currently planned that two units will be retrofitted at one time. This will effectively reduce the processing capacity of the Facility by 50 percent for an anticipated period of 36 to 48 months.

Although the entire Facility may be retrofitted at once to minimize construction costs and schedule, it is anticipated that two adjacent units will be taken off-line at a time. The existing furnace, kiln, ESP, and ID fan on each unit will be removed. The existing steel stack currently serving these two units will also be demolished. New combustion and air pollution control equipment will then be constructed in the general area now occupied by the these systems. If the existing boilers are not removed, they will be substantially improved to be compatible with the new combustion system. It is anticipated that a new concrete shell stack with four steel flues will be constructed to the south of the new ID fans.

Installation of the new ash handling systems will also begin when the first two units are off-line. Once installation, startup, and testing of the first two units has been successfully completed, the second two units will be shut down. Existing equipment will be removed in a similar manner as the first two units and new systems will be installed.

3.5 Summary

The proposed Retrofit will be designed to reduce the level of emissions initially generated within the combustion units and subsequently released from the Facility. This will be accomplished by a combination of combustion and post-combustion controls. The existing combustion units and air pollution control equipment will be totally replaced, or substantially rebuilt, with new systems representing the latest design technology.

The specific controls to be employed are summarized in Table 3-1. The proposed Retrofit will not change the number of combustion units or the physical capacity of the Facility to process MSW.

Table 3-1
Summary of Proposed Control Technologies
Tampa McKay Bay Refuse-to-Energy Facility

Pollutant Category	***Proposed Technologies***
Particulate Matter	Fabric Filter.
Carbon Monoxide	Good Combustion Practices*/Auxiliary Burners.
MWC Acid Gases (HCl, SO_2)	Spray Dryer Absorber/Fabric Filter.
MWC Metals (Hg, Pb, Cd)	Carbon Injection/Spray Dryer Absorber/Fabric Filter.
MWC Organics (dioxins/furans, etc.)	Carbon Injection/Spray Dryer Absorber/Fabric Filter/Good Combustion Practices*/Auxiliary Burners.
Nitrogen Oxides	Selective Non-Catalytic Reduction.
Fugitive Dust	Ash Moisture/Enclosed Ash Conveyors/Ash Storage Building.

* Good Combustion Practices include proper fuel mixing, combustion air distribution, combustion air preheat, furnace temperatures and combustion monitoring.

Section 4
Emissions Estimates

4.1 Introduction

The overall emissions from the City's Facility will be reduced by the City's proposed Retrofit. Emissions reductions will be accomplished by GCP, and the use of a MACT standard APC system consisting of an SDA, a FF system, an ACI system, and an SNCR system on each MWC unit. A description of the proposed control technologies and the expected control levels were described in Section 3 of this application. The estimated emission rates from the MWC units with the proposed APC system improvements are discussed in Section 4.2. The estimated emissions from miscellaneous minor sources are discussed in Section 4.3. The discussion of emissions factors and rates presented in this section focuses primarily on those pollutants of public health and regulatory concern.

MSW is a heterogeneous mixture of materials, and the physics and chemistry of its combustion are very complex. Broadly speaking, describing the combustion process involves chemical reaction kinetics and equilibrium, combustor fluid mechanics, and heat transfer rates. The City's consultant, Camp Dresser & McKee Inc., has developed a computer model which performs mass-balance modeling of the combustion process for a "reference waste." The ultimate analysis for the reference waste used for this Facility is presented in Section 6. Model results can be used to estimate stack gas flow rates, temperature, and composition. The model output is contained in Appendix C of this volume. This output is used with monitoring test data from comparable facilities, and with regulatory limits to calculate emission rates. The calculations are shown in Appendix B.

4.2 Pollutant Emission Estimates - MWC Units

The emission estimates in this application were developed based on the worst-case emissions estimated for the full range of operating conditions at the Facility. The analysis considered variations in waste throughput, waste feed type, and heating values. The APC system will be designed to achieve and maintain the EPA EG limits in a consistent manner. Emission estimates and limits for SO_2, HCl, NO_X, Pb, PM, CO, Hg, Cd, and total dioxins are based on the EG, as revised August 25, 1997 (40 CFR 60 Subpart Cb). Emission limits for Be and HF are the existing permit limits, which will be retained for the Facility after the proposed improvements. (The City is requesting that the existing permit limit for VOC be deleted and replaced with the overlapping requirements in the EG for GCP and continuous CO monitoring. See Section 2.) The projected emission limits of pollutants from the proposed project are shown in Table 4-1.

Table 4-1
Estimated Controlled Maximum Potential Emission Rates for the City of Tampa's McKay Bay Refuse-to-Energy Facility

Pollutant	***Proposed Permit Limit[1]***	***Equivalent Annual Emission Rate[2,3] (tons/year)***
Particulate matter (PM)[4]	0.012 gr/dscf[5]	49
Sulfur dioxide (SO_2)	150 ppmdv[8]	716
Nitrogen oxides (NO_x)	205 ppmdv[5]	703
Carbon monoxide (CO)	100 ppmdv[5]	209
Lead (Pb)	440 µg/dscm[5]	0.788
Mercury (Hg)	135 µg/dscm[8]	0.243
Cadmium (Cd)	40 µg/dscm[5]	0.073
Beryllium (Be)	0.000115 lb/hr/unit[6]	0.002
Hydrogen chloride (HCl)	100 ppmdv[8]	272
Hydrogen fluoride (HF)	1.5 lb/hr /unit[6]	26
Dioxin[7]	30 ng/dscm[5]	5.37E-05
Ammonia (NH_3)	50 ppmdv	63

Notes:

[1] Estimated controlled emission concentration, corrected to 7% O2 for each MWC unit.
[2] Estimated controlled emission rate for all MWC units combined (excludes minor and fugitive emission sources).
[3] Based on 115 percent of the design heat release rate firing 958.4 tpd of reference waste at 6,000 Btu/lb. The modeled air flow rate for each of the four units at this load is 27,289.8 dscfm at 7% oxygen (12.881 dscm/sec).
[4] For purposes of analysis, PM_{10} is assumed equivalent to PM.
[5] Emissions Guidelines limit for existing large MWC units.
[6] Current permit limits to be retained for Facility after proposed improvements.
[7] Total tetra through octa PCDD and PCDF.
[8] For these pollutants, the EG specifies a concentration or a percent removal, whichever is less stringent (see Table 1-1). When used with a maximum inlet concentration from available test data (see Appendix B), the percent removal is less stringent. The inlet concentrations and required removal efficiencies used in this table are:

SO_2:	75% removal of 600 ppmdv inlet
Mercury:	85% removal of 900 µg/dscm inlet
HCl:	95% removal of 2,000 ppmdv inlet

As stated above, the basis for the proposed emissions limits is the EG (40 CFR 60 Subpart Cb). As described in the preamble to the December 19, 1995 Federal Register announcement promulgating this rule (Federal Register Vol. 60, No. 243, p. 65387, December 19, 1995), these limits are based on the best demonstrated performance at operating MWC facilities. EPA studies showing that MWC facilities can meet these limits, and other supporting data for the emissions limits, are contained in *Municipal Waste Combustion: Background Information for Promulgated Standards and Guidelines*, EPA-453/R-95-0136, and *Standard Form 83 Supporting Statement for ICR No. 1506.5-1995 Standards for New Municipal Waste Combustors (Subpart Eb)*, September 29, 1995, as well as other background documents contained in Dockets A-90-45 and A-89-08. Because these are EPA-recommended emissions limits, supported by this test data and documentation, a professional engineer's stamp on the proposed emissions limits in this permit amendment application is not essential, as a practical matter, but will be provided to comply with FDEP requirements. In addition, it should be noted that the City of Tampa will require that the facility operator guarantee that their equipment will comply with the proposed emissions limits.

4.2.1 Particulate Matter and PM_{10}

The proposed control technologies include a FF system to remove fly ash (including trace metals) from combustion flue gas and reaction products generated in the SDA. The estimated maximum PM concentration at the FF system inlet is 3.10 grains per dry standard cubic foot (gr/dscf) corrected to 7 percent O_2. PM emissions will be reduced by greater than 99 percent in the FF system. The PM outlet concentration from the FF system of each MWC unit will be at or below 0.012 gr/dscf corrected to 7 percent O_2, consistent with the EPA EG limit. Emission calculations are presented in Appendix B.

In order to perform a conservative assessment of ambient impacts from PM with an aerodynamic diameter less than or equal to ten microns (PM_{10}), it has been assumed in this application that all emissions of PM consist of PM_{10}.

4.2.2 MWC Acid Gases

Sulfur Dioxide

The SDA in series with the FF system will be used to reduce sulfur dioxide (SO_2) emissions. The flue gas containing SO_2 enters the SDA where it comes into contact with a finely atomized lime slurry. The resultant reactions are:

$$Ca(OH)_2 + SO_2 + H_2O \rightarrow CaSO_3 \cdot 1/2\,H_2O + 3/2H_2O$$
$$CaSO_3 \cdot 1/2H_2O + 1/2O_2 + 3/2H_2O \rightarrow CaSO_4 \cdot 2H_2O$$

The ultimate analysis of the MSW charged at the Facility indicates that the upper end of the range of fuel sulfur content is 0.32 percent by weight. Assuming a conservative 100 percent conversion rate of sulfur to sulfur dioxide, the maximum uncontrolled sulfur dioxide emission rate would be approximately 600 ppmdv corrected to 7 percent O_2. Conservatively assuming that the SDA removes 75 percent of the gaseous sulfur compounds in the flue gas, the SO_2 outlet concentration from the SDA of each MWC unit will be at or below 150 ppmdv corrected to 7 percent O_2. Achieving at least a 75 percent reduction of SO_2 is consistent with the EPA EG limit. Emission calculations are presented in Appendix B.

Hydrogen Chloride

The SDA in series with the FF system will be used to reduce hydrogen chloride (HCl) emissions. The flue gas containing HCl will enter the SDA where it will come into contact with a finely atomized lime slurry. The resultant reaction follows:

$$2\,HCl + Ca(OH)_2 \rightarrow CaCl_2 + 2H_2O$$

The upper end of the chlorine content (average plus three standard deviations) of the waste charged at the Facility ranges up to 0.65 percent based on the ultimate analysis of the waste charged at the Facility. Assuming a 100 percent conversion rate of fuel chlorine to hydrogen chloride gives a maximum uncontrolled HCl emissions range between 1,420 ppmdv and 2,000 ppmdv at 7 percent O_2. The hydrogen chloride outlet concentration from the SDA/FF system of each MWC unit will be at or below 100 ppmdv corrected to 7 percent O_2, based on reduction of the maximum uncontrolled emission rate by 95 percent using the SDA/FF system. Achieving at least 95 percent reduction of HCl is consistent with the EPA EG limit. Emission calculations are presented in Appendix B.

Hydrogen Fluoride

The SDA in series with the FF system will be used to reduce hydrogen fluoride (HF) emissions. The flue gas containing HF will enter the SDA where it will come into contact with a finely atomized lime slurry. The resultant reaction follows:

$$2\,HF + Ca(OH)_2 \rightarrow CaF_2 + 2H_2O$$

The maximum potential emissions of HF are estimated to be 1.5 lb/hr for each MWC unit, or 6.0 lb HF/hr/Facility, consistent with the current FDEP permit limit. Emission calculations are presented in Appendix B.

4.2.3 Carbon Monoxide

The combustion controls at each of the MWC units at the Facility will be upgraded and GCP will be used (as described in Section 3.3.1) to provide improved carbon monoxide (CO) control. The CO outlet concentration of each MWC unit will be at or below 100 ppmdv corrected to 7 percent O_2 (4-hour arithmetic block average if mass burn waterwall or refractory MWC), consistent with the EPA EG limit. Emission calculations are presented in Appendix B.

4.2.4 Nitrogen Oxides

Nitrogen oxides (NO_X) outlet concentrations of each MWC unit will be at or below 205 ppmdv corrected to 7 percent O_2, consistent with the EPA EG limit. Emission calculations are presented in Appendix B. Even though the EG do not specify a NO_X limit for refractory lined furnaces, the City of Tampa has committed to meeting a NO_X limit of 205 ppmdv, regardless of the type of furnace that is selected for the Retrofit.

4.2.5 MWC Metals

Trace metals in the flue gas will be controlled by the SDA/FF system. The SDA will condition the flue gas and reduce its temperature to approximately 270°F. At that temperature, volatilized metals will condense on available PM to be collected in the FF system.

The EPA EG specify emission limits for mercury (Hg), lead (Pb), and cadmium (Cd). The Florida Mercury Rule (Section 62-296.416 FAC) provides additional emission limits for mercury emissions. Emissions of beryllium (Be) are limited by the FDEP permit. The other metals are regulated by the particulate control standard established by the EPA EG (see Section 4.2.1). The emission rates for Hg, Pb, Cd, and Be are discussed below.

Mercury

The ACI system proposed for the Facility will provide a stable and reliable control of mercury (Hg) emissions. The uncontrolled Hg concentration for each MWC unit will be at or below 900 $\mu g/dscm$ corrected to 7 percent O_2, based on emission tests conducted at the Facility in 1995 and 1996. On the conservative assumption that the activated carbon system removes 85 percent of the Hg in the flue gas, the Hg outlet concentration from each unit will be at or below 135 $\mu g/dscm$ corrected to 7 percent O_2. Achieving at least an 85 percent reduction is consistent with the EPA EG limit. Emission calculations are presented in Appendix B.

Lead

It has been shown that a SDA followed by a FF system results in a high degree of lead (Pb) removal from incinerator flue gas streams (NITEP, 1986). The Pb outlet concentration from the SDA/FF system of each MWC unit will be at or below 440 $\mu g/dscm$ corrected to 7 percent O_2, consistent with the EPA EG limit. Emission calculations are presented in Appendix B.

Cadmium

The cadmium (Cd) outlet concentration from the FF system of each MWC unit will be at or below 40 $\mu g/dscm$ corrected to 7 percent O_2, consistent with the EPA EG limit. Emission calculations are presented in Appendix B.

Beryllium

Emissions of beryllium (Be) from the FF system of each MWC unit will be at or below 0.000115 lb/hr, or 0.00046 lb/hr for the Facility, consistent with the current FDEP permit limit. Emission calculations are presented in Appendix B.

Other trace metals are controlled with the PM, and compliance is verified by the PM standard.

4.2.6 MWC Organics

Numerous organic compounds have been measured in emissions from solid waste facilities. However, the principal compounds of MWC organics of concern are dioxins and furans. The EPA EG specify emission limits for total emissions of all tetra- through octa-isomers of dioxins and furans.

The dioxins and furans adsorbed on fly ash will be removed from the flue gas with the PM using FFs. In addition, in a pilot plant study, it was found that reducing dry scrubber outlet temperatures resulted in higher dioxin and furan removal efficiencies (Nielson, Moeller, and Rasmussen, 1985). The ACI system may also provide some reduction in dioxin/furan emissions.

The proposed Retrofit will employ GCP in combination with the SDA/FF/ACI system to minimize dioxin and furan formation and emissions. GCPs will be used, providing sufficient oxygen for destruction of organic species, limiting PM carryover, monitoring PM inlet temperature to minimize post-combustion dioxin/furan formation. GCP are described in Section 3.3.1.

The dioxin and furan (total) outlet concentration from the SDA/FF system of each MWC unit is estimated to be at or below 30 ng/dscm at 7 percent O_2, consistent with the EPA EG limits. Emission calculations are presented in Appendix B.

4.3 Pollutant Emissions Estimates - Miscellaneous Sources

4.3.1 Lime Storage Silos

The Facility will utilize an SDA system to control acid gases and sulfur dioxide emissions. The use of the SDA system requires the receiving, storing, handling, and processing of lime. Lime is a granular material that is inherently dusty and capable of significant particulate emissions if not controlled. However, the Facility will incorporate highly effective controls to limit potential lime dust emissions.

The lime storage silos will be equipped with a FF system designed for an outlet grain loading of 0.015 gr/dscf and an air flow rate of approximately 1,200 scfm. This baghouse will control fugitive lime particulate emissions which are generated while unloading the delivery trucks. Pressure drop monitoring across the FF system will not be necessary. Assuming that unloading one 20-ton truck would take approximately one hour to complete, the estimated peak one-hour particulate emission rate is 0.154 lb/hr. Based on a worst-case assumption that emissions of 0.154 lb/hr occur from a silo 24 hours/day and 7 days/week, annual particulate emissions from this source will not exceed 0.68 tons. In actuality, the baghouse will only be operated and emissions will only occur during filling operations. Emissions of this quantity are not considered excessive for this type of operation. The potential ambient impacts from these emissions are expected to be minimal.

4.3.2 Activated Carbon Storage Silo

The Facility will utilize a powdered ACI system for the control of mercury emissions. Operation of this system will require the installation of one silo for the storage of activated carbon prior to injection into the flue gas for mercury control. As powdered activated carbon is a fine granular material that is inherently dusty, steps will be taken to control particulate emissions generated during its delivery and storage.

Powdered activated carbon will be delivered to the Facility by truck. Annually, approximately 200 tons of activated carbon will be delivered to the storage silo. The activated carbon storage silo will be equipped with a FF system designed for an outlet grain loading of 0.015 gr/dscf and an air flow rate of approximately 1,200 scfm. This FF system will control fugitive powdered activated carbon particulate emissions, which are generated while unloading the delivery trucks. Pressure drop monitoring across the FF system will not be necessary. Assuming that unloading one 20-ton truck would take approximately one hour to complete, the estimated peak one-hour particulate emission rate is 0.154 lb/hr. Based on a worst-case assumption that emissions of 0.154 lb/hr occur from the silo 24 hours/day and 7 days/week, annual particulate emissions from the silo will not exceed 0.68 tons. In actuality, the baghouse will only be operated and emissions will only occur during filling operations. Emissions of this quantity are not considered excessive for this type of operation. The potential ambient impacts from these emissions are expected to be minimal.

4.3.3 Residue and Ash Handling System

The Facility will be equipped with a system for handling both fly ash and bottom ash from the municipal waste combustors. Fly ash and bottom ash are fine particulates, and controls will be utilized in the storing and handling of the ash to prevent fugitive emissions. Visible emissions (5 percent opacity) will occur less than 5 percent of the time from ash transfer systems, except during maintenance and repair activities, in accordance with EPA EG (40 CFR 60.36b).

Bottom ash, consisting of grate siftings and grate ash, will be quenched and then conveyed by an enclosed vibrating or similar type conveyor to an ash storage facility. Fly ash from the municipal waste combustors will be collected from the SDA/FF system and discharged to an enclosed conveyance system. The fly ash will be conveyed to the bottom ash quench tank where it will be combined with the bottom ash. Emissions consistent with the above requirement are expected from this wet ash system.

4.3.4 Metals Recovery System

Combined fly ash and bottom ash from the facility will be processed to extract recyclable metals in a new totally enclosed structure to be located south of the existing Facility. This structure will be ventilated and equipped with roll-up doors. The metals recovery process will include a ferrous magnet and trommel. Because the ash will be wet, emissions will be consistent with the above requirement in the building ventilation exhaust.

4.3.5 Auxiliary Burners

Each MWC unit will be equipped with natural gas fired burner(s). These burners are necessary for firing the combustor during startups and shutdowns and to maintain required furnace temperatures when sustained low-Btu wastes are encountered. Startup and shutdown periods are discussed in Section 2.2.4. The City is requesting that excess emissions due to startup, shutdown, and malfunction periods be limited to 3 hours per occurrence, consistent with EG requirements (rather than 2 hours per day as suggested at FAC 62-210.700). The duration of warmup periods (*i.e.*, when only natural gas is being combusted and no MSW is being introduced into the combustor) is not limited by the EG requirements. As discussed in Section 2.2.5, the City is requesting permit limits which restrict the annual use of natural gas to less than 10 percent of the total annual capacity for each unit so that the NSPS Subpart Db requirements for NO_x do not apply. The anticipated time for boiler warmup is expected to be approximately 8 hours. The size of the burners and their fuel consumption rate is to be determined.

4.3.6 Ammonia (or Urea) Storage Tank

A common storage tank will be provided as part of the SNCR system. The tank will be equipped with a vent. The tank size has not yet been designed and annual throughput has not yet been determined.

Section 5
Ambient Air Quality

5.1 Ambient Air Quality Standards/Attainment Status

EPA has established national ambient air quality standards (AAQS) for certain "criteria" pollutants, as mandated by the Clean Air Act Amendments of 1970 (P.L. 91-604). These standards have been set at two levels. Primary national AAQS are designed to protect public health with an adequate margin of safety. Secondary national AAQS are designed to protect the public welfare, including property, materials, and plant and animal life. Florida has adopted AAQS that are at least as stringent as the national AAQS and has incorporated both the national primary and secondary AAQS into the FDEP rules (FAC 62-204.240). The Florida AAQS for sulfur dioxide annual and 24-hour averaging periods are more stringent (lower) than the national AAQS. These national and Florida AAQS are shown on Table 5-1. The six criteria pollutants with AAQS are: sulfur dioxide (SO_2); nitrogen dioxide (NO_2); carbon monoxide (CO); fine particulate matter less than 10 microns in diameter (PM_{10}); lead (Pb); and ozone (O_3). The AAQS for PM_{10} replaced the national AAQS for total suspended particulates (TSP) in 1987, and the Florida AAQS in March 1996. Table 5-1 also shows PSD Increments and Modeling Significance Levels for the criteria pollutants. These are discussed in more detail in Section 6.0.

Under Section 107 of the Clean Air Act, each state is required to develop a State Implementation Plan (SIP) which specifies how all areas within the state will achieve and maintain compliance with the national AAQS. For regulatory purposes under the SIP, all areas in the United States are designated as either attainment, non-attainment, or unclassifiable with the national AAQS for each criteria pollutant. Attainment areas are areas which are currently in compliance with the national AAQS, and continued compliance is expected under the current SIP requirements. Non-attainment areas are areas which either currently do not comply with the national AAQS or which significantly contribute to nearby areas which do not comply with the national AAQS. Unclassifiable areas are areas where insufficient data exists to classify the area as either attainment or non-attainment and are generally presumed to be in attainment with the national AAQS. In addition to attainment, non-attainment, and unclassifiable areas, certain areas are designated as "maintenance" areas. Maintenance areas are areas that have been redesignated from non-attainment to attainment or unclassifiable. Because they are transition areas, some non-attainment requirements continue to apply, particularly requirements for RACT for certain new and existing sources of emissions [FAC 62-204.320(1)(d)]. The attainment status of the Facility site is listed in Table 5-2 for each criteria pollutant.

Table 5-1
National and Florida Ambient Air Quality Standards

Pollutant	Average Time	Florida Standard[1]	National Primary Standard[2]	National Secondary Standard[2]	Significant Impact Level[3]		PSD Increments[4]	
					Class II	Class I	Class II	Class I
NO_2 (µg/m³)	Annual	100	100	100	1	0.03	25	2.5
SO_2 (µg/m³)	3-Hr	1,300	-	1,300	25	0.48	512	25
	24-Hr	260	365	-	5	0.07	91	5
	Annual	60	80	-	1	0.03	20	2
CO (µg/m³)	1-Hr	40,000	40,000	-	2,000	N/A	-	-
	8-Hr	10,000	10,000	-	500	N/A	-	-
Pb (µg/m³)	Qtr	1.5	1.5	1.5	-	N/A	-	-
O_3 (ppm)	1-Hr	0.12	0.12	0.12	-	N/A	-	-
PM_{10} (µg/m³)	24-Hr	150	150	150	5	0.27	30	8
	Annual	50	50	50	1	0.08	17	4

- All short-term (1-hour, 3-hour, and 24-hour) standards except ozone are not to be exceeded more than once per year.
- All quarterly and annual standards are never to be exceeded.
- The 1-hour ozone standard should not be exceeded more than an average of one day per year over three years.
- The National NO_2 standards are promulgated as 0.053 ppm (1ppm NO_2 = 1,881 µg NO_2/m^3).
- The National and Florida CO standards are promulgated as 35 ppm (1-hour) and 9 ppm (8-hour) (1ppm CO = 1,145 µg CO/m^3).
- The SO_2 standards are promulgated as 0.5 ppm (3-hour), 0.14 ppm (24-hour), and 0.030 ppm (annual) (1 ppm SO_2 = 2,618 µg SO_2/m^3).

Notes:

[1] FAC 62-204.240
[2] 40 CFR 50
[3] 40 CFR 51.165(b)(2)
[4] 40 CFR 51.166(c)

Table 5-2
Attainment Status(1) for Areas Including the
Tampa McKay Bay Refuse-to-Energy Facility

Pollutant	*State Designation*	*Federal Designation*
Total Suspended Particulate Matter (TSP)	Maintenance Area[(2)] [FAC 62-204.340(4)(b)1]	Cannot be classified[(2)]
Particulate Matter with Diameter Less Than 10 Microns (PM_{10})	Unclassifiable [entire state FAC 62-204.340(3)(a)]	Cannot be classified
Sulfur Dioxide (SO_2)	Unclassifiable[(3)] [FAC 62-204.340(3)(b)3]	Cannot be classified[(3)]
Nitrogen Dioxide (NO_2)	Attainment [entire state FAC 62-204.340(1)(e)]	Cannot be classified or attainment
Carbon Monoxide (CO)	Attainment [entire state FAC 62-204.340(1)(d)]	Cannot be classified or attainment
Ozone (O_3)	Maintenance Area[(4)] [FAC 62-204.340(4)(a)4] Attainment [FAC 62-204.340(1)(a)]	Cannot be classified or attainment[(5)]
Lead (Pb)	Maintenance Area[(6)] [FAC 62-204.340(4)(c)] Unclassifiable [entire state FAC 62-204.340(3)(c)]	Cannot be classified[(6)]

Notes:

(1) Florida Administrative Code (FAC) Chapter 62-204 and Code of Federal Regulations (CFR) Title 40, Part 81.310. EPA defines Hillsborough County as part of the West Central Florida Intrastate Air Quality Control Region (40 CFR 81.96).

(2) That portion of Hillsborough County within 12 kilometers (km) of the intersection of US 41 South and State Road 60.

(3) Local unclassifiable areas for SO_2 include Hillsborough County and the southwest corner of Pasco County.

(4) Local maintenance area for O_3 includes Hillsborough and Pinellas Counties

(5) Redesignated from marginal nonattainent to attainment in December 7, 1995, Federal Register (FR) at 60 FR 62748, effective February 5, 1996.

(6) Area within 5 km of UTM Zone 17 coordinates (in km) of 364.0 east and 3093.5 north

Hillsborough County is part of the West Central Florida Intrastate Air Quality Control Region (AQCR), which also includes Citrus, Hardee, Hernando, Pinellas, Levy, Manatee, Pasco, Polk, and Sumter Counties (40 CFR 81.96). The attainment status of the project site for each criteria pollutant is shown in Table 5-2. The project site and vicinity is considered to be in attainment with all national AAQS.

There are currently no non-attainment areas in Florida. Local maintenance areas for O_3, TSP, and Pb exist in parts of Florida. The Facility is located within local maintenance areas for all three of these pollutants. These local maintenance areas are described in Table 5-2. Any RACT requirements for these three pollutants are described in Section 2.0.

5.2 Existing Air Quality

Existing air quality in the Facility vicinity can be evaluated by comparing monitored ambient pollutant concentrations to AAQS. The Air Quality Division of the Hillsborough County Environmental Protection Commission operates a network of ambient air monitoring stations. These monitoring sites are listed in Table 5-3, along with their Universal Transverse Mercator (UTM) coordinates. Table 5-4 identifies the pollutants monitored at each of the Hillsborough County monitoring stations. Table 5-5 shows the highest and second- highest short-term and annual concentrations measured at the closest monitoring site to the Facility for each year. Monitoring data available for the most recent 3-year period (January 1994 to December 1996) are presented.

A comparison of ambient monitoring data in Table 5-6 with the AAQS shows that the air quality in the Facility vicinity is good. Oxides of nitrogen (NO_x) are typically emitted by combustion sources and eventually form ambient NO_2 concentrations. Maximum oxides of nitrogen (measured as NO_2) concentrations measured at the nearest NO_2 monitor in Hillsborough County during the last 3 years were about one-fifth of the national and Florida AAQS for annual periods.

Sulfur dioxide emissions are primarily produced by combustion of sulfur-containing fossil fuels. Maximum SO_2 concentrations measured at the nearest SO_2 monitor in Hillsborough County during the last 3 years were less than one-third of the more restrictive of the national or Florida AAQS for all averaging times.

Localized CO concentrations tend to be associated with vehicle emissions. Maximum CO concentrations measured at the nearest CO monitor in Hillsborough County during the last 3 years were about one-seventh and one-third of the national and Florida AAQS for averaging times of 1 hour and 8 hours, respectively.

Table 5-3
Locations of Ambient Pollutant Monitors
and Relative Distance to Stack Location at the
Tampa McKay Bay Refuse-to-Energy Facility

Stack Location	***UTME (km)***	***UTMN (km)***	
	360.185	3092.198	
Monitor Locations Hillsborough County	***UTME (km)***	***UTMN (km)***	***Distance from Stack (km)***
Tampa-Health Dept.	357.193	3092.154	2.992
Tampa-Harbor Island AC	357.150	3090.750	3.363
Ganon-5012 Causeway Blvd.	362.100	3089.240	3.524
Tampa-220 Madison Ave.	356.576	3092.192	3.609
Tampa-National Distribution Ctr.	363.750	3093.700	3.868
Tampa-Gulf Coast Lead	364.000	3093.400	4.000
Tampa-Davis Island	356.851	3089.908	4.045
Tampa-4702 Central Ave.	357.000	3096.500	5.353
Gibsonton-Hwy 41N ICWU Bldg.	362.014	3086.140	6.328
Tampa Stadium-Dale Mabry	351.980	3095.065	8.691
Tampa-Neptune & Church	351.467	3090.422	8.897
Tampa-Interbay & Ballast	354.169	3085.361	9.107
Tampa-Navajo & 27th	359.650	3102.270	10.086
Gardinier Park-US41	363.890	3082.701	10.194
Gibsonton-Giant's Camp	363.750	3081.900	10.898
Tampa-9851 Highway 41	363.758	3081.853	10.945
Tampa-5121 Gandy Blvd	348.560	3086.060	13.146
Brandon-2929 S. Kingsway	374.240	3094.200	14.197
Tampa-Cooks Lumber/FL Steel	374.436	3091.410	14.273
Tampa-Eisenhower JHS	365.199	3074.807	18.099
North Ruskin-Big Bend Road	365.200	3074.800	18.106
Tampa-Big Bend Rd & Hwy672	365.940	3074.860	18.268
North Ruskin-Bullfrog Creek	366.750	3074.950	18.455
Tampa-4013 Ragg Rd.	352.250	3109.300	18.853
Tampa-Simmons Park	355.544	3069.100	23.560
Ruskin-Ruskin Fire Station	358.750	3066.750	25.488

Table 5-4
Pollutants Monitored at Hillsborough County Ambient Monitors

Monitor	NO_2	SO_2	CO	Pb	O_3	PM_{10}
Tampa-Health Dept.				x		x
Tampa-Harbor Island AC						x
Ganon-5012 Causeway Blvd.		x				x
Tampa-220 Madison Ave.			x			
Tampa-National Distribution Ctr.				x		
Tampa-Gulf Coast Lead				x		
Tampa-Davis Island		x	x		x	x
Tampa-4702 Central Ave.			x			x
Gibsonton-Hwy 41N ICWU Bldg.						x
Tampa Stadium-Dale Mabry			x			
Tampa-Neptune & Church						x[a]
Tampa-Interbay & Ballast		x				
Tampa-Navajo & 27th				x		
Gardinier Park-US41						x[a]
Gibsonton-Giant's Camp		x				
Tampa-9851 Highway 41		x				
Tampa-5121 Gandy Blvd	x				x	
Brandon-2929 S. Kingsway						x[a]
Tampa-Cooks Lumber/FL Steel				x		
Tampa-Eisenhower JHS						x[a]
North Ruskin-Big Bend Road		x				
Tampa-Big Bend Rd & Hwy 672		x				
North Ruskin-Bullfrog Creek		x				
Tampa-4013 Ragg Rd.		x	x		x	x
Tampa-Simmons Park	x	x			x	
Ruskin-Ruskin Fire Station				x		

[a] PM10 monitoring replaced TSP monitoring in April 1995

Table 5-5
Ambient Monitored Concentrations
at the Nearest Stations to the
Tampa McKay Bay Refuse-to-Energy Facility

Pollutant	***Avg. Time***	***1994***		***1995***		***1996***	
		High	***2nd High***	***High***	***2nd High***	***High***	***2nd High***
NO_2 (µg/m³)	Annual	18		21		18	
SO_2 (µg/m³)	3-Hr	361	325	433	407	455	422
	24-Hr	90	79	78	75	91	76
	Annual	14		12		14	
CO (ppm)	1-Hr	4	4	5	5	4	3
	8-Hr	2	2	3	3	3	2
Pb (µg/m³)	Qtr	0		0		0	
O_3 (ppm)[1]	1-Hr	0.100	0.088	0.143	0.104	0.125	0.112
PM_{10} (µg/m³)	24-Hr	91	57	62	51	82	43
	Annual	27		25		26	

Concentrations reflect the closest monitors to the Facility for each pollutant as follows:

NO_2 - Tampa 5121 Gandy Blvd. (348.560 km UTM Easting, 3086.060 km UTM Northing)
SO_2 - Ganon 5012 Causeway Blvd. (362.100 km UTM Easting, 3089.240 km UTM Northing)
O_3 - Tampa Davis Island (356.851 km UTM Easting, 3089.908 km UTM Northing)
Pb, PM_{10} - Health Dept. (357.193 km UTM Easting, 3092.154 km UTM Northing)
CO - Tampa 220 Madison Ave (356.576 km UTM Easting, 3092.192 km UTM Northing)

Table 5-6
Comparison of Ambient Monitored Concentrations to Ambient Air Quality Standards

Pollutant	***Averaging Time***	***Ambient Monitored Concentration[a]***	***AAQS[b]***	***Percent of AAQS***
NO_2 (μg/m^3)	Annual	21	100	21%
SO_2 (μg/m^3)	3-hr	422	1,300	32%
	24-hr	79	260	30%
	Annual	14	60	23%
CO (ppm)	1-hr	5	35	14%
	8-hr	3	9	33%
Pb (μg/m^3)	Qtr	0	1.5	0%
O_3 (ppm)	1-hr	0.104	0.12	87%
PM_{10} (μg/m^3)	24-hr	57	150	38%
	Annual	27	50	54%

Notes:

[a] Ambient monitored concentrations are maximum second-highest short-term and maximum long-term concentrations for all three years for NO_2, SO_2, CO, Pb, and PM_{10} and maximum 1-hour, fourth-highest day concentration for O_3 (comparable to the format of the AAQS). The monitoring locations of the data are shown in Table 5-5.

[b] The AAQS shown are the more stringent of the National primary or secondary AAQS or the State AAQS.

Lead emissions have been historically associated primarily with motor vehicles using leaded gasoline. These have greatly declined in recent years. A local Pb non-attainment area existed, until January 1996, around a battery recycling facility near the Facility. This area has been redesignated as unclassifiable. During the last 3 years, lead levels measured at the nearest Pb monitor in Hillsborough County have been below the detection limits of the EPA monitoring methods.

Ozone is not emitted directly into the atmosphere but is formed in the troposphere through the photolysis by sunlight of VOCs and NO_2 to yield NO and O_3. In urban areas, the primary source of NO_X is combustion-related sources such as motor vehicles and industrial sources as discussed earlier. VOCs are emitted from motor vehicles, combustion sources, consumer products, and industrial processes.

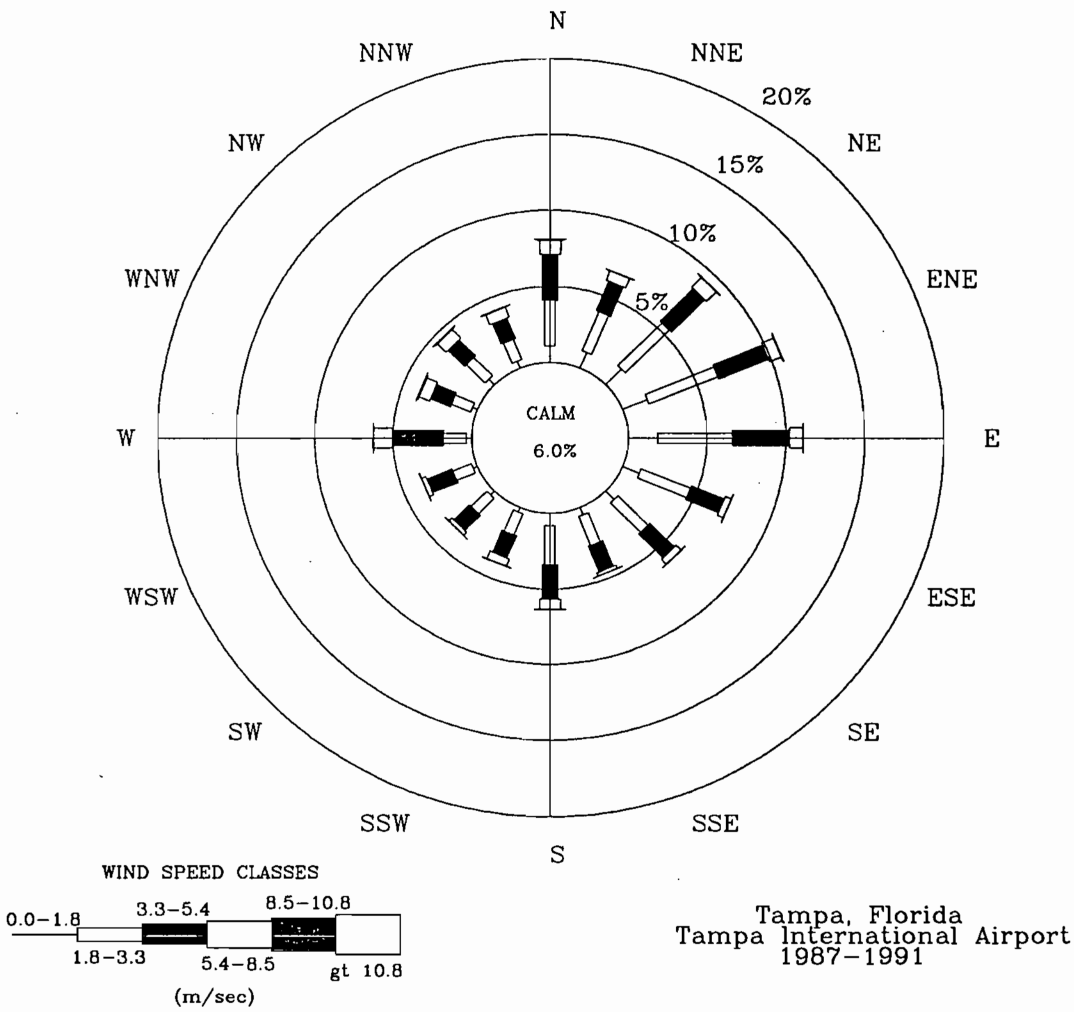
Table 5-5 shows 2 days in the past 3 years that experience concentrations over the 1-hour ozone standard. However, these do not count as violations since the standard allows for 1 day over the AAQS per year when averaged over 3 years. Recent ambient ozone data for Hillsborough County and all of Florida indicate compliance with the ozone national AAQS (*i.e.*, number of days with ambient measurements above the AAQS at any one location is less than or equal to 1.0 when averaged over a 3-year period) (FDEP, Air Quality Report 1994, p. 4-5). The maximum 1-hour, fourth-highest day ozone concentration measured at the nearest ozone monitor in Hillsborough County during the last 3 years is 87 percent of the AAQS, as shown in Table 5-6.

PM_{10}, or fine particulate matter, consists of soot, acidic particles, fine dusts, and other aerosols. Maximum PM_{10} concentrations measured in the Facility vicinity during the last available 3 years were around one-half of the PM_{10} national and Florida AAQS for averaging times of 24 hours and annual periods.

5.3 Meteorology

Meteorological data from the Tampa International Airport has been used with the dispersion models described in Section 6.0. The Tampa International Airport, approximately 6.7 miles (10.8 km) west of the Facility, is the National Weather Service Station (WBAN Station No. 12842) closest to the site, and provides the meteorological data most representative of the site vicinity. Meteorological data needed for the models, and available from this station, include hourly readings of temperature, wind speed, wind direction, and total opaque cloud cover, as well as twice-daily measurements of upper air data used to calculate mixing heights. The most recent available 5 years, 1987 to 1991, of combined surface and upper air data were used in the modeling reported in Section 6.0. A 5-year composite wind rose for the Tampa International Airport is shown in Figure 5-1. The dominant wind directions during the 5 modeled years were primarily from the north and east, reflecting the predominant easterly trade winds. Wind roses for each of the individual 5 years are shown in Appendix D.

Figure 5-1
1987-1991 Windrose for Tampa International Airport, Florida



Section 6
Air Quality Impact Analyses

6.1 Introduction

The City plans to upgrade the Facility by replacing the combustion units and APC equipment, as well as making improvements in the tipping floor and ash handling systems. The Facility's existing ESPs will be removed or replaced with SDAs, FFs, ACI, and SNCR systems. These systems are discussed in Section 3.

The two existing single-flue steel stacks will be replaced with a single four-flue stack. The new stack will be constructed up to the maximum height allowed by Federal Aviation Administration (FAA) air navigation rules (14 CFR Part 77), which is 201 feet above ground level (FAA Notice dated 1/10/97 for Aeronautical Study No. 96-ASO-5810-OE). The new stack, with individual flues dedicated to each of the four combustion units, and 36 feet taller than the two existing 165-foot stacks, will improve pollutant dispersion of flue gases from the Facility. In addition, under all operating conditions, the APC equipment and combustion system improvements will result in no change to, or significant reductions in, actual emissions for all pollutants, except ammonia.

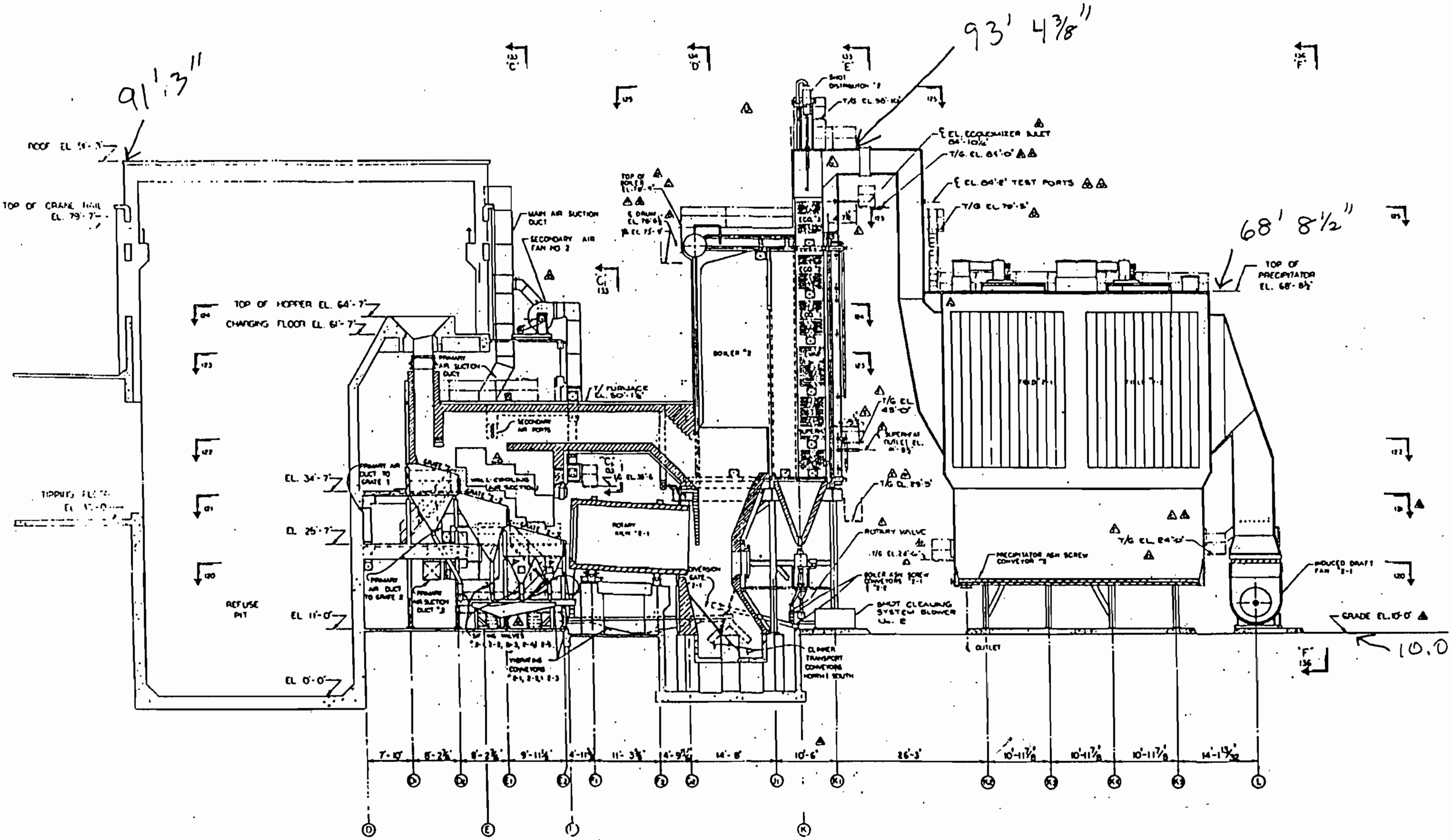
The new SDA will cool flue gas exit temperatures, reducing plume rise and pollutant dispersion. A vendor has not yet been selected for the Facility improvements, but it is possible that new building configurations could have greater aerodynamic influence on the stacks than do the existing structures. Dispersion modeling analyses have been performed to demonstrate that the upgraded Facility, based on preliminary design, will continue to comply with all ambient air quality standards (AAQS).

Additional emissions of PM will also be generated by the storage silos necessary for the reagents (carbon and lime) for the proposed APC equipment. Modeling analyses were not performed for these PM sources, because these minor sources will be controlled with FFs and are expected to have a negligible impact on air quality.

6.2 Source Description

6.2.1 Good Engineering Practice Stack Height

Because a vendor has not yet been selected for the Facility upgrade, final design information for building dimensions, stack dimensions, emissions, and flue gas parameters are not yet available. Malcolm Pirnie, the consultant overseeing combustor design and vendor selection, has estimated that proposed building dimensions will not differ greatly from the existing configuration, and that the combustion units, economizer, and APC equipment will remain unenclosed. Figures 6-1 through 6-4, show the existing Facility cross-section and layout, and an estimated future Facility cross-section (not to scale) and layout. However, it is possible that a vendor could propose to enclose some or all of these systems,



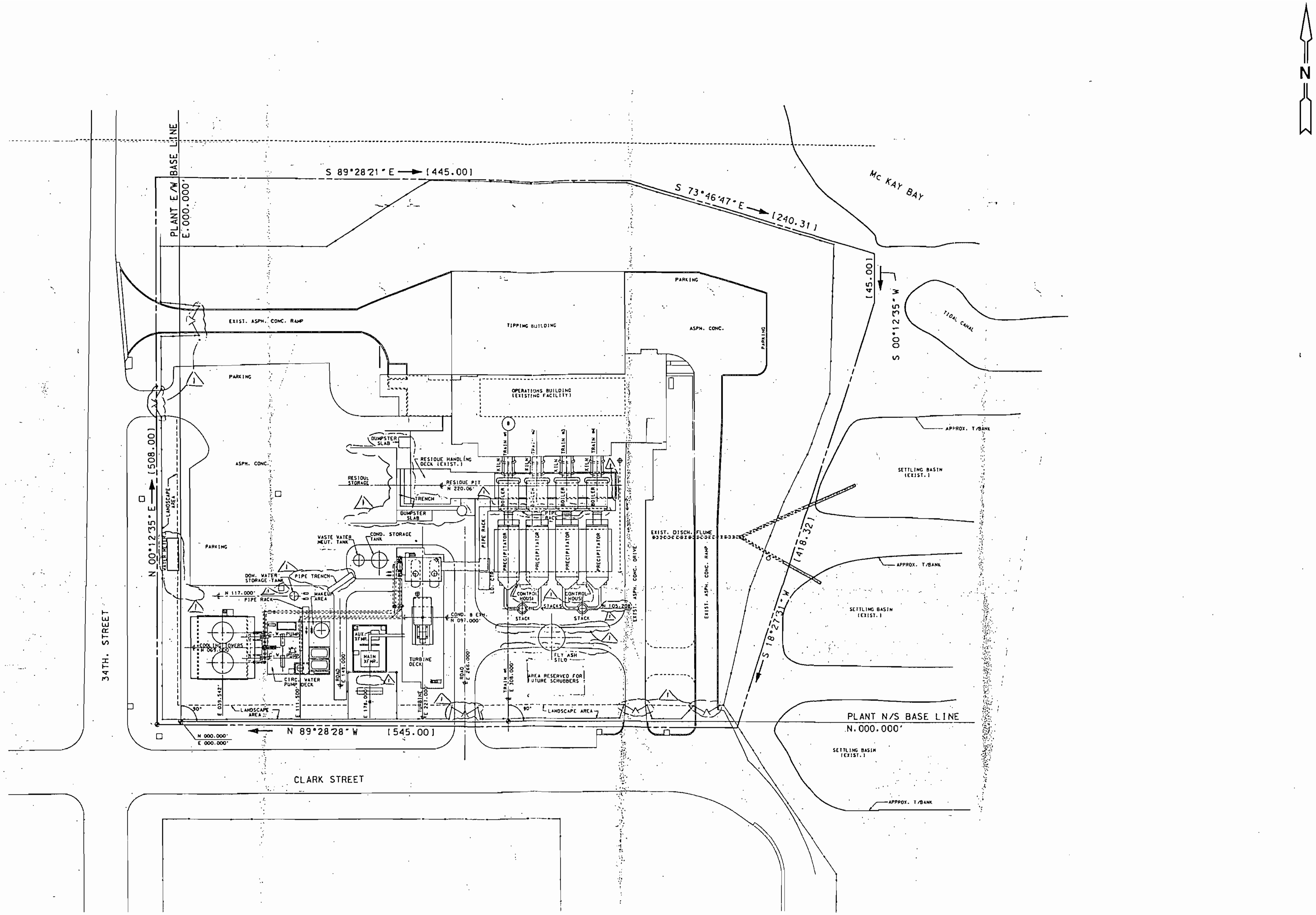
SECTION 'B-B'

Stack Top Elevation 175
Height 165

Source: Volund USA Ltd.

Tampa McKay Bay Refuse to Energy Facility

Figure 6-1
Existing Facility Cross-Section



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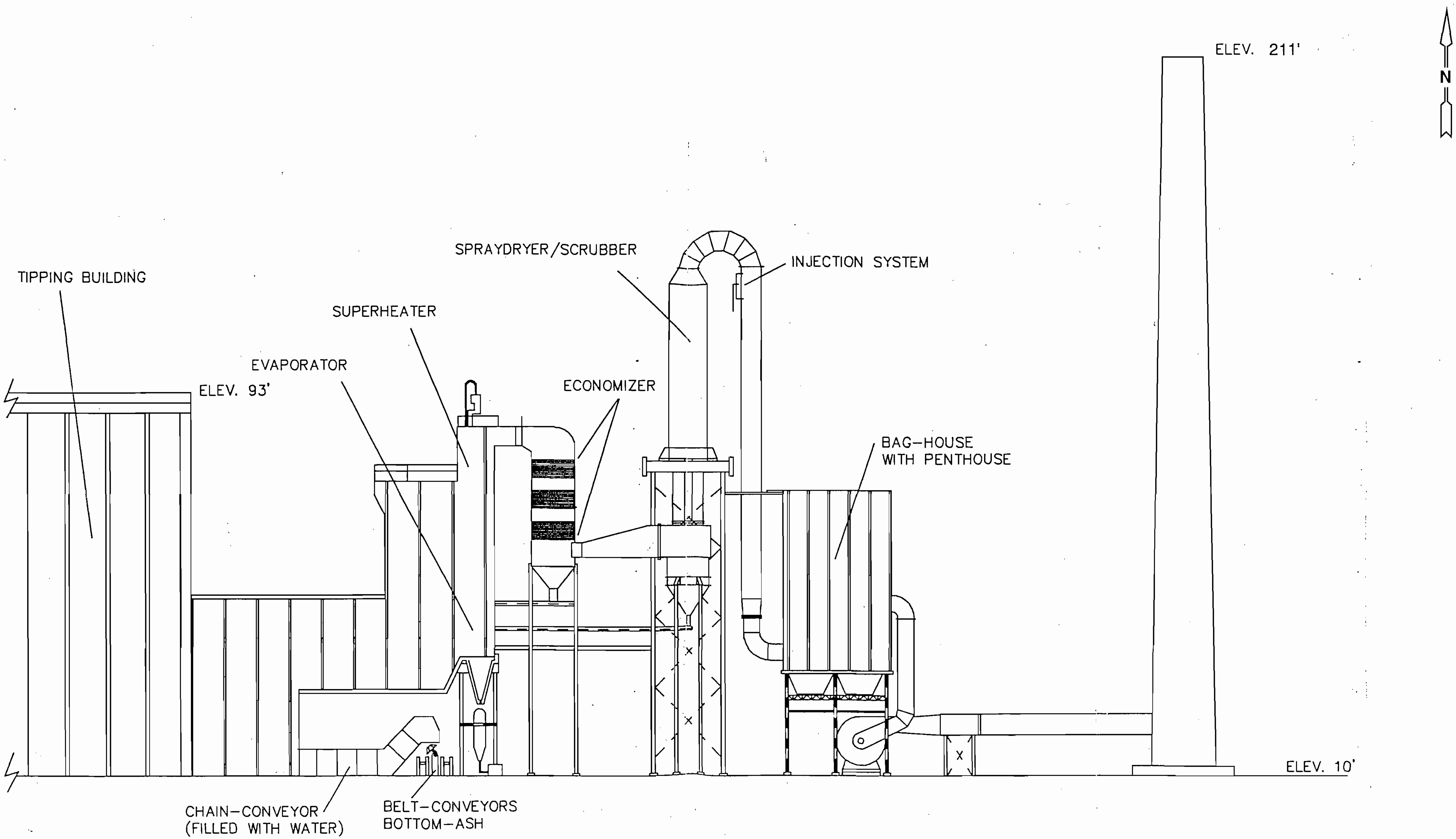
Tampa McKay Bay Refuse to Energy Facility

Figure 6-2
Existing Facility Site Layout



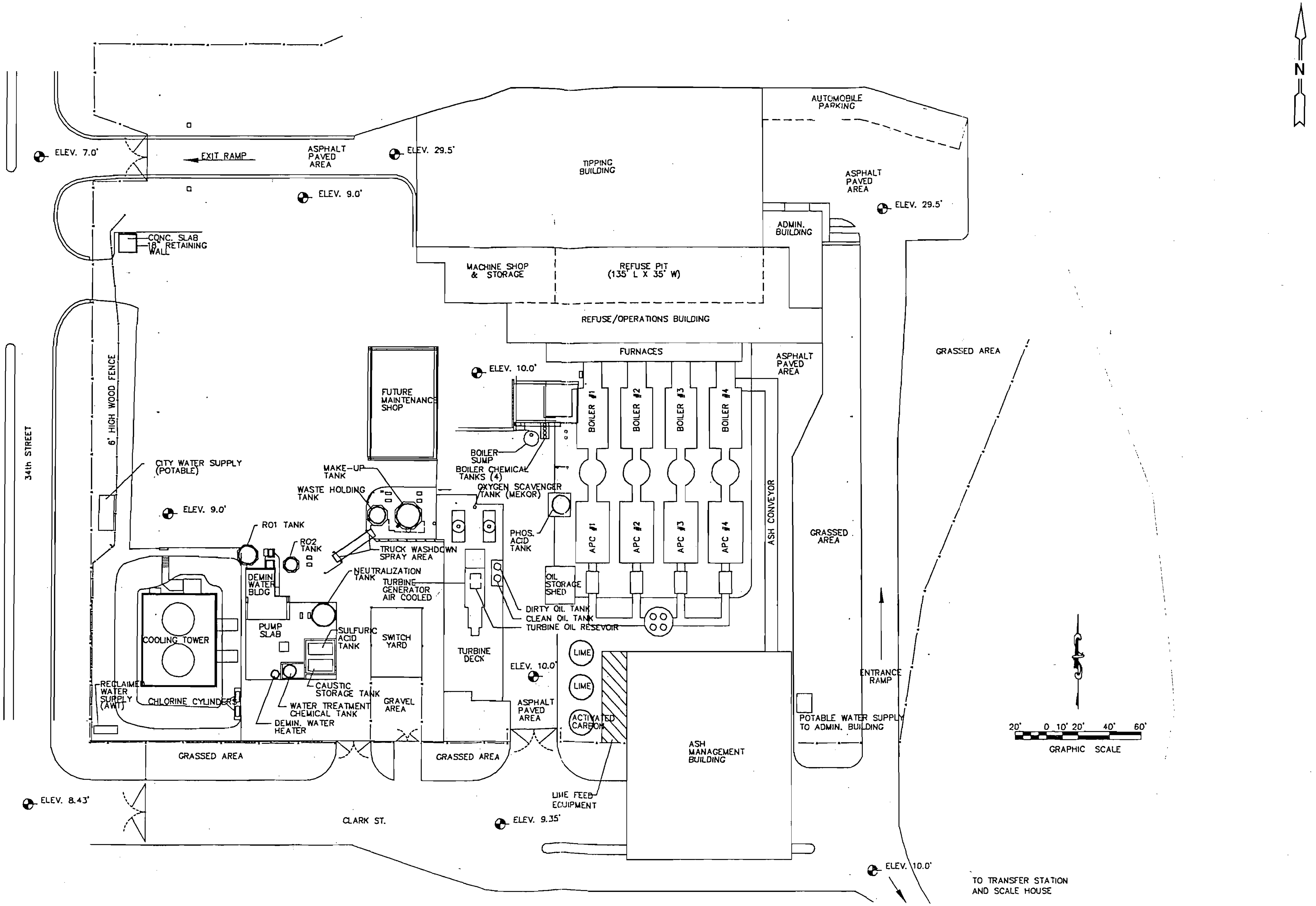
SCALE: 1" = 80'

Source: Malcolm Pirnie, Tampa, FL

CDM Camp Dresser & McKee

Tampa McKay Bay Refuse to Energy Facility

Figure 6-3
Possible Future Facility Site Layout



Source: Malcolm Pirnie, Tampa, FL

Figure 6-4
Possible Future Facility Site Layout

producing larger structures with greater aerodynamic influence on dispersion of stack emissions.

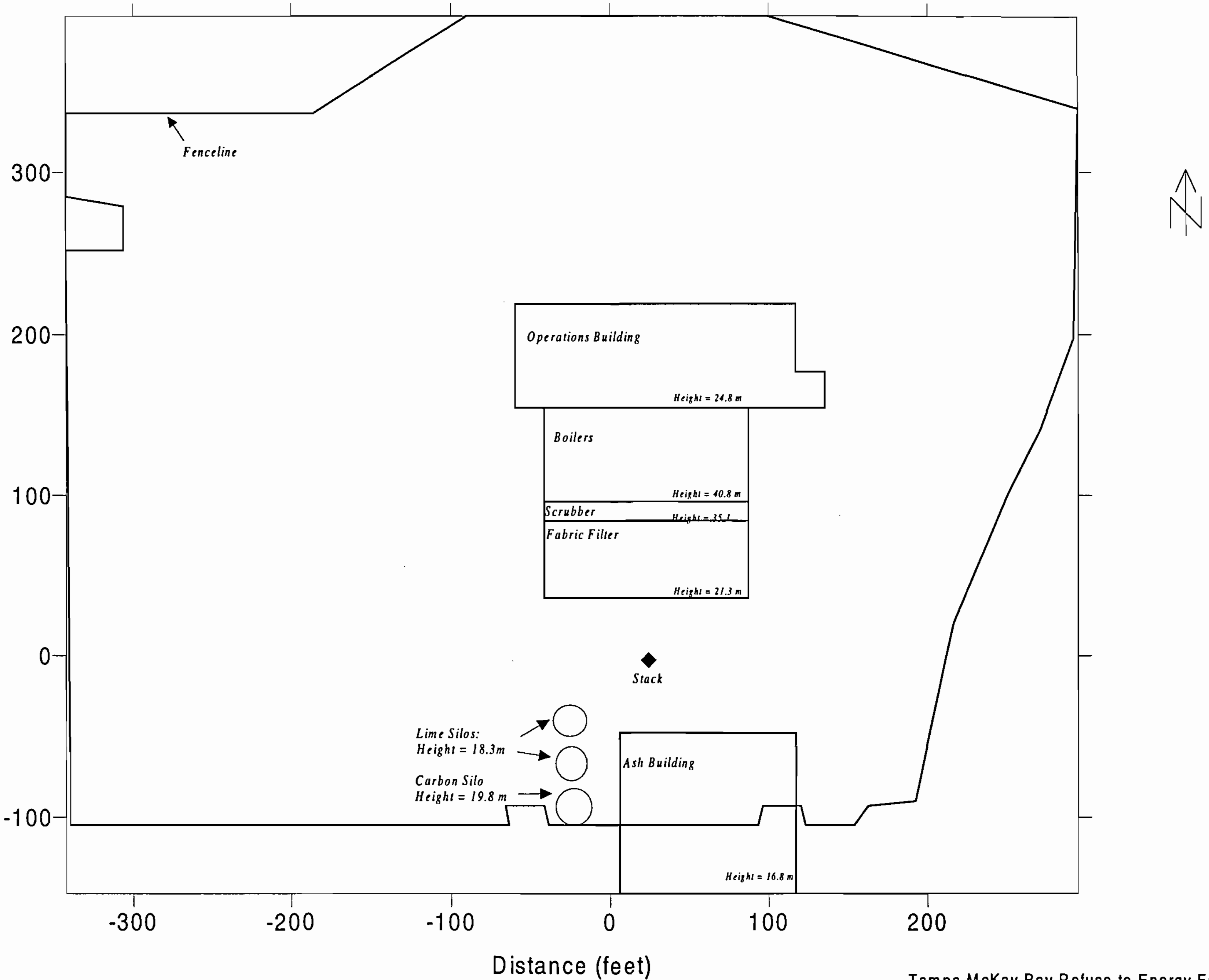
Downwash occurs when structures influence the plume from a nearby stack. The Good engineering practice (GEP) stack height is defined as the minimum stack height which ensures that the emissions from the stack do not result in excessive concentrations in the cavity and wake regions near structures. EPA has promulgated stack height regulations under 40 CFR Part 51 which help to determine the GEP stack height for any stationary source.

GEP analyses were performed for the existing Facility, and the possible future Facility (after the proposed improvements) to determine the GEP stack heights. EPA's preferred building downwash model, the Building Profile Input Program (BPIP, version 95086) was used to determine GEP stack heights. The existing Facility GEP stack height is 63.4 meters (208 feet) above ground level, governed by the influence of the existing Facility's pipe rack over the boilers. The pipe rack is 25.4 meters (83.33 feet) above ground level.

For the purposes of this permit application, a worst-case future Facility configuration was estimated that would produce maximum air pollutant impacts for the possible range of Facility designs. The selected vendor will be required to construct a new stack of GEP stack height, if possible, or the tallest possible stack allowed by the FAA (201 feet). For a fixed stack height, worst case dispersion is generally created by the tallest nearby buildings because these tend to have the greatest downwash effect on stack emissions. Foster Wheeler, which intends to bid on the Facility upgrade, has an upright boiler configuration which, if enclosed, would produce a squat building about 134 feet tall (Mr. Michael Cooper, Foster Wheeler, telephone conversation, January 8, 1997). This structure produces a GEP stack height of 102.1 meters (335 feet), which was estimated to be the worst case for modeling future Facility impacts after the proposed improvements.

Figure 6-5 is a generalized layout showing the worst-case buildings used in the modeling analysis for the future Facility. In addition to the Boiler Building, it was conservatively assumed that the SDA and FF could also be enclosed. It was assumed that the Operations Building would not be significantly changed, and that the Ash Handling Building would be as shown by Malcolm Pirnie in Figure 6-4.

The Facility's existing stack height of 50.3 meters (165 feet), and the assumed new stack height of 61.3 meters (201 feet), are less than the calculated GEP stack heights of 63.4 meters (208 feet) and 102.1 meters (335 feet), respectively. Thus, the influence of aerodynamic downwash must be considered in the modeling analyses. Direction-specific building parameters generated by the Building Profile Input Program (BPIP) model were used in the refined modeling analysis.



Tampa McKay Bay Refuse-to-Energy Facility

Figure 6-5
Facility Layout

6.2.2 Operating Conditions

Because MSW varies substantially in energy content (combustible fraction) and moisture, the Facility's four combustion units/boilers operate under a range of conditions. The estimated heat content of the MSW varies from 3,800 Btu/lb to 6,000 Btu/lb, with an average estimated to be 5,000 Btu/lb based on recent sampling data. Each unit has a nominal, or guaranteed minimum, MSW feed rate of 250 tons per day (tpd). However, higher feed rates are necessary for low-Btu waste, and lower feed rates are necessary for high-Btu wastes, to produce comparable amounts of steam. As described in Section 2.3.2, above, the City requests that the permit conditions for the Facility's operating capacity limitation be based on each unit's heat input, rather than on tonnage. Heat input can be directly correlated to steam flow or feedwater flow rates. The City requests that steam flow or feedwater flow be used for monitoring operating capacity. This is consistent with the EG which use steam or feedwater flow to monitor a unit's operating capacity (40 CFR 60.51b).

Figure 6-6 is a diagram of the heat input operating window for each of the four combustion units. The nominal load of 250 tpd for a waste of 5,000 Btu/lb is based on the existing Facility design. This is equal to a heat input of 104.167 million Btu (MMBtu) per hour. This point is shown inside the operating window in Figure 6-6. The boundaries of the operating window around this point are based on the physical (minimum and maximum) ability of each unit to feed MSW and release heat. With the existing units, waste could be fed at between 80 and 115 percent of the nominal 250 tpd (20,833 pounds per hour), without exceeding the physical capacity of the system. Gross heat input could be between 80 and 115 percent of the nominal 104.167 MMBtu/hr.

The EG allow MWCs to operate at levels up to 110 percent of the maximum steam load demonstrated during dioxin testing. Since the maximum load during dioxin testing may be greater than the nominal load, and the Facility would be permitted to operate at 110 percent of the maximum demonstrated load, the maximum permitted load was estimated to be about 115 percent of the nominal load.

The worst-case operating condition is used to model predicted Facility impacts. The worst-case operating condition is that which produces the highest ground-level air pollutant concentrations. Screening dispersion modeling was conducted to examine the seven cases identified in Figure 6-6 that bound each unit's operating window to determine which produces the worst-case impacts.

The range of possible operating conditions, shown as points on the operating window in Figure 6-6, are also summarized in the matrix in Table 6-1.

Figure 6-6
Operating Window
McKay Bay Resource Recovery Facility

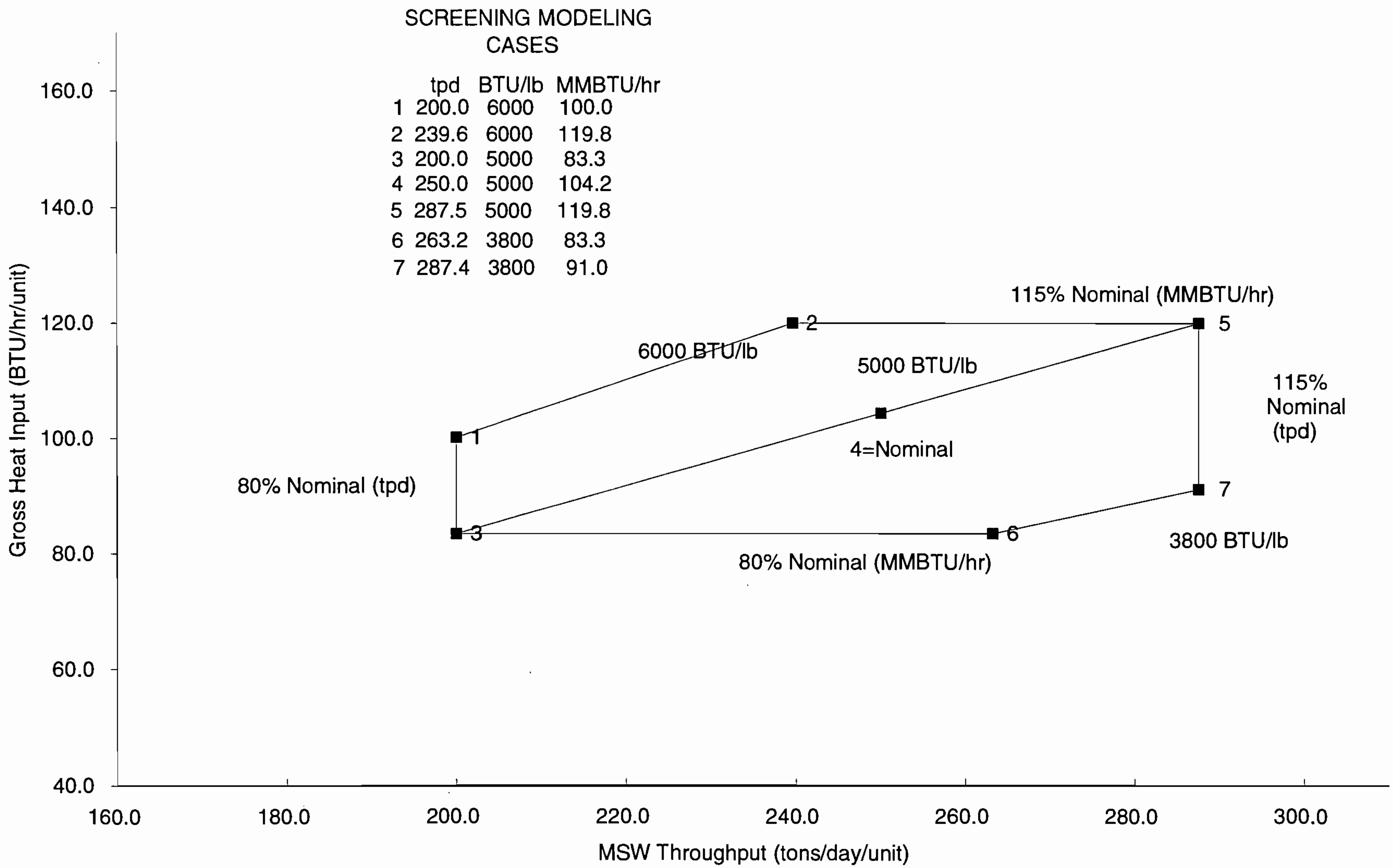


Table 6-1
Boiler Operating Window Conditions for Screening Modeling
Tampa McKay Bay Refuse-to-Energy Facility

Percent of Maximum Continuous Rating	Heat Input (MMBtu/hr/unit)	Refuse Throughput (tpd per unit) by Waste Heat Value		
		6,000 Btu/lb	5,000 Btu/lb	3,800 Btu/lb
115	119.8	239.6	287.5	---
100	104.2	---	250.0	---
96	100.0	200.0	---	---
87	91.0	---	---	287.4
80	83.3	---	200.0	263.2

A proprietary combustion thermodynamics model, BURN, was used to calculate air flows, stack gas composition, and exit temperatures for each of the operating conditions. The model needs an ultimate analysis of the waste as input. The waste used for the Facility is listed below.

Estimated Waste Ultimate Analysis
Tampa McKay Bay Refuse-to-Energy Facility

Component	***Amount***
HHV (Btu/lb)	5,000
Percent by wt:	
Moisture	20.7
Total Inert	20.9
Carbon	28.5
Hydrogen	3.8
Oxygen	25.1
Nitrogen	0.5
Sulfur	0.1
Chlorine	0.4
Total	100.0

Source: Power Plant Siting Application for the Lee County Waste-to-Energy Facility, 1991. The Higher Heating Value (HHV) was verified in a waste composition testing program at the Tampa McKay Bay Refuse-to-Energy Facility during 1993-1994.

The heat content of the reference waste is adjusted to 6,000 Btu/lb or 3,800 Btu/lb for the BURN runs by varying its moisture content. Other input assumptions necessary for BURN include the amount of excess air (112 percent for existing conditions; 100 percent for future conditions), the design temperature set point at the economizer outlet (525°F existing; 450°F future), and whether or not the SDA is present in the APC equipment train.

BURN model outputs are presented in Appendix C, BURN model runs. Table 6-2 shows the BURN results (stack gas flows and temperature) for each operating window case, and lists all of the other source parameters used in the screening modeling. Note that for the future new single-stack case, which would have four flues in a common stack shell, an equivalent stack diameter was used to represent the total area of the flues in service. This calculation allows the model to simulate the merged momentum plume rise of the collocated flues.

A normalized, non-pollutant-specific, emission rate of one gram per second (1.0 g/s) was assigned to a single unit operating at the nominal load of 250 tpd at 5,000 Btu/lb. Emission rates for each of the other operating cases were scaled from this based on the ratio of the case's dry standard stack gas flow (adjusted to 7 percent oxygen) to the nominal flow. For example, the single-unit, 115 percent, 5,000 Btu/lb case has a stack gas

Table 6-2
Tampa McKay Bay Refuse-to-Energy Facility
Future Stack Characteristics

Parameter	***Cases (percent of nominal gross heat input / waste heat content in Btu/lb)***						
	115% 6,000 Btu/lb	***115%*** 5,000 Btu/lb	***Nominal 100%*** 5,000 Btu/lb	***96%*** 6,000 Btu/lb	***80%*** 5,000 Btu/lb	***87%*** 3,800 Btu/lb	***80%*** 3,800 Btu/lb
Single Unit Parameters							
Stack Gas Flow (dscfm @ 7% O_2)	27,290	27,277	23,733	22,782	18,987	20,740	18,987
Normalized Emission Rate (g/s)	1.15	1.15	1.00	0.96	0.80	0.87	0.80
Stack Height (m)	61.3	61.3	61.3	61.3	61.3	61.3	61.3
Stack Inside Flue Diameter (m)	1.28	1.28	1.28	1.28	1.28	1.28	1.28
Stack Gas Flow Rate (acfm)	60,894	63,000	54,822	50,832	43,856	51,002	46,691
Stack Gas Flow Rate (m^3/sec)	28.74	29.74	25.88	23.99	20.70	24.07	22.04
Stack Gas Exit Velocity (m/sec)	22.22	22.98	20.00	18.54	16.00	18.61	17.03
Stack Gas Temperature (K)	415.98	415.98	415.98	415.98	415.98	415.98	415.98
Multiple Unit Parameters							
2 Units - Normalized Emission Rate (g/s)	2.30	2.30	2.00	1.92	1.60	1.75	1.60
2 Units - Equivalent Inside Diameter (m)	1.82	1.82	1.82	1.82	1.82	1.82	1.82
2 Units - Stack Gas Flow Rate (acfm)	121,788	126,000	109,643	101,663	87,712	102,004	93,381
2 Units - Stack Gas Flow Rate (m^3/sec)	57.48	59.47	51.75	47.99	41.40	48.15	44.08
2 Units - Stack Gas Exit Velocity (m/sec)	22.22	22.98	20.00	18.54	16.00	18.61	17.03
3 Units - Normalized Emission Rate (g/s)	3.45	3.45	3.00	2.88	2.40	2.62	2.40
3 Units - Equivalent Inside Diameter (m)	2.22	2.22	2.22	2.22	2.22	2.22	2.22
3 Flues - Stack Gas Flow Rate (acfm)	182,683	189,001	164,465	152,495	131,569	153,006	140,072
3 Units - Stack Gas Flow Rate (m^3/sec)	86.23	89.21	77.63	71.98	62.10	72.22	66.11
3 Units - Stack Gas Exit Velocity (m/sec)	22.22	22.98	20.00	18.54	16.00	18.61	17.03
4 Units - Normalized Emission Rate (g/s)	4.60	4.60	4.00	3.84	3.20	3.50	3.20
4 Units - Equivalent Inside Diameter (m)	2.57	2.57	2.57	2.57	2.57	2.57	2.57
4 Units - Stack Gas Flow Rate (acfm)	243,577	252,001	219,286	203,327	175,425	204,008	186,762
4 Units - Stack Gas Flow Rate (m^3/sec)	114.97	118.94	103.50	95.97	82.80	96.29	88.15
4 Units - Stack Gas Exit Velocity (m/sec)	22.22	22.98	20.00	18.54	16.00	18.61	17.03

flow rate of 27,277 dry standard cubic feet per minute at 7 percent oxygen (dscfm @ 7% O_2). This is 1.15 times the dry standard flow for the nominal case, so it is assigned an emission rate of 1.15 g/s. EG pollutant-specific emission limits for the Facility will be specified in ppmdv, gr/dscf, or ug/dscm, corrected to 7 percent O_2. Therefore, Facility emissions will be proportional to the dry standard flow rate corrected to 7 percent O_2. In addition, the BURN runs show that the dry standard flow rate is proportional to the combustible fraction of the waste feed, or to the gross heat input. Emissions, therefore, will also be proportional to the gross heat input.

In addition to the Facility stack and combustors, the APC improvement project will require the construction of several silos (for storage of lime and activated carbon) for the APC equipment. Small amounts of PM will be emitted from each silo, basically during filling operations. These particulate emissions will be controlled by FFs to 0.015 grains/dscf. The FFs exhaust through a vent 10.3" by 5.12" (equivalent diameter of 0.683 feet or 0.208 meters). The FFs are located on top of each vent at a height of about 7 feet above the top of each silo. Modeling analyses were not performed for these minor PM sources, and impacts are expected to be negligible.

6.3 Model Selection and Model Options

The EPA Guideline on Air Quality Models (40 CFR 51, Appendix W) (Guideline) lists preferred EPA dispersion models. A screening analysis was performed initially to determine the worst-case Facility operating condition. Screening modeling uses a set of built-in test-case meteorological conditions for a single wind direction, and is usually run with a single normalized emission rate. This was followed by a refined dispersion modeling analysis using actual hourly meteorological data and pollutant-specific emission rates. Models, input data, and methodology are discussed below.

6.3.1 Model Selection

Two models were selected for calculating downwind pollutant concentrations from the proposed plant design. The two-level approach used screening and refined modeling methodologies to predict the worst-case Facility design and maximum Facility impacts, respectively. The analysis included estimating impacts within the cavity wake regions of structures.

Screening and Cavity Model

The Guideline identifies the latest version of SCREEN as the recommended screening dispersion model. SCREEN3, version 96043, was used in this analysis and was selected because it:

- Is EPA's preferred screening level model for point sources subject to building induced downwash.

- Calculates impacts within the cavity region of nearby structures.

- Uses a built-in set of meteorological conditions (54 combinations of wind speed and stability) and automatically screens for the worst-case combination of wind speed and stability class.

- Uses an automated receptor distance array which finds the point of maximum impact to within one meter. This feature is helpful when selecting receptor grid distances for the refined analysis.

The SCREEN3 model was selected to filter through the set of 28 potential operational conditions for the worst-case set of heat load, waste throughput, and number of operating units. The screening analysis was also used to determine if a cavity region is generated as a result of the stack orientation with respect to nearby structures. Screening results are presented in Section 6.4.

Refined Model

The worst-case operating condition determined in the SCREEN3 analysis was then modeled using a refined model. The Guideline lists the latest version of the Industrial Source Complex Short-Term (ISCST) model as a preferred refined dispersion model for handling "complicated sources," such as those subject to aerodynamic downwash. The Facility's existing and proposed stacks are both less than GEP stack height and are, therefore, influenced by downwash from onsite structures. Therefore, the ISCST3 model (version date 96113) was used to calculate Facility impacts. The ISCST3 model was selected for this analysis for the following reasons:

- ISCST3 is the EPA preferred refined model for facilities with multiple sources, source types, and building-induced downwash.

- It uses actual representative hourly meteorological data.

- Direction-specific building parameters are used to predict impacts within the wake region of nearby structures.

- Multiple sources can be modeled together to predict cumulative downwind impacts.

- Multiple averaging periods between one hour and one year can be selected.

- The model can be run with negative emission rates. This feature is useful for predicting the relative changes in impacts between two differing Facility designs.

- Large Cartesian or polar receptor grids, as well as discrete receptor locations, can be used.

The primary study area for this analysis is the Facility vicinity (within a 10-kilometer radius of the stack). These results are presented in Sections 6.4.3 and 6.5. There is also a Class I Area (Chassahowitzka National Wildlife Refuge) located 75 to 100 kilometers north-northwest of the Facility. ISCST3 was also used to provide estimates for impacts at this Class I Area (see Section 6.5.3).

6.3.2 Model Options and Input Data

Model Options

Dispersion models include numerous options that must be selected to simulate the impacts from the Facility. Model options were set equal to regulatory defaults or EPA-recommended values to the maximum extent possible. SCREEN3 regulatory default settings were selected for anemometer height (10 meters), mixing height, and cavity wake calculations. The ISCST3 regulatory default setting was used, which selects final plume rise (except in cases of building downwash), stack-tip downwash (except in cases of Schulman-Scire downwash), buoyancy-induced dispersion (except in cases of Schulman-Scire downwash), default wind speed profile exponents, and default potential temperature gradients. These ISCST3 settings are automatically selected by SCREEN3. The ISCST3 regulatory default option also selects EPA-recommended calm processing routines and upper-bound concentration estimates for building downwash from squat buildings. Other ISCST3 options selected were concentration calculations (rather than the various types of ISCST3 deposition calculations) and inert pollutants (*i.e.*, no pollutant decay or chemical transformation).

Since the area around the Facility is relatively flat, receptor elevations were not considered. In other words, SCREEN3 and ISCST3 inputs and/or options were selected such that receptor elevations equal the source base elevation. ISCST3 and SCREEN3 can be used with either simple terrain (receptor elevations below stack release height), intermediate terrain (receptor elevations between stack release height and final plume rise), or complex terrain (receptor elevations above final plume rise). Since no areas in the project vicinity have terrain above the stack release heights modeled, complex and intermediate terrain were not considered in either the SCREEN3 or ISCST3 modeling analyses. Elevated receptors (*i.e.*, flagpoles) were not considered with either SCREEN3 or ISCST3.

Finally, both ISCST3 and SCREEN3 can be used for either rural or urban dispersion environments. The area within three kilometers of the Facility stacks is "rural" using the Auer method (Auer, 1978) to categorize the area surrounding the Facility, because more than 50 percent of this area is water or residential development. This determination was supported by FDEP (Cleve Holladay, FDEP Tallahassee, telephone conversation, October 29, 1996). Therefore, rural dispersion coefficients were used in both models.

Meteorological Data

The process of plume dispersion is determined by a set of atmospheric variables including wind speed, wind direction, ambient temperature, mixing layer depth, and atmospheric stability. For the screening modeling analyses, SCREEN3 uses a set of internal meteorological conditions that represent a wide range of possible dispersion meteorology (54 combinations of wind speed and stability).

For SCREEN3, the default anemometer height of 10 meters was selected. The SCREEN3 default ambient temperature of 293 Kelvin was replaced with a temperature of 296 Kelvin (National Oceanic and Atmospheric Administration, 1980, *Climates of the States*), which more accurately represents the 30-year climatological mean temperature (72.5°F) of the area.

The ISCST3 refined modeling analyses used actual meteorological data representative of the Tampa area to estimate 1-hour, 3-hour, 8-hour, 24-hour, and annual averaged impacts. Surface and upper-air files from the National Weather Service (NWS) Station located at the Tampa International Airport (WBAN number 12842) were obtained from the EPA Office of Air Quality Planning and Standards (OAQPS) Support Center for Regulatory Air Modeling (SCRAM) bulletin board system (BBS). The most recent 5 years (1987 to 1991) of data available on the SCRAM BBS were downloaded and processed into a model-ready format using the EPA PCRAMMET preprocessor. A composite wind rose for the 5 years of meteorological data is presented in Section 5. Wind roses for each of the individual 5 years are shown in Appendix D. The Tampa International Airport NWS anemometer height is 20 feet (6.1 meters) for the period of meteorological data modeled, and was input to ISCST3 accordingly.

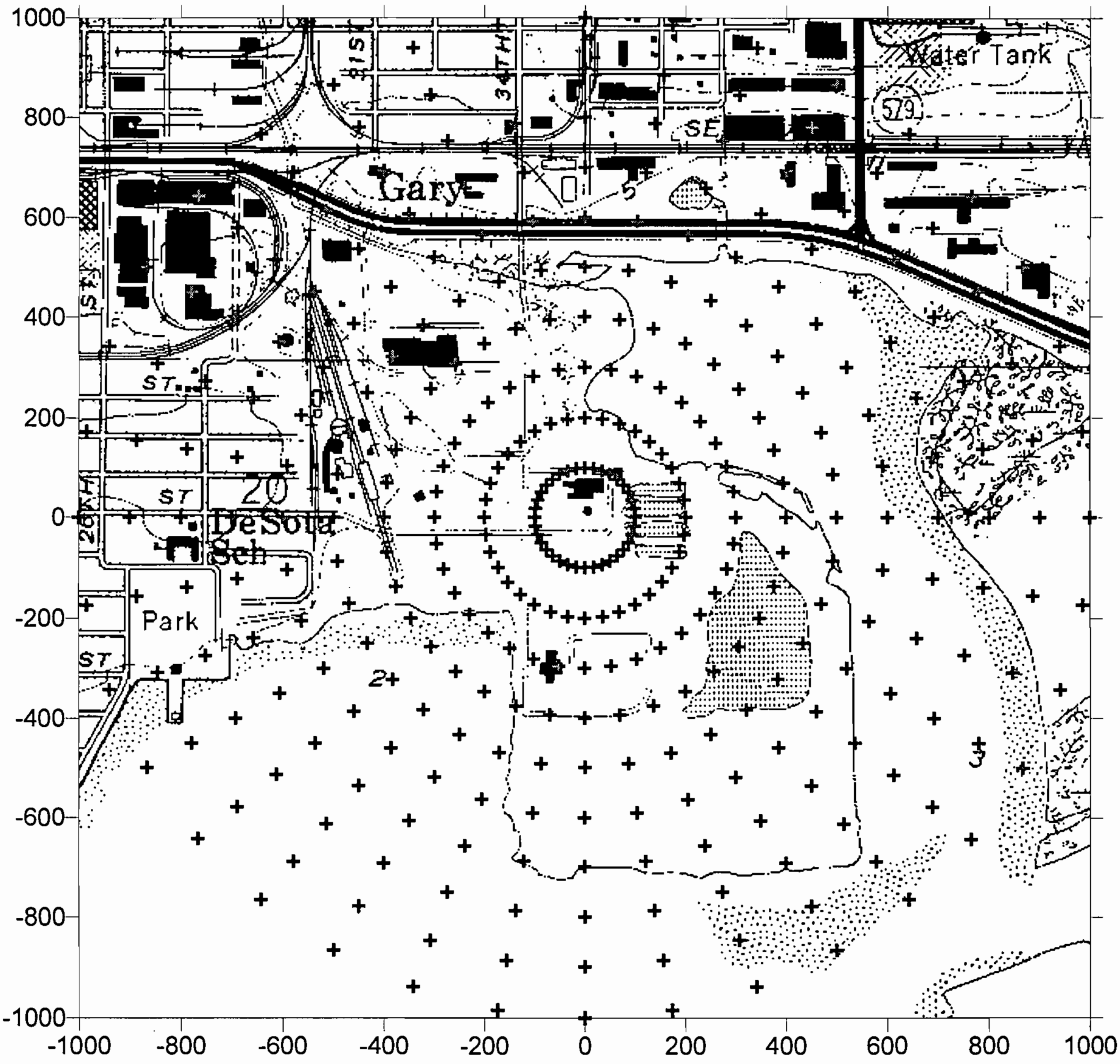
Receptor Grids

For the screening analysis, the automated distance receptor array for distances from 100 to 10,000 meters (m) from the stack was used. Using this array, SCREEN3 reports worst-case one-hour-average downwind concentrations for points spaced every 100 m out to 3,000 m away, and every 500 m beyond that. The model then iterates to find the point of maximum impact to within one meter.

Refined modeling was performed with ISCST3 with a 10° spaced polar receptor grid from 100 to 10,000 m from the stack. The grid spacing varies with distance, with 100 m spacing out to 1 kilometer, 500-meter spacing out to 5 kilometers, and 1 kilometer spacing out to 10 kilometers. The polar grid out to 1 kilometer is shown in Figure 6-7.

As noted above, the area within 10 kilometers of the Facility is all well below stack-top elevation, and is relatively flat. For this reason, the Facility was modeled with the surrounding terrain at stack-base elevation, and FDEP has concurred with this approach (Cleve Holladay, FDEP Tallahassee, telephone conversation, October 29, 1996).

Figure 6-7
Refined Modeling Polar Receptor Grid
Receptors Within 1000 meters
Tampa McKay Bay Refuse to Energy Facility



The Chassahowitzka Wilderness Area in northwestern Florida is a PSD Class I Area within 100 kilometes of the Facility. Class I Areas have the smallest PSD increments allowing only a small degree of air quality deterioration. FDEP required that dispersion modeling for the proposed Facility Retrofit consider impacts to the Chassahowitzka Wilderness Area. FDEP also provided a standard list of 13 receptors at the Wilderness Area for which the modeling was to be performed. (Cleve Holladay, Dispersion Modeling Coordinator, FDEP Bureau of Air Regulation, meeting held November 6, 1996; and facsimile transmittal dated December 4, 1996). Table 6-3 lists the 13 discrete receptors provided by FDEP for this analysis, their Universal Transverse Mercator (UTM) coordinates, and the calculated coordinates in the modeling grid system used for this analysis. The modeling grid system set X = 0 and Y = 0 (0, 0) at the Facility's existing western stack, which has UTM coordinates X = 360.196 km East, and Y = 3092.208 North.

Source Data

Source information needed by the dispersion models consists of stack characteristics (*i.e.*, stack height and diameter, flue gas temperatures, exit velocities, and emission rates) and, for stacks less then GEP height, building dimensions for determining the effect of aerodynamic downwash on stack emissions. Source data for the existing Facility required by the models are discussed later in Section 6.5.3. For the future Facility after the proposed improvements, stack characteristics are given in Table 6-2. As discussed in Section 6.2.1, the maximum stack height allowed is 201 feet, which is less than the GEP stack height of 335 feet for the future Facility. Therefore, building dimensions are required as inputs to estimate building downwash. SCREEN3 building dimensions for the future Facility, after the proposed improvements, were input as a building height of 134 feet (40.8 meters), a building length of 141 feet (43.1 meters), and a building width of 107 feet (32.7 meters). For ISCST3, the direction-specific building dimensions determined by BPIP were used as noted in Section 6.2.1.

As discussed in detail in Section 6.2.2, pollutant emission rates are proportional to the dry standard flue gas flow rate corrected to 7 percent oxygen (dscfm at 7% O_2). Therefore, emission rates input into SCREEN3 are normalized to the 100 percent load and 5,000 Btu/lb refuse condition, and are shown in Table 6-2.

The ISCST3 modeling was performed for the worst case source configuration predicted by the SCREEN3 analysis. A total "unitized" emission rate of 1 g/s for Facility emissions was modeled with ISCST3. Pollutant impacts were then calculated from the "unitized" impacts by multiplying by the Facility emission rate in grams/second for the modeled source configuration.

Table 6-3
Chassahowitzka Wilderness Class I Area Receptors
City of Tampa's McKay Bay Refuse-to-Energy Facility

Receptor Number	UTM Coordinates[1]		Location Relative to Modeling Grid System[2]			
	East (km)	North (km)	Distance from Stack (km)	Direction from Stack (degrees)	X Coordinate (km)	Y Coordinate (km)
1	340.3	3165.7	76.138	344.85	-19.896	73.492
2	340.3	3167.7	78.070	345.24	-19.896	75.492
3	340.3	3169.8	80.102	345.62	-19.896	77.592
4	340.7	3171.9	82.042	346.25	-19.496	79.692
5	342.0	3174.0	83.792	347.46	-18.196	81.792
6	343.0	3176.2	85.734	348.43	-17.196	83.992
7	343.7	3178.3	87.658	349.15	-16.496	86.092
8	342.4	3180.6	90.166	348.62	-17.796	88.392
9	341.1	3183.4	93.170	348.17	-19.096	91.192
10	339.0	3183.4	93.623	346.91	-21.196	91.192
11	336.5	3183.4	94.220	345.43	-23.696	91.192
12	334.0	3183.4	94.880	343.97	-26.196	91.192
13	331.5	3183.4	95.600	342.53	-28.696	91.192

Notes:

[1] Universal Transverse Mercator Coordinates of Chassahowtizka Wilderness Area receptors provided by FDEP.

[2] Modeling grid system is set with origin (0, 0) at existing Facility's western stack. This location has UTM Coordinates 360.196 km East and 3092.208 km North.

Emission rates reflect the requirements of the Facility's current operating permit, the EG in 40 CFR 60 Subpart Cb, and the Florida Mercury Rule at Section 62-296.416 FAC (see Section 2.0, Section 4.0, and Appendix A). Existing actual Facility emissions for SO_2 and NO_2 for all four units were based on the highest average (three-hour average) measurements for the total Facility (four units) in stack tests performed since the Facility was reconstructed in 1985. Stack characteristics were assumed to be those conditions representative of the existing Facility's nominal load (250 tpd/unit at 5,000 Btu/lb). Appendix E contains Stack Test Summaries of all stack test measurements.

6.4 Modeling Results

6.4.1 SCREEN3 Results

Table 6-4 shows the unitized, non-pollutant-specific, 1-hour-average maximum predicted ground-level concentrations for each of the 28 operating cases modeled for future conditions, for the new single-stack case. ("Unitized" is defined as emissions for one unit at nominal load, 250 ton/day/unit at 5,000 Btu/lb set arbitrarily to 1.0 g/s and emissions for all other cases ratioed to this.) The operating load producing the highest ground-level impacts for the new single-stack case is that in which all four units are operating, and each has a heat input of 119.8 MMBtu/hr, or 115 percent of nominal load, and a waste heat content of 6,000 Btu/lb. This unitized 1-hour impact is 19.0 $\mu g/m^3$, predicted to occur at a distance of 400 meters from the stack (for Stability Class F, very stable conditions, and a wind speed of 4.0 m/s). Stack emissions were influenced by Huber-Snyder downwash conditions (the less severe of two types of downwash) from the Boiler Building. This condition was used in the refined modeling to represent the worse case.

The GEP analyses showed a potential for cavity wake impacts due to aerodynamic downwash from the Facility structures on emissions. These cavity impacts were considered in more detail and are discussed below.

6.4.2 Cavity Results

A cavity wake analysis was performed for the proposed Facility stack. This is shown in Table 6-5. The Operations Building, Boiler Building, scrubbers, and FFs all produce GEP stack heights greater than 61.3 meters, the stack height limit established by FAA restrictions. For these reasons, a cavity wake analysis of these structures was performed with SCREEN3. This analysis shows that only the Boiler Building could cause a cavity wake tall enough to influence stack emissions for the future Facility configuration. However, the distance to the fence line in the critical wind direction is greater than the length of the cavity, so no offsite effects are expected.

Table 6-4
Screening Modeling Results
Unitized One-Hour Concentration (μg/m^3)*
Future Conditions for the One Stack Case
Tampa McKay Bay Refuse-to-Energy Facility

No. of Units in Operation	Operational Load (percent of nominal gross heat input / waste heat content in Btu/lb)						
	115% 6,000	115% 5,000	Nominal 100% 5,000	96% 6,000	80% 5,000	87% 3,800	80% 3,800
One Stack							
1 Unit	10.55	10.26	9.98	10.16	9.45	9.18	9.03
2 Units (merged)	13.88	13.66	12.68	12.60	11.27	11.47	10.90
3 Units (merged)	16.87	16.55	15.54	15.53	14.02	14.10	13.52
4 Units (merged)	19.00	18.62	17.59	17.66	16.13	16.07	15.45

Note:

* Based on unitized emission rates given in Table 6-2.

Table 6-5
Direction Specific Cavity Wake Analyses
Tampa McKay Bay Refuse-to-Energy Facility

		Worst Case Building Widths: 1)		*SCREEN3 Model Results (along wind dimension):*				
Structure	***Dominating Wind Vectors (degrees)***	***Maximum Width (m)***	***Minimum Width (m)***	***Cavity Height (m)***	***Cavity Height Above Stack Height (yes/no)***	***Cavity Length (m)***	***Direction Specific Fenceline (m)***	***Cavity Extends Beyond Property Boundary (yes/no)***
Boiler	10 - 60	37.1	32.7	63.8	yes	63	73	no
	130 - 240	40.7	39.3	59.5	no	--	--	--
	310 - 360	43.1	42.6	57.6	no	--	--	--
Fabric-Filter/ Scrubber	70,250	33.6	24.3	57.9	no	--	--	--
	80,100,260,280	42.4	18.0	32.6	no	--	--	--
	120.3	38.3	29.9	53.7	no	--	--	--
Fabric Filter	110,290	29.9	24.3	29	no	--	--	--

1) Building dimensions for the boilers were measured for the wind directions with the closest property boundary (60, 180 and 340 degrees).

6.4.3 ISCST3 Results

Refined modeling was performed with ISCST3 for the future Facility after the proposed improvements for the worst case future source configuration predicted by the SCREEN3 modeling (four units at 115 percent load with 6,000 Btu/lb refuse). Normalized impacts for a 1 g/s facility emission rate are shown on Table 6-6 for the Facility vicinity. Since all maximum impacts occurred in the area of 100-meter spaced receptor grids, no additional analyses with fine receptor grids were required. Pollutant-specific modeling results were produced for comparison to Florida and national AAQS and air quality guidelines and are discussed below. The purpose of the air quality analysis is to demonstrate that the emissions from the proposed Facility will not cause or contribute to a violation of AAQS, and will not cause an exceedance of the Florida ARCs.

A step-wise approach was used for this analysis for criteria pollutants. It starts with conservative assumptions, and becomes more realistic. It begins with a comparison of the future impact of the proposed Facility to the Significant Impact Levels (SILs) and Florida ARCs. Pollutant impacts below SILs are considered insignificant, and further analyses are not required. For those pollutants found to exceed the SILs, based on the future Facility's total impact, additional analyses were performed to compare the net change in Facility upgrade impacts to SILs and PSD increments, and a comparison of future Facility impacts to AAQS after adding in background concentrations (see Section 5).

6.5 Comparison to SILs and ARCs

6.5.1 Total Retrofit Facility Impacts

The proposed Facility was modeled using worst-case direction-specific building dimensions, maximum potential emission rates, and refined meteorological data. Maximum normalized impacts were predicted for the 1-, 3-, 8-, and 24-hour periods and the annual average (see Tables 6-6 and 6-7). The normalized concentrations were then multiplied by pollutant-specific emission rates to produce pollutant-specific impacts (see Table 6-8). If Facility impacts exceeded the SILs, the net difference of future Facility and existing Facility impacts may be calculated by assigning negative emission rates to the existing Facility, and modeling them both together. By subtracting out the impacts from the existing Facility, the resulting impacts represent the effects of the net change in concentrations due to the proposed Facility Retrofit. The resulting impacts are then compared to the SILs. The results from these analyses are discussed in more detail below.

PSD pollutant impacts for the proposed Facility are compared in Table 6-9 to the EPA SILs for Class II Areas and to the proposed National Park Service/Fish and Wildlife Service (NPS/FWS) SILs for Class I Areas. Maximum impacts for PM_{10}, CO, and lead are less than the SILs. Therefore, no additional impact analyses are required for these pollutants. For SO_2, maximum predicted impacts for the Facility after APC improvements are shown to be greater than the SILs in both Class I and II areas. For NO_2, maximum predicted impacts are greater than the SIL only in the Class II Area.

Table 6-6
Normalized Modeling Results (1)
Project Vicinity (Class II Area)
Tampa McKay Bay Refuse-to-Energy Facility

Year	*High or High Second High (H/HSH)*	*1-Hour (μg/m³)/(g/s)*	*3-Hour (μg/m³)/(g/s)*	*8-Hour (μg/m³)/(g/s)*	*24-Hour (μg/m³)/(g/s)*	*Annual (μg/m³)/(g/s)*
1987	H	4.96657	2.68012	1.77661	**1.06560**	0.07556
		(0, -400)	(-52, 295)	(150, -260)	**(129, -153)**	(-306, -257)
	HSH	4.06861	2.56285	**1.75637**	0.70160	---
		(-257, 306)	(-150, 260)	**(150, -260)**	(-129, -153)	---
1988	H	4.29659	**3.10547**	1.81471	1.05715	**0.10393**
		(-150, 260)	**(-103, 282)**	(-68, -188)	(-68, -188)	**(-129, -153)**
	HSH	**4.25380**	2.38560	1.51923	**0.94816**	---
		(-150, 260)	(-52, 295)	(-68, -188)	**(-100, -173)**	---
1989	H	4.36768	3.06212	**2.31837**	1.02963	0.08810
		(-103, -282)	(0, -400)	**(-103, -282)**	(0, -400)	(-68, -188)
	HSH	4.20535	**2.59969**	1.73355	0.89209	---
		(-150, 260)	**(0, -400)**	(0, -400)	(0, -400)	---
1990	H	4.51146	3.01163	1.60605	0.80208	0.07520
		(-150, -260)	(0, -400)	(-68, 188)	(-68, 188)	(-306, 257)
	HSH	4.24269	2.29990	1.46651	0.72156	---
		(193, -230)	(-35, 197)	(-193, -230)	(-100, 173)	---
1991	H	**5.29640**	2.80881	1.95744	0.91135	0.08244
		(-35, -197)	(52, 295)	(-35, -197)	(-129, -153)	(-306, -257)
	HSH	4.24269	2.42406	1.50198	0.79604	---
		(-150, -260)	(-150, 260)	(-129, -153)	(-129, -153)	---

* Note: Maximum values for each averaging period are highlighted in bold type.
(1) Emission rate is normalized to 1 g/s for the total Facility (4 units).

Maximum 5-year Normalized Model Results

High or High Second High (H/HSH)	*1-Hour (μg/m³)/(g/s)*	*3-Hour (μg/m³)/(g/s)*	*8-Hour (μg/m³)/(g/s)*	*24-Hour (μg/m³)/(g/s)*	*Annual (μg/m³)/(g/s)*
H	5.29640	3.10547	2.31837	1.06560	0.10393
HSH	4.25380	2.59969	1.75637	0.94816	--

Table 6-7
Normalized Modeling Results (1)
Chassahowitzka National Wildlife Refuge (Class I Area)
Tampa McKay Bay Refuse-to-Energy Facility

Year	*High or High Second High (H/HSH)*	*1-Hour (μg/m³)/(g/s)*	*3-Hour (μg/m³)/(g/s)*	*8-Hour (μg/m³)/(g/s)*	*24-Hour (μg/m³)/(g/s)*	*Annual (μg/m³)/(g/s)*
1987	H	0.12824	0.05691	0.02754	0.00787	0.00039
1988	H	0.13748	0.05590	0.02795	0.01348	0.00061
1989	H	**0.14871**	**0.07374**	0.03516	0.01223	**0.00108**
1990	H	0.14858	0.07268	**0.04527**	**0.01516**	0.00060
1991	H	0.14613	0.06038	0.03834	0.01278	0.00043

* Note: Maximum values for each averaging period are highlighted in bold type.
(1) Emission rate is normalized to 1 g/s for the total Facility (4 units).

Maximum 5-year Normalized Model Results

High or High Second High (H/HSH)	*1-Hour (μg/m³)/(g/s)*	*3-Hour (μg/m³)/(g/s)*	*8-Hour (μg/m³)/(g/s)*	*24-Hour (μg/m³)/(g/s)*	*Annual (μg/m³)/(g/s)*
H	0.14871	0.07374	0.04527	0.01516	0.00108

Table 6-8

Pollutant-Specific Impacts 1

City of Tampa's McKay Bay Refuse-to-Energy Facility

Pollutant	**Facility Emission Rate (g/s)**	**Averaging Time**	**Maximum Facility Vicinity Impact (µg/m³)**	**Maximum Class I Area Impact (µg/m³)**
SO_2	20.60	3-hour	63.97	1.52
		24-hour	21.95	0.31
		Annual	2.14	0.02
NO_2	20.22	Annual	2.10	0.022
CO	6.00	1-hour	31.78	---
		8-hour	13.91	---
PM10	1.42	24-hour	1.51	0.02
		Annual	0.15	0.0015
Dioxin	1.55E-06	8-hour	3.58E-06	---
		24-hour	1.65E-06	---
		Annual	1.61E-07	---
Mercury	7.0E-03	8-hour	1.62E-02	---
		24-hour	7.46E-03	---
		Annual	7.28E-04	---
Cadmium	2.1E-03	8-hour	4.78E-03	---
		24-hour	2.20E-03	---
		Annual	2.14E-04	---
Lead	2.3E-02	8-hour	5.33E-02	---
		24-hour	2.45E-02	---
		Annual	2.39E-03	---
HCl	7.82	8-hour	18.13	---
		24-hour	8.33	---
		Annual	0.81	---
HF	0.756	8-hour	1.75	---
		24-hour	0.81	---
		Annual	0.08	---
Beryllium	5.8E-05	8-hour	1.34E-04	---
		24-hour	6.18E-05	---
		Annual	6.03E-06	---
Ammonia	1.82	8-hour	4.22	---
		24-hour	1.94	---
		Annual	0.19	---

Note: [1] Impacts are highest maximum short-term and annual impacts.

Table 6-9
Comparison of Proposed Facility PSD Impacts to Significant Impact Levels (SILs) City of Tampa's McKay Bay Refuse-to-Energy Facility

Pollutant	Averaging Time	Refined Modeling Concentration ($\mu g/m^3$)	Refined Modeling SILs ($\mu g/m^3$)	Refined Modeling Percent of SIL	Class I Modeling Concentration ($\mu g/m^3$)	Class I Modeling SILs [a] ($\mu g/m^3$)	Class I Modeling Percent of SIL
SO_2	3-hour	63.97	25	256%	1.52	0.48	316%
	24-hour	21.95	5	439%	0.31	0.07	446%
	Annual	2.14	1	214%	0.02	0.03	74%
NO_2	Annual	2.10	1	210%	0.022	0.03	73%
CO	1-hour	31.78	2000	2%	n/a	n/a	n/a
	8-hour	13.91	500	3%	n/a	n/a	n/a
PM_{10}	24-hour	1.51	5	30%	0.021	0.27	8%
	Annual	0.15	1	15%	0.002	0.08	2%
Pb	Quarter	0.010 [b]	0.1	10%	n/a	n/a	n/a

Notes: [a] Significant Impact Levels currently recommended by the National Park Service/Fish and Wildlife Service. NPS/FWS SILs are more stringent, or lower than (about 1/2 to 1/3 of) those proposed by the U.S. EPA as part of New Source Review Reform (61 FR 38292, July 23, 1996).
[b] Conservatively estimated as four times the maximum annual lead impact.

Additional modeling analyses for these pollutants to determine the effect of the Facility improvements on ambient concentrations are required.

Table 6-10 shows the maximum Facility impacts for those pollutants without AAQS (*i.e.*, non-criteria pollutants). Impacts are less than FDEP's ARCs in all cases. Therefore, Facility impacts for these pollutants are not expected to cause significant effects, and no additional analysis of non-criteria pollutants was performed.

6.5.2 Net Impact of Proposed APC Improvements

As described above, the first round of refined modeling analyses demonstrated that Facility impacts after the APC improvements could have SO_2 and NO_2 maximum impacts greater than the PSD Class II SILs in the vicinity of the source, and SO_2 maximum impacts greater than the proposed NPS/FWS Class I SILs in the nearest Class I Area. Additional modeling analyses were performed to determine the net change from existing Facility SO_2 and NO_2 impacts due to the proposed Facility improvements.

As discussed earlier, the APC improvements will result in no change to, or significant reductions in, actual emissions for all criteria pollutants under all operating conditions. Since the two existing stacks will be replaced by a single stack of different height, building influences, and exit temperatures, additional modeling analyses are needed to determine the change in Facility impacts due to the Facility improvements.

To determine the maximum increase in pollutant impacts due to the APC improvements, the existing Facility stacks were modeled with stack characteristics for the Facility operating under "actual" conditions (four units at nominal load with 5,000 Btu/lb refuse) as determined by the BURN runs. The SO_2 and NO_x emissions were the worst case measured emission rate for the entire facility based on stack tests from 1985 to 1991. The proposed new stack for the Retrofit was modeled with the worst-case source configuration determined in the screening analyses (four units at 115 percent of nominal load with 6,000 Btu/lb refuse) and worst-case potential emissions. The existing Facility was represented with negative emission rates. This modeling analysis resulted in model outputs that show the maximum net increase in pollutant impacts due to the proposed project. Modeling parameters for the existing and future proposed stacks are summarized in Table 6-11.

Tables 6-12 and 6-13 show the maximum net increase in SO_2 and NO_2 impacts due to the proposed APC improvement project for each year of meteorological data analyzed for the source vicinity (PSD Class II Area) and the nearest Class I Area (Chassahowitzka National Wildlife Refuge). These impacts are summarized in Table 6-14 and compared to the applicable EPA Class II and NPS/FWS Class I SILs. For the Facility vicinity, predicted increases in ambient SO_2 and NO_2 concentrations are greater than the PSD Class II SILs. Figures 6-8 through 6-10 show the maximum radii of increases greater than the SILs for 3- and 24-hour and annual SO_2 impacts, respectively.

Table 6-10
Comparison of Proposed Facility Impacts to FDEP "Ambient Reference Concentrations"
Tampa McKay Bay Refuse-to-Energy Facility

Pollutant	Averaging Time	Refined Modeling Concentration (μg/m3)	Refined Modeling ARCs (μg/m3)	Refined Modeling Percent of ARCs
Dioxin [1]	Annual	1.61E-07	1.21E-06	13%
Mercury	8-hour	0.016	0.1	16%
	24-hour	0.007	0.02	37%
	Annual	0.001	0.30	0%
Cadmium	8-hour	4.78E-03	0.02	24%
	24-hour	2.20E-03	0.005	44%
	Annual	2.14E-04	0.00056	38%
Lead	8-hour	0.053	0.5	11%
	24-hour	0.025	0.1	25%
	Annual	0.0024	0.090	3%
HCl	8-hour	18.13	70	26%
	24-hour	8.33	17	49%
	Annual	0.81	7	12%
HF	8-hour	1.75	26	7%
	24-hour	0.81	6.2	13%
Beryllium	8-hour	1.34E-04	0.02	1%
	24-hour	6.18E-05	0.005	1%
	Annual	6.03E-06	4.2E-04	1%
Ammonia	8-hour	4.22	170	2%
	24-hour	1.94	41	5%
	Annual	0.19	100	0%

(1) The ARC is for toxic equivalent dioxin, 2,3,7,8-TCDD. This was adjusted for total dioxins and furans, consistent with the Facility impact analysis, by multiplying by 55. The conversion factor is from 60 FR 65395, December 19, 1995, Table 1.

Table 6-11
Model Parameters1 for Net Impact Analysis
Tampa McKay Bay Refuse-to-Energy Facility

Parameter	***Two Existing Stacks***	***Future Proposed Single Stack***
Height	50.3 m	61.3 m
Exit Diameter	1.77 m each	2.57 m
Exit Temperature	547 K	416 K
Exit Velocity	27.889 m/s	22.215 m/s
SO_2 Emission Rate[2]	17.63 g/s	20.60 g/s
NO_X Emission Rate[2]	29.08 g/s	20.22 g/s

[1] Based on four operating units and two stacks for the existing Facility, and one stack for the upgraded future Facility.
Existing stack parameters are based on 100% load and 5000 BTU/lb results from BURN runs. Future stack parameters are based on 115% load and 6000 BTU/lb
results from BURN runs.

[2] Emission rates are for the total combined Facility of 4 units. Existing emission rates are the highest combined Facility measured emission rate during stack tests performed since the Facility reconstruction in 1985 (6 SO_2 tests and 6 NO_X tests in that period). Future emission rates are the maximum potential to emit. See Section 2 and Appendix A.

Table 6-12
5-year Modeled Maximum Net Increases in Facility Impacts
Due to Proposed Facility Retrofit
Project Vicinity (Class II Area)
Tampa McKay Bay Refuse-to-Energy Facility

	SO_2			NO_2
Year	***3-Hour ($\mu g/m^3$)***	***24-Hour ($\mu g/m^3$)***	***Annual ($\mu g/m^3$)***	***Annual ($\mu g/m^3$)***
1987	49.82323 (-200, 346)	15.22795 (129, -153)	1.45621 (-306, -257)	1.36276 (-306, -257)
1988	**56.35820** **(-137, 376)**	17.61923 (-306, -257)	**1.92078** **(-257, -306)**	**1.75298** **(-257, -306)**
1989	56.22899 (0, -400)	**18.04675** **(0, -400)**	1.60645 (-137, -376)	1.47892 (-200, -346)
1990	53.91748 (0, -400)	13.94170 (-100, 173)	1.47136 (-306, -257)	1.39271 (-306, -257)
1991	53.68973 (-306, 257)	14.99264 (-257, -306)	1.60679 (-306, -257)	1.51661 (-306, -257)

* Note: Maximum values for each averaging period are highlighted in bold type and summarized below.

Summary of Maximum Increases

Pollutant	***3-Hour ($\mu g/m^3$)***	***24-Hour ($\mu g/m^3$)***	***Annual ($\mu g/m^3$)***
SO_2	56.35820	18.04675	1.92078
NO_2	--	--	1.75298

Table 6-13
5-year Modeled Maximum Net Increases in
Facility Impacts Due to Proposed Facility Retrofit
Chassahowitzka National Wildlife Refuge (Class I Area)
Tampa McKay Bay Refuse-to-Energy Facility

Year	SO_2 3-Hour ($\mu g/m^3$)	SO_2 24-Hour ($\mu g/m^3$)	SO_2 Annual ($\mu g/m^3$)
1987	0.07601	0.01389	0.00055
1988	0.10786	0.01348	0.00055
1989	**0.19145**	**0.03189**	**0.00092**
1990	0.08189	0.01379	0.00031
1991	0.10811	0.02297	0.00058

* <u>Note</u>: Maximum values for each averaging period are highlighted in bold type and summarized below.

Summary of Maximum Increases

Pollutant	3-Hour ($\mu g/m^3$)	24-Hour ($\mu g/m^3$)	Annual ($\mu g/m^3$)
SO_2	0.19145	0.03189	0.00092

Table 6-14
Comparison of Maximum Increases in Facility Impacts to Significant Impact Levels (SILs)
Tampa McKay Bay Refuse-to-Energy Facility

		Facility Vicinity			*Class I Area Receptors*					
					NPS/FWS [1]			*U.S. EPA* [2]		
Pollutant	*Averaging Time*	*Concentration ($\mu g/m^3$)*	*SILs ($\mu g/m^3$)*	*Percent of SIL*	*Concentration ($\mu g/m^3$)*	*SILs ($\mu g/m^3$)*	*Percent of SIL*	*Concentration ($\mu g/m^3$)*	*SILs ($\mu g/m^3$)*	*Percent of SIL*
SO_2	3-hour	56.36	25	225%	0.191	0.48	40%	0.191	1.0	19%
	24-hour	18.05	5	361%	0.032	0.07	46%	0.032	0.2	16%
	Annual	1.92	1	192%	0.001	0.03	3%	0.001	0.1	1%
NO_2	Annual	1.75	1	175%	N/R			N/R		

Notes: [1] National Park Service (NPS)/Fish and Wildlife Service (FWS) Class I SILs
[2] U.S. EPA proposed Class I SILs (61 FR 38292, July 23, 1996).
N/R = not required.

Figure 6-8
Maximum 3-Hour Net Increase in SO_2 Concentrations (µg/m³)
Significant Impact Area
Tampa McKay Bay Refuse-to-Energy Facility

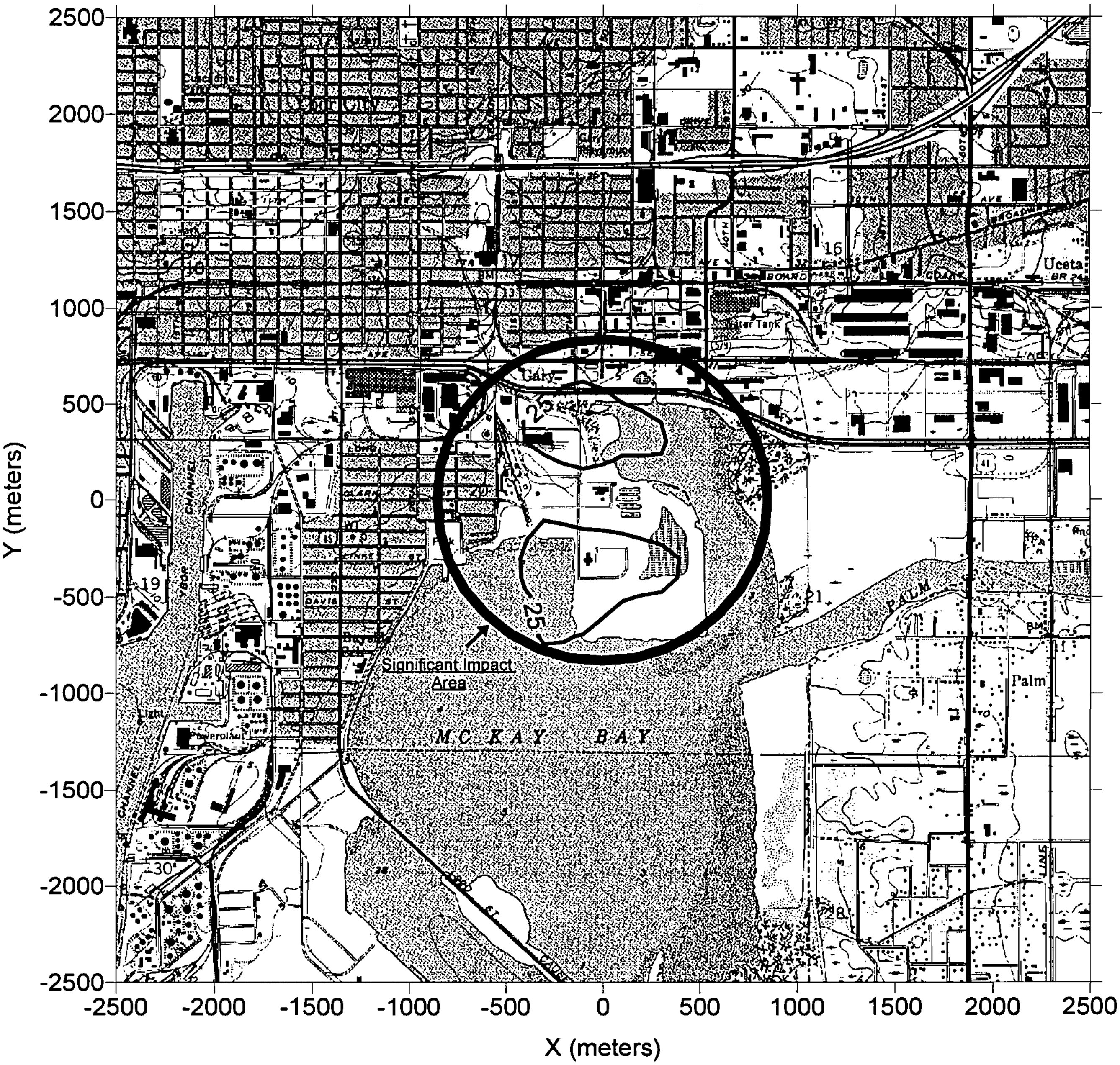


Figure 6-9
Maximum 24-Hour Net Increase in SO_2 Concentrations (μg/m³)
Significant Impact Area
Tampa McKay Bay Refuse-to-Energy Facility

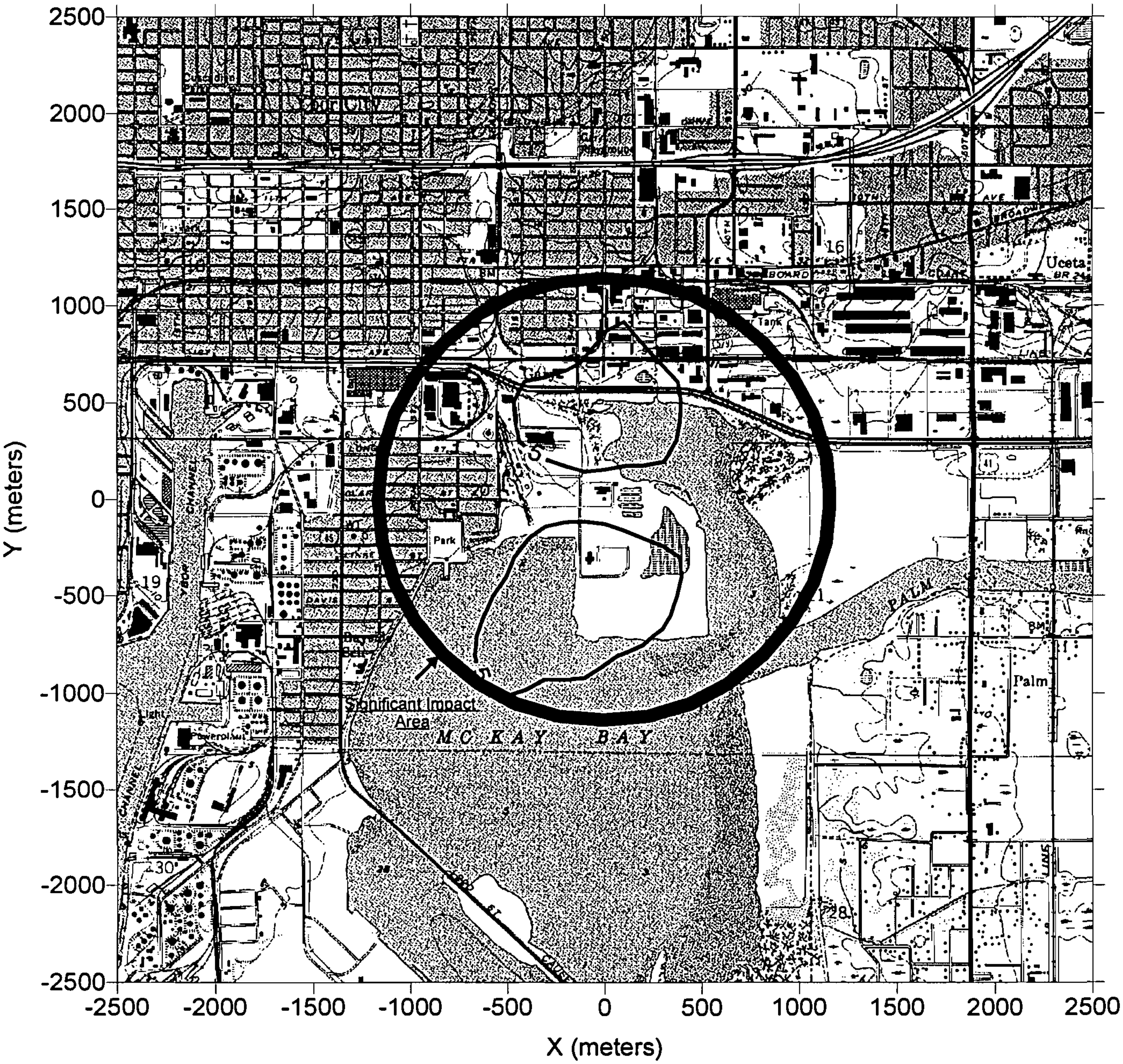


Figure 6-10
Maximum Annual Average Net Increase in SO_2 Concentrations (µg/m³)
Significant Impact Area
Tampa McKay Bay Refuse-to-Energy Facility

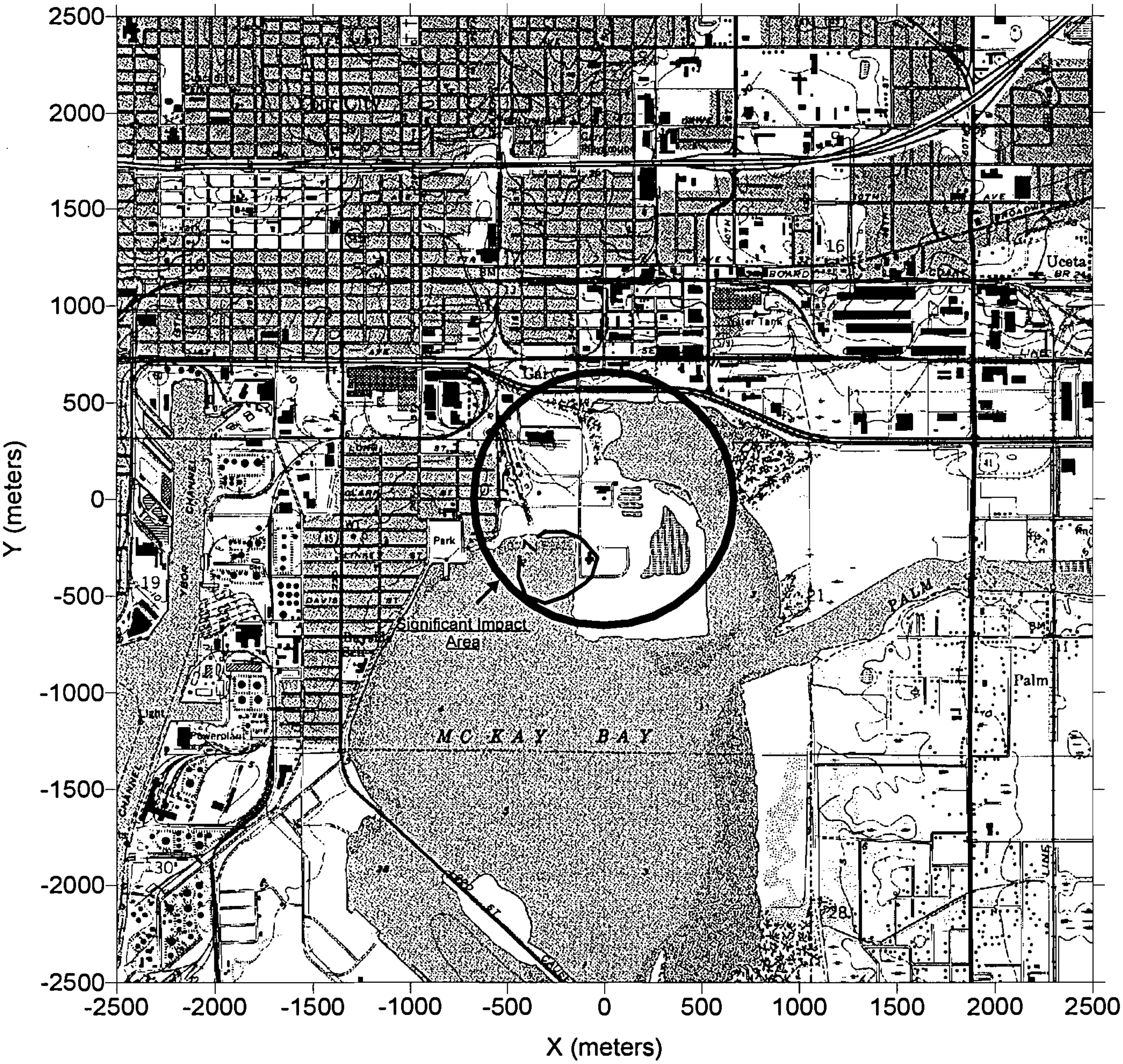


Figure 6-11 shows the maximum radius of increases greater than the SIL for the annual NO_2 impact. All increases are less than the PSD Class II SILs at distances greater than approximately 985, 1310, and 670 meters, for SO_2, 3-hour, 24-hour, and annual impacts respectively, and 615 meters for annual NO_2 impacts. Class I Area maximum impacts are all shown to be well below both the proposed NPS/FWS SILs and the proposed EPA SILs.

Net increases in Facility impacts after the Retrofit appear to be primarily due to the reduction in flue gas exit temperatures caused by the SDAs, the possible replacement of the existing buildings with taller and more influential structures, and the use of worst-case potential emissions to represent future operations, while the existing case is represented by actual measured emissions.

6.6 Comparison to AAQS and PSD Increments

Because this is not a PSD analysis, comparison of Facility impacts with AAQS and PSD Class I and II increments is not strictly required. However, significant impact areas (SIAs) were modeled for net Facility impact to SO_2 and NO_X concentrations. Therefore, a general comparison with AAQS and PSD Increments has been performed to provide benchmarks for evaluating this impact. Since the SIAs are quite small, no other sources are expected to contribute significant concentrations in these SIAs. Therefore, no additional sources were modeled for the AAQS and increment comparison. (This approach was confirmed by FDEP in a scoping/protocol meeting held November 6, 1996.)

Table 6-15 compares the maximum increases in Facility SO_2 and NO_2 impacts due to the APC improvement project to the applicable PSD Class II increments. Increases in impacts due to the APC improvement are all less than the applicable PSD Class II increments. Table 6-16 shows that the predicted SO_2 and NO_2 impacts from the Facility after proposed APC improvements, when added to background concentrations (see Table 5-6), will be less than the applicable AAQS. Total NO_2 concentrations are 20 percent of the annual AAQS. Total SO_2 concentrations are 37, 38, and 27 percent of the most restrictive 3-hour, 24-hour, and annual average AAQS, respectively.

Figure 6-11
Maximum Annual Average Net Increase in NO_2 Concentrations (µg/m³)
Significant Impact Area
Tampa McKay Bay Refuse-to-Energy Facility

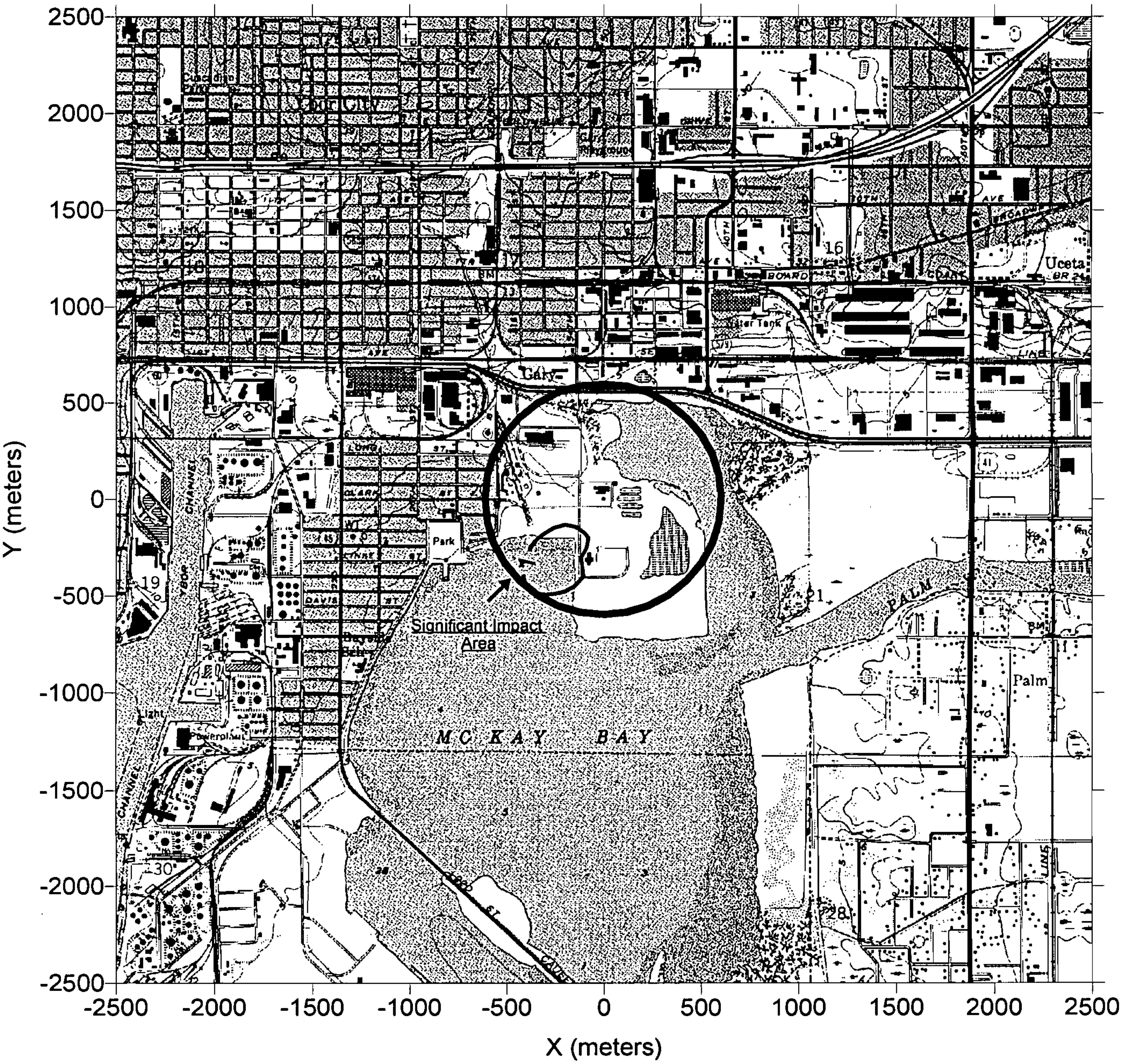


Table 6-15
PSD Class II Increment
Comparison
Tampa McKay Bay Refuse to Energy Facility

Pollutant	Averaging Time	Facility Vicinity Maximum Increase in Facility Impacts ($\mu g/m^3$)	Class II Increment ($\mu g/m^3$)	% of Increment ($\mu g/m^3$)
SO_2	3-hour	56.36	512	11%
	24-hour	18.05	91	20%
	Annual	1.92	20	10%
NO_2	Annual	1.75	25	7%

Table 6-16
AAQS Comparison
Tampa McKay Bay Refuse-to-Energy Facility

Pollutant	*Averaging Time*	*Modeled Concentration (µg/m³)* [1]	*Background (µg/m³)* [2]	*Total Concentration (µg/m³)*	*AAQS (µg/m³)* [3]	*% of AAQS*
SO_2	3-hour	53.55	422	475.6	1300	37%
	24-hour	19.53	79	98.5	260	38%
	Annual	2.14	14	16.1	60	27%
NO_2	Annual	2.10	18	20.1	100	20%

Notes:

[1] Maximum second-highest short-term and maximum annual modeled impacts for the future facility were used, since one excess per year of the short-term AAQS is allowed.

[2] Maximum second-highest short-term and maximum annual monitored values during 1994-1996. SO2 values were monitored at the Causeway Blvd. monitoring station. NO_2 values were monitored at the Gandy Blvd. monitoring station.

[3] AAQS shown are the Florida AAQS, which are more restrictive than the National AAQS.

Section 7
Compliance Monitoring

7.1 Introduction

After the proposed improvements to the City's Facility, the City will comply with performance testing and monitoring requirements in the EPA EG for MWC (40 CFR 60.38b). The parameter or pollutant compliance monitoring methods, requirements for installation, calibration, maintenance, and operation of monitoring system under the EG are described below. Existing permit conditions to be retained are described in Section 7.11.

7.2 Oxygen

The City will install a continuous emissions monitoring system (CEMS) for measurement of oxygen at each location in the Facility where carbon monoxide (CO), sulfur dioxide (SO_2), or nitrogen oxide (NO_X) emissions are monitored [40 CFR 60.58b(b)]. The span value of the oxygen monitor will be 25 percent oxygen. The monitor will be installed, evaluated, and operated as required by 40 CFR 60.13. The monitor will conform to Performance Specification 3 in 40 CFR 60, Appendix B except for Section 2.3. Quality assurance procedures will conform to 40 CFR 60, Appendix F except for Section 5.1.1. The initial performance evaluation must be completed within 180 days after initial startup of each retrofitted unit, as per 40 CFR 60.58b(b)(3).

7.3 Particulate Matter and Opacity

The City will use EPA Method 5 to determine compliance with the PM emission limit [40 CFR 60.58b(c)]. The minimum sample volume will be 1.7 cubic meters. The probe and filter holder heating systems in the sample train will be set to provide a gas temperature no greater than 160° plus or minus 14°C. An oxygen measurement will be obtained simultaneously with each test run. EPA Method 1 will be used to select sampling sites and number of traverse points. EPA Method 3 will be used for gas analysis. Compliance with the opacity limit will be determined by EPA Method 9. The initial compliance for PM emissions and opacity will be conducted within 60 days after achieving maximum operating capacity, but no later than 180 days after initial startup of each retrofitted unit (40 CFR 60.8). Following the initial compliance test, performance tests for particulate and opacity will be conducted annually.

In addition, the City will install a continuous opacity monitoring system (COMS) for measuring opacity [40 CFR 60.58b(c)(8)]. The output of the COMS will be recorded on a 6-minute average basis. The COMS will be installed, evaluated, and operated in accordance with 40 CFR 60.13, and will conform to Performance Specification 1 in 40 CFR 60,

Appendix B. The initial performance evaluation for the COMS must be completed within 180 days after the date of initial startup of each retrofitted unit as per 40 CFR 60.58b(c)(8)(iv).

7.4 Metals

Compliance with emission limits for cadmium (Cd), lead (Pb), and mercury (Hg) will be determined by EPA Method 29 [40 CFR 60.58b(d)]. A minimum sample volume of 1.7 cubic meters will be obtained for the mercury test [40 CFR 60.58b(d)(2)]. Oxygen measurements will be obtained simultaneously with each test run. The location and number of sampling points will be determined by EPA Method 1. EPA Method 3 will be used for flue gas analysis. A minimum of three test runs will be conducted under representative full-load operating conditions. The average of these test runs will be used to determine compliance. Initial compliance tests must be conducted within 60 days after achieving maximum operating capacity, but no later than 180 days after initial startup of each retrofitted unit (40 CFR 60.8). Following the completion of initial compliance testing, compliance will be verified by annual stack tests.

In addition, the Facility will measure and record the amount of activated carbon used in kilograms for each hour the Facility is operating, as required by 40 CFR 60.58b(m)(3)(ii). This value will be reported quarterly, and must equal or exceed the values recorded during the most recent performance tests.

7.5 Sulfur Dioxide

Compliance with sulfur dioxide (SO_2) emission limits will be determined by using a CEMS to measure SO_2 emissions and calculating a 24-hour daily geometric mean emission concentration [40 CFR 60.58b(e)]. An oxygen measurement will be obtained simultaneously with the SO_2 measurements. Compliance will be determined based on the geometric mean of the hourly arithmetic average emission concentrations during each 24-hour daily period measured between 12:00 midnight and the following midnight. The 1-hour arithmetic averages will be expressed as ppmdv corrected to 7 percent O_2, and will be calculated using at least two data points. At a minimum, valid paired CEMS hourly averages (*i.e.*, SO_2 and O_2) will be obtained for at least 75 percent of the hours per day for at least 90 percent of the days per calendar quarter of operation. The CEMS will be installed, evaluated, and operated in compliance with 40 CFR 60.13.

The initial performance test must be completed within 180 days after initial startup of each retrofitted unit. The CEMS will be operated according to Performance Specification 2 in 40 CFR 60, Appendix B, and quarterly accuracy determinations and daily calibration drift tests will be performed in accordance with Procedure 1 in 40 CFR 60, Appendix F.

7.6 Nitrogen Oxides

Compliance with nitrogen oxides (NO_X) emission limits will be determined by use of a CEMS for measuring NO_X and calculating 24-hour daily arithmetic average emissions [40 CFR 60.58b(h)]. Oxygen measurement will be obtained simultaneously with each measurement. Compliance with the NO_X limit will be based on the arithmetic average of the hourly emission concentration during each 24-hour daily period, corrected to 7 percent O_2, measured between 12:00 midnight and the following midnight, with the CEMS. At a minimum, valid paired CEMS hourly emissions [NO_2 (or NO_X) and O_2] will be obtained for at least 75 percent of the hours per day, for at least 90 percent of the days per calendar quarter of operations. At least two data points will be used to calculate each 1-hour arithmetic average. The CEMS installation, evaluation, and operation will follow the procedures set forth in 40 CFR 60.13. The CEM will be operated according to Performance Specification 2 in 40 CFR 60, Appendix B. Quarterly accuracy determinations and daily calibration drift tests will be performed in accordance with Procedure 1 in 40 CFR 60, Appendix F. The initial performance evaluation must be completed within 180 days after initial startup of each retrofitted unit, as required by 40 CFR 60.58b(h)(9).

7.7 Hydrogen Chloride

Compliance with hydrogen chloride (HCl) emission limits will be determined by EPA Method 26 [40 CFR 60.58b(f)]. The minimum sampling time will be 1 hour. Oxygen measurements will be obtained simultaneously with each test run. Initial compliance tests must be conducted within 60 days after achieving maximum operating capacity, but no later than 180 days after initial startup of each retrofitted unit, as required by 40 CFR 60.8. Thereafter, annual stack tests will be conducted to verify compliance.

7.8 Dioxins/Furans

Compliance with emission limits for dioxins and furans will be determined by EPA Method 23, as required by 40 CFR 60.58b(g). The minimum sample time for each test run will be 4 hours, and three test runs must be conducted. The average of the three test runs will be used to determine compliance. Oxygen measurement will be obtained simultaneously with each test run. Compliance will be based on total emissions of all tetra- through octa-isomers of dioxins and furans. The initial compliance test must be conducted within 60 days after achieving maximum operating capacity, but no later than 180 days after initial startup of each retrofitted unit (40 CFR 60.8). Thereafter, compliance will be demonstrated by annual stack tests.

In the event that all performance tests for all MWC units over a 2-year period indicate dioxin/furan emissions less than or equal to 15 ng/dscm at 7 percent O_2, the City may elect to conduct subsequent annual performance tests on one MWC unit per year [40 CFR 60.38b(b)]. A different MWC unit will be tested each year and the units will be tested in sequence (*i.e.*, Unit No. 1 in year n + 1, Unit No. 2 in year n + 2, etc.). In the event that an annual performance test indicates dioxin/furan emissions greater than 15 ng/dscm at 7 percent O_2, all MWC units will be tested in the subsequent and following years until and unless all annual performance tests for all MWC units over a 2-year period indicate compliance with the 15 ng/dscm limit to again qualify for less frequent testing.

7.9 Operating Standards

GCPs were selected by EPA as the best demonstrated technology for controlling MWC organic emissions (*e.g.*, dioxins and furans). The format selected by EPA for ensuring GCP is a mix of operational and work practice standards that can be readily monitored. Since measurement technologies for continuously monitoring MWC organic emissions are not available or are not practical, standards for GCP ensure that MWC organic emissions are minimized on a continuous basis. The EG specify three operating parameters to be continuously monitored to ensure GCP: (1) CO emissions; (2) combustor load levels; and (3) flue gas temperature at the inlet to the PM control device.

7.9.1 Carbon Monoxide

Compliance with the carbon monoxide (CO) emission limit will be determined by a CEMS for measuring CO at the combustor outlet using a 4-hour block arithmetic average [40 CFR 60.58b(i)(1)], unless the Facility uses rotary waterwall combustors. In that case, compliance will be determined using a 24-hour daily arithmetic average [40 CFR 60.58b(i)(2)]. The CEM system will be operated according to Performance Specification 4A in 40 CFR 60, Appendix B. The 4-hour arithmetic average (expressed as ppmdv at 7 percent O_2) will be calculated from 1-hour arithmetic averages using at least two data points. Required data will consist of valid paired hourly averages (*i.e.*, CO and O_2). Quarterly accuracy determinations and daily calibration drift tests for CEMs will be performed in accordance with Procedure 1 in 40 CFR 60, Appendix F.

7.9.2 MWC Load Level

Compliance with MWC load level requirements will be determined by a steam flow or feedwater flowmeter using the ASME Power Test Code for Steam Generating Units, Method 4.1, Section 4 [40 CFR 60.58b(i)(6)]. Steam flow or feedwater flow will be calculated in 4-hour block arithmetic averages. The design, construction, installation, and calibration of the steam flow or feedwater flowmeter will be based on ASME Interim Supplement 19.5 on Instruments and Apparatus: Application, Part II of Fluid Meters, 6th Edition, Chapter 4, except that measurement devices such as flow nozzles and orifices are not required to be recalibrated after they are installed [40 CFR 60.58b(i)(6)(i) and (ii)].

The "maximum demonstrated MWC unit load" will be the highest 4-hour arithmetic average load recorded for 4 consecutive hours during the most recent dioxin/furan performance test in which compliance with the dioxin/furan emissions limit was achieved [40 CFR 60.51b and 60.58b(i)(8)]. Subsequent operations of the MWC unit would then be limited to MWC load levels of 110 percent or less of the maximum demonstrated MWC unit load based on 4-hour block-averaged measurements, except for testing purposes as specified by the EG [40 CFR 60.53b(b)].

7.9.3 Particulate Matter Control Device Temperature

Compliance with maximum PM control device temperature requirements will be determined by a device to measure temperature on a continuous basis at the FF inlet [40 CFR 60.58b(i)(7)]. Temperature will be calculated in 4-hour block arithmetic averages. The "maximum demonstrated PM control device temperature" will be the highest 4-hour arithmetic average temperature measured at the FF inlet for 4 consecutive hours during the most recent dioxin/furan performance test in which compliance with the dioxin/furan limit was achieved [40 CFR 60.51b and 60.58b(i)(9)]. Subsequent operations of the MWC unit must maintain the PM control device inlet temperature, on a 4-hour block-averaged basis, to the maximum demonstrated PM control device temperature plus 17°C (30°F), except for testing purposes as specified by the EG [40 CFR 60.53b(c)].

7.9.4 Operator Training

Operator certification and training is another element of GCP. The EG require each chief facility operator and shift supervisor to obtain and maintain a current provisional operator certification and be scheduled for a full certification exam, or receive full certification, with either ASME or an equivalent state-approved certification program by December 19, 1996 [40 CFR 60.54b(a) and (b)]. Thereafter, one of these persons, or a provisionally certified control room operator, must be on duty and on site at all times when the facility is operating [40 CFR 60.54b(c)]. Further, all chief facility operators, shift supervisors, and control room operators must complete the EPA or state MWC operator training course no later than December 19, 1996 [40 CFR 60.54b(d)].

The EG also require that a site-specific operating manual be developed and updated yearly [40 CFR 60.54b(e)]. A training program must be established to review the operating manual with each person who has responsibilities affecting the operation of the MWC including chief facility operators, shift supervisors, control room operators, ash handlers, maintenance personnel, and crane/load handlers. Each person must undergo initial training before the day the person assumes responsibilities or December 19, 1996, whichever is later, and annually thereafter [40 CFR 60.54(f)]. The operating manual shall be kept in a readily accessible location for all persons required to undergo training.

7.10 Fly Ash/Bottom Ash Fugitive Emissions

Compliance with the fly ash/bottom ash fugitive emission standards will be demonstrated with EPA Method 22 [40 CFR 60.58b(k)]. The minimum observation time will be 3 hours. The observation period will include times when the Facility will transfer ash from the MWC unit to the ash storage area and times when the ash will be loaded for disposal. Initial compliance tests must be conducted within 60 days after achieving maximum operating capacity, but no later than 180 days after initial startup of the ash handling system (40 CFR 60.8). Compliance will be verified by annual tests following the date of completion of the initial compliance test.

As described in Section 2.2.9, the City is requesting the EG fugitive opacity limits as RACT and the Method 22 testing requirements instead of RACT requirements at FAC 62-296.711 (2)(a) and Method 9 testing requirements at FAC 62-296.711(3)(a).

7.11 Fugitive Particulate Matter Emissions from Lime and Carbon Silos

The FDEP RACT requirement for no visible emissions (i.e., 5 percent opacity) [FAC 62-296.711(2)(a)] would be applicable to fugitive PM emissions and PM emissions from the lime and activated carbon storage silos unless exempted by virtue of PM emissions being less than 1 ton/year [FAC 62-296.700(1)(c)].

Pursuant to FAC 62-296.711(3)(c), the City requests that compliance for these minor sources equipped with baghouses (i.e., the lime and carbon storage silos) be determined using Method 22 visible emission tests indicating no visible emissions (5 percent opacity) instead of particulate stack tests. Compliance will be verified by annual tests following the date of completion of the initial compliance test.

7.12 Existing Permit Conditions

The existing PSD permit (No. PSD-FL-086, July 2, 1982) and operating permit (No. AO29-206279, September 9, 1992, amended June 17, 1994) for the Facility require initial compliance tests for PM, opacity, Pb, SO_2, NO_X, CO, HF, Hg, and Be, in accordance with 40 CFR 60.8 and Specific Condition No. 6 of the PSD permit. Annual stack tests are required for PM, opacity, and Pb (Specific Condition No. 8 of the operating permit). Testing for the following pollutants must be conducted 6 months before the expiration of the operating permit (*i.e.*, once every 5 years): volatile organic compounds (VOC), Hg, NO_X, HF, Be, and SO_2 (Specific Condition No. 9). Emissions from the fly ash silo must be tested for PM and opacity annually. The permittee can replace this testing with an EPA Method 9 test showing no visible emissions from the silo, except at permit renewal (Specific Condition No. 10). Continuous opacity monitoring is required for both Facility stacks (Specific Condition No. 14. C).

After the Retrofit is completed, the City will demonstrate compliance with the new emission limits for PM, opacity, Pb, SO_2, NO_X, CO, Hg, Cd, HCl, total dioxins and furans, and NH_3, in accordance with the protocols described in the preceding portions of Section 7. Compliance with emission limits for HF and Be will be determined under the existing operating permit requirements. Compliance with the HF emission limit will be determined by stack tests every 5 years using EPA Method 13A/13B (Specific Condition No. 12). Compliance with the Be emission limit will be determined by stack tests every 5 years using EPA Method 104 (Specific Condition No. 12). The EG requirement for GCP and continuous CO monitoring are more stringent surrogates for VOC control than the current permit VOC emissions limit. The City requests that the VOC emissions requirements be deleted, and that EG monitoring and testing requirements for PM, opacity, Pb, SO_2, NO_x, CO, and Hg replace those in the existing permit.

Additional compliance monitoring requirements under the existing operating permit include recording the daily charging rate and hours of operation of each unit, and reporting this information quarterly. The proposed project will determine the MWC load level requirements using the steam flow monitors, as required by the EPA EG described above.

7.13 Summary

The proposed Retrofit will comply with the requirements in the EPA EG (Subpart Cb) for oxygen, PM, opacity, Cd, Pb, Hg, carbon injection rate, SO_2, HCl, dioxins/furans, NO_x, CO, MWC load level, FF inlet temperature, and fly ash/bottom ash. Compliance with HF and Be emission limits will be determined in accordance with the requirements in the existing operating permit for the Facility. Compliance with fugitive PM emission limits from the carbon and lime silos will be determined in accordance with FDEP RACT requirements for PM.

Section 8
Conclusions

8.1 Reason for Proposed Action

The City is proposing to install new APC equipment and make other improvements to the Facility. The proposed improvements (collectively called "the Retrofit") will allow the Facility to meet the new emissions limits and monitoring requirements established by the EPA's EG for large MWC, which are codified in 40 CFR Subpart Cb and adopted by FDEP in FAC 62-204.800(8).

8.2 Proposed Facility Improvements

The proposed improvements to the APC equipment consist of replacing the existing ESPs with SDAs, FFs, ACI systems, and SNCR systems. The new APC equipment will require storage silos for lime and carbon. PM emissions during silo filling operations will be controlled with FF dust collectors. The City is also planning to improve and upgrade each MWC, most likely by replacing the existing grate furnaces, rotary kilns, and waste heat boilers. New bottom and fly ash handling systems will also be installed to support the new combustion and APC systems, and a new Ash Residue Storage Building will be constructed. The two existing 165-foot stacks (two units per stack) will be replaced by a single, multi-flued 201-foot stack.

8.3 Summary of Air Permit Revisions

With this application, the City is requesting amendments to its existing air permit (AO29-206279) and authorization to proceed with the Retrofit in compliance with the EG. Revisions to the existing operating permit required by the EG include:

- New emission limits and/or averaging times for nearly all pollutants, including emission limits for pollutants not currently regulated by the existing permit [carbon monoxide (CO), dioxins/furans, hydrogen chloride (HCl), and cadmium (Cd)].

- Continuous emissions monitoring for sulfur dioxide (SO_2), nitrogen oxides (NO_x), and CO not currently required under the existing permit.

- Annual compliance tests for pollutants not measured by CEM [PM, lead (Pb), mercury (Hg), Cd, HCl, dioxins/furans[1], and opacity for the MWC and fugitive sources], including some new pollutants and monitoring methods not included in the existing permit.

- Real-time, continuous monitoring of GCP parameters (steam or feedwater flow to precisely monitor MWC load and PM device inlet temperature) to minimize MWC organic emissions as well as other parameters such as carbon injection rates to ensure compliance with facility-specific requirements established by compliance tests.

In addition to the EG requirements, the City is proposing additional revisions to the existing operating permit for the Facility after the proposed improvements consistent with current industry practices and EG definitions as follows:

- Replacement of the VOC limit with the EG requirement for GCP and continuous CO monitoring.

- More accurate definition of the types of fuels allowed to be processed at the Facility consistent with the EG definition of MSW.

- More complete description of the allowable MWC operating conditions which recognizes unit operations under a wide range of MSW heat contents.

- Restricting auxiliary burner natural gas usage in each MWC to less than 10 percent of the total annual gross heat input to obviate the NO_x monitoring and reporting requirements under 40 CFR 60 Subpart Db.

- Requirement under 40 CFR 60 Subpart E to determine the amount of MSW combusted on a daily average basis, to be determined for the improved Facility[2] for each MWC using the Facility's truck scale weight data for each calendar month and MWC operating data for the same calendar month.

8.4 Air Quality Impacts

Facility impacts after the proposed improvements will comply with all applicable AAQS for criteria pollutants, FDEP's Ambient Reference Concentrations (ARC) for non-criteria pollutants, and PSD increments. Because of the reduction in exhaust temperatures due to

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[1]Dioxin/furan compliance tests allowed less frequently for facilities which meet alternative limits.

[2]The existing Facility is not subject to Subpart E, only the Facility after the proposed improvements.

the SDA, there might be a slight increase in Facility impacts in the immediate vicinity of the plant (*i.e.*, within 700 meters, based on the area of annual SO_2 and NO_2 significant impacts) when conservatively comparing future potential emissions to existing actual emissions. However, if actual emissions were considered for both existing and future conditions, there would most likely be a significant reduction in Facility impacts for all pollutants (except ammonia) in all areas due to the Retrofit.

8.5 Requested Exceptions to FDEP Rules

The improvements necessary to comply with the EG will require additional APC and other equipment which have minor emissions associated with their use (lime and carbon storage silos, auxiliary burners, fly and bottom ash handling equipment). The City is requesting authorization by FDEP in the permit conditions for the following exceptions to FAC requirements as allowed for by the regulations:

- Excess emissions resulting from startup, shutdown, or malfunction conditions as regulated by FAC 62-210.700 shall be permitted for up to 3 hours per occurrence (rather than 2 hours per day) consistent with the EG requirements. Startup periods commence when the combustor begins the continuous burning of MSW and does not include any warmup period. The duration of warmup periods, when only natural gas is being combusted by the auxiliary burners, shall not be limited.

- For the lime and carbon silo FF dust collectors, the City is requesting that compliance with the proposed emission limits be determined using Method 9 visible emission tests indicated no visible emissions (5 percent opacity) pursuant to FAC 62-296.711(3)(c) and 62-297.260(4) in lieu of particulate stack tests.

- The City is requesting that the EG limit[3] at 40 CFR 60.55b(a) for fugitive PM emissions from ash handling operations of no visible emissions "in excess of 5% of the observation period" be approved as RACT for the Facility by FDEP as allowed by FAC 62-296.711(2)(c). The EG fugitive PM emissions limit does not apply during maintenance and repair activities of the ash conveying systems.

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[3]The EG fugitive PM emission limit had been determined by U.S. EPA to represent Maximum Achievable Control Technology (MACT) for existing MWCs (*i.e.*, the level of performance attained by the best 12 percent of all existing facilities) based on several years of study. Accordingly, the MACT standard should be representative of RACT for this source type.

- The City is requesting in accordance with FAC 62-297.620 that compliance with the EG limit for fugitive emissions due to ash handling operations be determined using U.S. EPA Method 22, rather than Method 9 as specified at FAC 62-296.711(3)(a). Both methods are incorporated by reference at FAC 62-204.800 and 62-297.401 but Method 22 is more appropriate for determining the frequency of visible emissions for fugitive sources when there is no need to determine the opacity level.

8.6 Benefits of Proposed Action

The proposed improvements to the Facility will allow the Facility to meet the EG emissions limits identified by EPA as representing MACT for MWCs, which are more stringent than current permit limits for nearly all pollutants. The existing ESPs used to control PM emissions will be replaced with state-of-the-art APC systems (SDA/FF/SNCR/ACI) to control SO_2, HCl, PM, metals, NO_x, Hg, and dioxins/furans. In addition, proposed changes to the MWCs and the institution of GCP will further reduce MWC organic emissions. The Retrofit will result in a net reduction in air pollutant emissions from the Facility for all pollutants except ammonia. Facility impacts after the Retrofit will comply with all applicable AAQS, ARCs, and PSD increments. Overall, the proposed improvements will provide a reduction in atmospheric emissions and an improvement in ambient air quality.

Section 9
References

Auer, A.H., 1978. "Correlation of Land Use and Cover with Meteorological Anomalies," Journal of Applied Meteorology. Vol. 17, pp. 636-643.

Beaumont Environmental Inc. (BEI), 1986. An Environmental Review of Air Pollution Control for Resource Recovery Facilities. Vol. 1. Revised Edition. State of New Jersey, Department of Environmental Protection, February 1986.

Browning-Ferris Industries, Inc., 1983. "Notes on Polychloro Dibenzo Dioxins and Polychloro Dibenzo Furans," Connection with Waste-To-Energy Plants. April 1983, p. 7.

California Air Resources Board (CARB), 1984. Air Pollution Control at Resource Recovery Facilities. Stationary Source Division. Sacramento, California, May 24,1984.

Code of Federal Regulations (CFR), Title 40, Protection of the Environment.

ENSR Consulting and Engineering, Inc. (ENSR), 1992. Best Available Control Technology Analysis for the Proposed Onondaga County Resource Recovery Facility. January 1991.

Federal Register (FR), 1996. 60 FR 65387. Standards of Performance for New Stationary Sources: Municipal Waste Combustors. June 19, 1996.

FR, 1995. 60 FR 65387. Emission Guidelines: Municipal Waste Combustors. December 19, 1995.

Florida Administrative Code (FAC), Title 62, Rules of the Dept. of Environmental Protection.

Florida Department of Environmental Protection (FDEP), 1996. ALLSUM Computer Report. Comparison of Air Quality Data with the National Ambient Air Quality Standards for 1995. April 30, 1996.

FDEP, 1996. ALLSUM Computer Report. Comparison of Air Quality Data with the National Ambient Air Quality Standards for 1994. February 29, 1996.

FDEP, 1994. Air Monitoring Report. 1993.

Franklin Associates, 1991. Characterization of Products Containing Mercury in Municipal Solid Waste in the United States 1970 to 2000. EPA Contract No. 68-W9-0040. Municipal Solid Waste Program, Office of Solid Waste, USEPA, Washington, DC.

Fred C. Hart Associates, Inc., 1984. Assessment of Potential Public Health Impacts Associated with Predicted Emissions of Polychlorinated Dibenzo-Dioxins and Polychlorinated Dibenzo-Furans from the Brooklyn Navy Yard Resource Recovery Facility. New York City Department of Sanitation.

Hasselriis, F., 1984. "Relationship Between Combustion Conditions and Emissions of Trace Pollutants," Northeast Regional APCA Conference. Albany, New York. May 1984.

Licata, A., 1983. "An Overview of Dioxin Emissions from Combustion Sources," ASME Solid Waste Processing Division Meeting.

MacKinnon, D.J., 1974. "Nitric Oxide Formation at High Temperatures," Journal of the Air Pollution Control Association. Vol. 24, No. 2, pp. 237-239.

Nielson, D.D., J.T. Moeller, and S. Rasmussen, 1985. Reduction of Dioxins and Furans by Spray Dryer Absorption from Incineration Flue Gas. A/S Niro Atomizer Company, Soeborg, Denmark.

Niessen, W.R., 1984. "Production of PCDD and PCDF from Resource Recovery Facilities," Proceedings of the 1984 ASME Waste Processing Conference. Orlando, Florida.

NITEP, 1986. The National Incinerator Testing and Evaluation Program: Air Pollution Control Technology. Environment Canada, Report EPS 3/UP/2, September 1986.

National Oceanic and Atmospheric Administration (NOAA), 1980. Climate of the States, Second Edition, Volume I, Gale Research Company, pp 136-161.

Perry, R.H. and C.H. Chilton, 1973. Chemical Engineers' Handbook. Fifth Edition.

RTP Environmental Associates, Inc. (RTP), 1993. BACT Determination for NO_x Emissions for the Proposed Mercer and Atlantic Counties Resource Recovery Facility. June, 1993.

RTP, 1992. Air Permit Application for the Regional Resource Recovery Facility Serving Mercer and Atlantic Counties. Hamilton Township. New Jersey (Revised). March 1992.

U.S. EPA, 1996. Compilation of Air Pollutant Emission Factors. AP-42, Fifth Edition, Supplement B. Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina, October 1996.

U.S. EPA, 1995. User's Guide for the Industrial Source Complex (ISC3) Dispersion Models. Volume I. EPA-454/B-95-003a, September 1995. Volume II, EPA 454/B-95-003b, September 1995.

U.S. EPA, 1995. SCREEN3 Model User's Guide. EPA-454/B-95-004, September 1995.

U.S. EPA, 1995. Municipal Waste Combustion: Background Information for Promulgated Standards and Guidelines - Summary of Public Comments and Responses. EPA-453/R-95-0136.

U.S. EPA, 1995. Information Collection Request document for these standards for new sources: Standard Form 83 Supporting Statement for ICR No. 1506.5-1995 Standards for New Municipal Waste Combustors (Subpart Eb), September 29, 1995.

U.S. EPA, 1994. Economic Impact Analysis for Proposed Emission Standards and Guidelines for Municipal Waste Combustors. EPA-450/3-91-029, March 1994.

U.S. EPA, 1993. User's Guide to the Building Profile Input Program (BPIP). EPA-454/R-93-038. October 1993.

U.S. EPA, 1992a. Screening Procedures for Estimating the Air Quality Impact of Stationary Sources. Revised. EPA-454/R-92-019, October 1992.

U.S. EPA, 1990. New Source Review Workshop Manual (Draft). October 1990.

U.S. EPA, 1989a. Municipal Waste Combustors - Background Information for Proposed Standard: Post-Combustion Technology Performance. EPA-450/3-89-027c, August 1989.

U.S. EPA, 1989b. Municipal Waste Combustion Assessment: Technical Basis for Good Combustion Practice. USEPA Air Docket A-89-08, Entry Number II-F-l. EPA-600/8-89-063.

U.S. EPA, 1989. Municipal Waste Combustors - Background Information for Proposed Standards: 111(b) Model Plant Description and Cost Report. EPA-450/3-89-27b, August 1989.

U.S. EPA, 1989. Municipal Waste Combustion Assessment: Combustion Control at Existing Facilities. EPA-600/8-89-057, August 1989.

U.S. EPA, 1989. Municipal Waste Combustion Assessment, Technical Basis for Good Combustion Practices. EPA-600/8-89-063, August 1989.

U.S. EPA, 1989. Municipal Waste Combustors - Background Information for Proposed Standards: Control of NOx Emissions. EPA-450/3-89-27d, August 1989.

U.S. EPA, 1989. Municipal Waste Combustors - Background Information for Proposed Standards: Cost Procedures. EPA-450/3-89-27a, August 1989.

U.S. EPA, 1989. Municipal Waste Combustors - Background Information for Proposed Guidelines for Existing Facilities. EPA-450/3-89-27e, August 1989.

U.S. EPA, 1987a. Municipal Waste Combustion Study - Combustion Control of Organic Emissions. EPA-530/SW-87-021c, May 1987.

U.S. EPA, 1987b. Municipal Waste Combustion Study - Report to Congress. EPA-530/SW-87-021a, June 1987.

U.S. EPA, 1986. Guideline on Air Quality Models (Revised) EPA-450/2-78-027R, July, 1986. With Supplement A, July 1987, Supplement B, February 1993, Supplement C, August 1995. Also contained in the Code of Federal Regulations at Title 40, Part 5 1, Appendix W.

U.S. EPA, 1985. Guideline for Determination of Good Engineering Practice Stack Height (Technical Support Document For the Stack Height Regulations) (Revised). EPA-450/4-80-023R, June 1985.

Appendix A
Active Permits

Gracy.

Department of Environmental Protection

FLORIDA

Lawton Chiles
Governor

Southwest District
3804 Coconut Palm Drive
Tampa, Florida 33619

RECEIVED JAN 2 1 1995

RECEIVED JUN 20 1994

Wetherell
Secretary

~~STATE OF FLORIDA~~
DEPARTMENT OF ENVIRONMENTAL REGULATION
NOTICE OF PERMIT AMENDMENT

CERTIFIED MAIL

Ms. Nancy McCann
Urban Environmental Coordinator
Office of Environmental Coordination
City of Tampa
City Hall Plaza, 5N
Tampa, FL 33602

DER File No.: A029-206279
County: Hillsborough

_______________________________/

Enclosed is amended Permit Number A029-206279 to operate the McKay Bay Refuse-to-Energy facility, issued pursuant to Section 403.087, Florida Statutes.

A person whose substantial interests are affected by this amended permit may petition for an administrative proceeding (hearing) in accordance with Section 120.57, Florida Statutes. The petition must contain the information set forth below and must be filed (received) in the Office of General Counsel of the Department at 2600 Blair Stone Road, Tallahassee 32399-2400, within fourteen (14) days of receipt of this amended permit. Petitioner shall mail a copy of the petition to the applicant at the address indicated above at the time of filing. Failure to file a petition within this time period shall constitute a waiver of any right such person may have to request an administrative determination (hearing) under Section 120.57, Florida Statutes.

The Petition shall contain the following information:

(a) The name, address, and telephone number of each petitioner, the applicant's name and address, the Department Permit File Number and the county in which the project is proposed;
(b) A statement of how and when each petitioner received notice of the Department's action or proposed action;
(c) A statement of how each petitioner's substantial interests are affected by the Department's action or proposed action;
(d) A statement of the material facts disputed by petitioner, if any;
(e) A statement of facts which petitioner contends warrant reversal or modification of the Department's action or proposed action;

Printed on recycled paper.

(f) A statement of which rules or statutes petitioner contends required reversal or modification of the Department's action or proposed action; and

(g) A statement of the relief sought by petitioner, stating precisely the action petitioner wants the Department to take with respect to the Department's action or proposed action.

If a petition is filed, the administrative hearing process is designed to formulate agency action. Accordingly, the Department's final action may be different from the position taken by it in this amended permit. Persons whose substantial interests will be affected by any decision of the Department with regard to the application have the right to petition to become a party to the proceeding. The petition must conform to the requirements specified above and be filed (received) within 14 days of receipt of this notice, in the Office of General Counsel at the above address of the Department. Failure to petition within the allotted time frame constitutes a waiver of any right such person has to request a hearing under Section 120.57, F.S., and to participate as a party to this proceeding. Any subsequent intervention will only be at the approval of the presiding officer upon motion filed pursuant to Rule 28-5.207, F.A.C.

This amended permit is final and effective on the date filed with the Clerk of the Department unless a petition is filed in accordance with the above paragraphs or unless a request for extension of time in which to file a petition is filed within the time specified for filing a petition and conforms to Rule 17-103.070, F.A.C. Upon timely filing of a petition or a request for an extension of time this permit will not be effective until further Order of the Department.

When the Order (amended Permit) is final, any party to the Order has the right to seek judicial review of the Order pursuant to Section 120.68, Florida Statutes, by the filing of a Notice of Appeal pursuant to Rule 9.110, Florida Rules of Appellate Procedure, with the Clerk of the Department in the Office of General Counsel, 2600 Blair Stone Road, Tallahassee, Florida 32399-2400; and by filing a copy of the Notice of Appeal accompanied by the applicable filing fees with the appropriate District Court of Appeal. The Notice of Appeal must be filed within 30 days from the date the Final Order is filed with the Clerk of the Department.

Executed in Tampa, Florida

Sincerely,

Gerald J. Kissel, P.E.
District Air Engineer

GJK/SKW/bm

Attachment:

cc: Environmental Protection Commission
of Hillsborough County

CERTIFICATE OF SERVICE

This is to certify that this NOTICE OF PERMIT AMENDMENT and all copies were mailed by certified mail before the close of business on JUN 17 1994 to the listed persons.

FILING AND ACKNOWLEDGEMENT FILED, on this date, pursuant to Section 120.52(11), Florida Statutes, with the designated Department Clerk, receipt of which is hereby acknowledged.

Clerk JUN 17 1994
Date

Department of Environmental Protection

FLORIDA

Southwest District
3804 Coconut Palm Drive
Tampa, Florida 33619

Lawton Chiles
Governor

Virginia B. Wetherell
Secretary

PERMITTEE:
City of Tampa
City Hall Plaza, 5N
Tampa, FL 33602

PERMIT/CERTIFICATION
Permit No: A029-206279
County: Hillsborough
Issuance Date: 9/1/92
Amendment Date: 06/17/94
Expiration Date: 08/01/97
Project: McKay Bay Refuse-to-Energy Facility

This amended permit is issued under the provisions of Chapter 403, Florida Statutes, and Florida Administrative Code Rules 17-2 and 17-4. The above named permittee is hereby authorized to perform the work or operate the facility shown on the application and approved drawing(s), plans and other documents, attached hereto or on file with the department and made a part of hereof and specifically described as follows:

For the operation of four (4) 250 TPD municipal solid waste incinerators designated as Units 1, 2, 3, and 4, respectively, from west to east. Municipal Solid Waste includes any solid waste, except for sludge, resulting from the operation of residential, commercial, governmental, or institutional establishments that would normally be collected, processed, and disposed of through a public or private solid waste management service. The term includes yard trash, but does not include solid waste from industrial, mining, or agricultural operations. Waste tires and waste oil may be incinerated under certain limitations and restrictions specified in the Specific Conditions.

Each incinerator is equipped with a 37,500 dscfm F.L. Smidth, Model F300, 2-field electrostatic precipitator to control particulate matter emissions. Units 1 and 2 share the same stack exhaust. Units 3 and 4 share the same stack exhaust. Each stack exhaust is equipped with a certified opacity monitor.

Fly ash collected by the electrostatic precipitator is pneumatically conveyed to the fly ash silo and then gravity fed onto the bottom ash drag conveyor where it is wetted. The ash handling system is designed to load the ash into tarped open bed trucks, via front-end loader, after dewatering. Particulate matter emissions generated during fly ash silo loading are controlled by a Flex-Kleen, Model BVBC-36 (IIG) 2109 ACFM baghouse. Fugitive emissions are controlled by the use of water as a dust suppressant.

Location: 107 North 34th Street, Adjacent to McKay Bay, Tampa

PROCESS DESCRIPTION: (continued)

UTM: 17-360.0 E 3091.9 N NEDS NO: 0127 Point ID: 01 - Unit No. 1
02 - Unit No. 2
03 - Unit No. 3
04 - Unit No. 4
05 - Fly Ash Silo

Replaces Permit No.: A029-114760

PERMITTEE:
City of Tampa

PERMIT/CERTIFICATION NO.: AO29-206279
PROJECT: McKay Bay Refuse-to-Energy Facility

SPECIFIC CONDITIONS:

1. A part of this permit is the attached 15 General Conditions.

2. Maximum allowable emissions from the following sources shall not exceed [PSD-FL-086 and AC29-47277 and Rule 17-4.070(3), F.A.C.]

Source	Pollutant	Emission Limitation
Combined Units 1-4	Particulate Matter	0.025 gr/DSCF, corrected to 12% CO_2 and 27.9 lbs./hr.
	Sulfur Dioxide	170.0 lbs./hr.
	Nitrogen Oxides	300.0 lbs./hr.
	VOC	9.0 lbs./hr.
	Lead	3.1 lbs./hr.
	Fluoride	6.0 lbs./hr.
	Mercury (vaporous and particulate)	0.6 lbs./hr.
	Beryllium	5 grams/24 hour period and 0.00046 lbs./hr.
Fly Ash Silo	Particulate Matter	0.025 gr/DSCF, up to 0.36 lbs./hr.

3. Visible emissions shall not exceed the following, except as noted in Specific Condition No. 4: [AC29-47277, Rule 17-2.510(8)(d)2., F.A.C. and Rule 17-2.650(2)(c)11., F.A.C.]

Source	Emission Limitation
Units 1-2 (West Stack)	15%
Units 3-4 (East Stack)	15%
Fly Ash Silo	5%

4. Excess emissions resulting from start-up, shutdown or malfunction of any unit shall be limited to a total of 2 hours in any 24 hour period provided best operational practices are adhered to and the duration of excess emissions are minimized. Best operational practices shall include but are not limited to: [Rule 17-2.250(1), F.A.C.]

A) Using the least pollution causing material available on site to charge the furnace on start-up.
B) Turning on the electrostatic precipitator as soon as possible but no later than two hours after the furnace is ignited.

The permittee shall maintain a log detailing the following information on every start-up of a unit:

A) Time (to the nearest minute) at which the furnace is ignited.
B) Time (to the nearest minute) at which the electrostatic precipitator is turned on and operational.

SPECIFIC CONDITIONS:

C) Temperature of the flue gas at the electrostatic precipitator inlet when it is turned on.

D) Six minute opacity reading taken from the opacity monitor strip chart beginning at two hours following the ignition of the furnace.

5. This permit authorizes the permittee to incinerate municipal solid waste, as defined in the project description, and waste oil from spills cleaned up by the Port Authority. The municipal solid waste may be generated outside the city limits. It may include waste tires as they are collected as part of the normal waste stream (not segregated) and do not exceed more than 3% of the total charge at any given time. The waste oil can not exceed 10,000 gallons per day from tanker trucks or 10 tons per day from fiber drums. No other materials, to include water treatment plant sludges, biomedical waste, radiological waste or hazardous waste, are to be incinerated at this facility. [PSD-FL-086, AC29-47277 and Rule 17-4.070(3), F.A.C.]

6. No auxiliary fuels or segregated materials other than those normally contained in MSW are to be used to raise the BTU content unless prior authorization is received from the Florida Department of Environmental Protection and the Environmental Protection Commission of Hillsborough County. [Rule 17-4.070(3), F.A.C.]

7. The permittee shall not cause, suffer, allow or permit the discharge of air pollutants which cause or contribute to an objectionable odor. [Rule 17-2.620(2), F.A.C.]

8. Test the emissions from each unit for the following pollutant(s) at intervals of 12 months (± 30 days) from October 29, 1991 and submit 2 copies of test data to the Air Section of the Environmental Protection Commission of Hillsborough County office within forty-five days of such testing. Testing of all four units for each pollutant shall be conducted in a consecutive five day period (except that the EPC may extend the five day test period when required by conditions beyond the control of the permittee) and shall be consistent with the requirements of Rule 17-2.700(2), F.A.C.:

(X) Particulates
(X) Opacity*
(X) Lead

* The visible emissions readings on each of the two stacks shall be at least 60 minutes in duration and shall be conducted simultaneously with the particulate testing. Both units which share a common stack shall be in operation during the visible emission test.

PERMITTEE:
City of Tampa

PERMIT/CERTIFICATION NO.: AO29-206279
PROJECT: McKay Bay Refuse-to-Energy Facility

SPECIFIC CONDITIONS: (continued)

9. Test the emissions from each unit for the following pollutant(s) six months prior to the expiration date of this permit and submit 2 copies of test data to the Air Section of the Environmental Protection Commission of Hillsborough County within forty-five days of such testing. Testing of all four units for each pollutant shall be conducted within a consecutive five day period (except that the EPC may extend the five day test period when required by conditions beyond the control of the permittee) and shall be consistent with the requirements of Rule 17-2.700(2), F.A.C.:

(X) Volatile Organic Compounds
(X) Mercury
(X) Nitrogen Oxides
(X) Total Fluorides
(X) Beryllium
(X) Sulfur Dioxide

10. Test the emissions from the fly ash silo for the following pollutant(s) at intervals of 12 months (± 30 days) from October 29, 1991 and submit 2 copies of test data to the Air Section of the Environmental Protection Commission of Hillsborough County office within forty-five days of such testing. Testing procedures shall be consistent with the requirements of Rule 17-2.700(2), F.A.C.:

(X) Particulates*
(X) Opacity

* In lieu of a stack test, the permittee may submit an EPA Method 9 testing showing no visible emissions pursuant to Rule 17-2.700(3)(d), F.A.C., except upon permit renewal. Upon permit renewal the EPA Method 9 test may not be substituted for the stack test. The Method 9 test interval shall be at least 60 minutes in duration on the fly ash silo. Should the Department have reason to believe the particulate emission standard is not being met, the Department may require that compliance with the particulate emission standards be demonstrated by testing in accordance with Rule 17-2.700, F.A.C.

11. The permittee shall notify the Air Compliance Section of the Environmental Protection Commission of Hillsborough County at least 15 days prior to the date on which each formal compliance test is to begin of the date, time, and place of each such test, and the contact person who will be responsible for coordinating and having such test conducted. [Rules 17-297.340(1)(i) and 17-209.500, F.A.C]

12. Compliance with the emission limitations of Specific Condition Nos. 2 and 3 shall be determined using EPA Methods 1, 2, 3, 5, 6, 7, 9, 12, 13A/13B, 25A/25B, 101A and 104 contained in 40 CFR 60, Appendix A and adopted by reference in Rule 17-2.700, F.A.C. The minimum requirements for stack sampling facilities, source sampling and reporting, shall be in accordance with Rule 17-2.700, F.A.C. and 40 CFR 60, Appendix A.

SPECIFIC CONDITIONS: (continued)

13. Testing of emissions shall be conducted within 90-100% of the maximum permitted charging rate of 10.5 tons/hr. for each unit and all four (4) units in operation for the fly ash silo testing. A compliance test submitted at operating levels less than 90% of the maximum permitted rate will automatically constitute an amended permit at the lesser rate plus 10% until another test (showing compliance) at a higher rate, not to exceed 10.5 tons/hr., is submitted to the Department and the Environmental Protection Commission of Hillsborough County. Acceptance of said tests by the Department and the Environmental Protection Commission of Hillsborough County will constitute an amended permit at the greater rate. The rates are not to exceed the maximum permitted rates. Emission limitations are not automatically adjusted above the allowables established by this permit and/or the maximum permitted rate. Failure to submit the charging rates during testing which do not reflect actual operating conditions may invalidate the data. [Rule 17-4.070(3), F.A.C.]

14. Operation and Maintenance Plan for Particulate Control: [Rule 17-2.650(2), F.A.C.]

A) Process Parameters:

1. Source Designators: Unit Nos. 1-4
2. Maximum Charging Rate: 250 tons per day per unit, 1000 tons per day total
3. Maximum Heat Input Rate: 2,500 MMBTU/day/line, 10,000 MMBTU/day total
4. Permitted Operating Schedule: 24 hrs./day, 7 days/wk., 52 wks./yr.
5. Furnace Temperature: 1800-2400° F.
6. Fuel Type: Unsorted Municipal Solid Waste
7. Design Fuel Analysis: Carbon-25.6%, Nitrogen-0.58%, Hydrogen-3.7%, Sulfur-0.3% Oxygen-22.75%, Moisture-30.0%, Non-combustibles-18.0%
8. Combustion Conditions: 50-120% excess air 7-11% O_2 in flue gas
9. Steam Pressure: 650 psig at turbine inlet
10. Steam Temperature: 700° F. at turbine inlet
11. Steam Production: 208,400 lbs./hr. total normal flow rate
12. Maximum Permitted Electric Output: 25 MW

B) Pollution Control Equipment Parameters:

1. Control Equipment Type: 4 Electrostatic Precipitators
2. Model Name and Number: F.L. Smidth Model F300
3. Design Flow Rate: 37,500 dscfm/line, 75,000 dscfm/stack
4. Primary Voltage: 480V
5. Primary Current: 89A

SPECIFIC CONDITIONS: (continued)

6. Secondary Voltage: 25,000-45,000 VDC
7. Secondary Current: 800 mA
8. Design Collection Efficiency: 99.45%
9. Stack Height Above Ground: 160 ft./stack
10. Stack Diameter: 5.75 ft. each stack
11. Exit Gas Temperature: 450-600° F. each stack
12. Exit Gas Moisture: 14%

C) The following observations, checks and operations apply to this source and shall be conducted on the schedule specified:

Continuously Monitored

1. Opacity
2. Temperatures*
   a. ESP Inlet and Outlet
   b. Furnace
   c. Bypass
   d. Kiln Outlet
   e. Secondary Superheater Outlet Steam

* Monitored every 5 seconds and a summed average is recorded every hour.

Every Four Hours

1. Monitor/inspect fly ash removal equipment and handling system
2. Observe fly ash silo operation, if unit is in operation
3. Primary voltage (ESP)
4. Primary current (ESP)
5. Secondary voltage (ESP)
6. Secondary current (ESP)

Daily

1. Monitor T/R temperature (ESP)
2. Monitor hours of operation per line

Weekly

1. Check lubrication on all external bearings, chains, idlers, sprockets
2. Lubricate fly ash collecting equipment, as needed
3. Spark rate
4. Rapper frequency
5. Rapper duration
6. Check gear box reservoir oil levels

SPECIFIC CONDITIONS: (continued)

<u>Semi-Annually</u> (during maintenance outages)

1. Inspect precipitators internals; observe dust build-up, corrosion
2. Check alignment of plates and electrodes
3. Inspect rappers, observe for cracking on rapper frame assembly
4. Clean rapper insulator bushing
5. Clean electrode bushings
6. Check screw conveyor bearings
7. Inspect all field connections, door frames, duct connections for corrosion
8. Replace door frame gaskets as needed.
9. Inspect internal structural members for corrosion and integrity
10. Clean relay cabinets, clean motor starter and relay contacts
11. Check hopper heaters for proper operation
12. Check insulator housing heaters for proper operation
13. Lubricate key interlock system

<u>Annually</u>

1. Hoppers and inlet distribution baffles are visually checked for wear
2. Wire thickness is checked visually
3. Check precipitator earth ground connection
4. Inspect collection plates for corrosion
5. Check external structural members for integrity
6. Run T/R oil analysis

D) Records:

Records of inspections, maintenance, and performance parameters shall be retained for a minimum of two years and shall be made available to the Department or Environmental Protection Commission of Hillsborough County upon request. [Rule 17-2.650(2)(g)5., F.A.C.]

15. The permittee shall calibrate, operate and maintain a continuous monitoring system in accordance with Rule 17-2.710(1), F.A.C. to monitor in-stack opacity.

16. The permittee shall record and keep on file the daily charging rate and hours of operation of each unit and report this information quarterly to the Environmental Protection Commission of Hillsborough County. [40 CFR 60.53(a) and PSD-FL-086]

SPECIFIC CONDITIONS: (continued)

17. The permittee shall provide a written quarterly report of excess emissions. For purposes of this report, excess emissions shall be all air pollutant emissions in excess of the permitted levels stated in Specific Condition Nos. 2 and 3 of this permit. Quarterly reports shall be submitted no later than 30 days from the end of each calendar quarter and shall include the following: [40 CFR 60.7(c) and Rule 17-4.070(3), F.A.C.]

A) The magnitude of excess emissions including the date, time and duration.
B) Nature and cause of excess emissions and the corrective action taken.
C) Date and time opacity monitors were inoperable except for zero and span and the nature of the repairs or adjustments.
D) Statement that excess emissions have or have not occurred and/or a statement that the opacity monitors were or were not inoperable.

18. Submit for this facility, each calendar year, on or before March 1, an emission report for the preceding calendar year containing the following information pursuant to Subsection 403.061(13), Florida Statutes:

A) Annual amount of materials and/or fuels utilized.
B) Annual emissions (note calculation basis).
C) Any changes in the information contained in the permit application.

Duplicate copies of all reports shall be submitted to the Environmental Protection Commission of Hillsborough County.

19. All reasonable precautions shall be taken to prevent and control generation of unconfined emissions of particulate matter at the facility in accordance with the provision in Rule 17-2.610(3), F.A.C.:

A) Use of tarps on trucks transporting ash.
B) Apply water or dust suppressants to all paved and unpaved roads to minimize fugitive emissions on the facility site.
C) Maintain vehicular speed to a minimum (10 MPH or less) on the facility site. Post signs.
D) Exercise good housekeeping at all times.
E) Use of water, as necessary, as a dust suppressant during the loading of trucks.

20. Issuance of this permit does not relieve the permittee from complying with applicable emission limiting standards or other requirements of Chapter 17-2, F.A.C., or any other requirements under federal, state, or local law. [Rule 17-2.210, F.A.C.]

PERMITTEE:
City of Tampa

PERMIT/CERTIFICATION NO.: A029-206279
PROJECT: McKay Bay Refuse-to-Energy Facility

SPECIFIC CONDITIONS: (continued)

21. An application for renewal of permit to operate this source, completed in quadruplicate, shall be submitted to the Department and a copy to the Environmental Protection Commission of Hillsborough County at least 60 days prior to its expiration date. [Rule 17-4.090, F.A.C.]

STATE OF FLORIDA DEPARTMENT OF
ENVIRONMENTAL REGULATION

for Richard Garrity, Ph.D.
Director of District Management

ATTACHMENT - GENERAL CONDITIONS:

1. The terms, conditions, requirements, limitations, and restrictions set forth in this permit are "Permit Conditions" and are binding and enforceable pursuant to Sections 403.141, 403.727, or 403.859 through 403.861, Florida Statutes. The permittee is placed on notice that the Department will review this permit periodically and may initiate enforcement action for any violation of these conditions.

2. This permit is valid only for the specific processes and operations applied for and indicated in the approved drawings or exhibits. Any unauthorized deviation from the approved drawings, exhibits, specifications, or conditions of this permit may constitute grounds for revocation and enforcement action by the Department.

3. As provided in Subsections 403.087(6) and 403.722(5), F.S., the issuance of this permit does not convey any vested rights or any exclusive privileges. Neither does it authorize any injury to public or private property or any invasion of personal rights, nor any infringement of federal, state or local laws or regulations. This permit is not a waiver of or approval of any other Department permit that may be required for other aspects of the total project which are not addressed in the permit.

4. This permit conveys no title to land or water, does not constitute State recognition or acknowledgement of title, and does not constitute authority for the use of submerged lands unless herein provided and the necessary title or leasehold interests have been obtained from the State. Only the Trustees of the Internal Improvement Trust Fund may express State opinion as to title.

5. This permit does not relieve the permittee from liability for harm or injury to human health or welfare, animal, or plant life, or property caused by the construction or operation of this permitted source, or from penalties therefore; nor does it allow the permittee to cause pollution in contravention of Florida Statutes and Department rules, unless specifically authorized by an order from the Department.

6. The permittee shall properly operate and maintain the facility and systems of treatment and control (and related appurtenances) that are installed or used by the permittee to achieve compliance with the conditions of this permit, as required by Department rules. This provision includes the operation of backup or auxiliary facilities or similar systems when necessary to achieve compliance with the conditions of the permit and when required by Department rules.

7. The permittee, by accepting this permit, specifically agrees to allow authorized Department personnel, upon presentation of credentials or other documents as may be required by law and at a reasonable time, access to the premises, where the permitted activity is located or conducted to:

GENERAL CONDITIONS:

a. Have access to and copy any records that must be kept under the conditions of the permit;

b. Inspect the facility, equipment, practices, or operations regulated or required under this permit; and

c. Sample or monitor any substances or parameters at any location reasonably necessary to assure compliance with this permit or Department rules.

Reasonable time may depend on the nature of the concern being investigated.

8. If, for any reason, the permittee does not comply with or will be unable to comply with any condition or limitation specified in this permit, the permittee shall immediately provide the Department with the following information:

a. a description of and cause of non-compliance; and

b. the period of noncompliance, including dates and times; or, if not corrected, the anticipated time the non-compliance is expected to continue, and steps being taken to reduce, eliminate, and prevent recurrence of the non-compliance.

The permittee shall be responsible for any and all damages which may result and may be subject to enforcement action by the Department for penalties or for revocation of this permit.

9. In accepting this permit, the permittee understands and agrees that all records, notes, monitoring data and other information relating to the construction or operation of this permitted source which are submitted to the Department may be used by the Department as evidence in any enforcement case involving the permitted source arising under the Florida Statutes or Department rules, except where such use is prescribed by Sections 403.73 and 403.111, F.S. Such evidence shall only be used to the extent it is consistent with the Florida Rules of Civil Procedure and appropriate evidentiary rules.

10. The permittee agrees to comply with changes in Department rules and Florida Statutes after a reasonable time for compliance, provided, however, the permittee does not waive any other rights granted by Florida Statutes or Department rules.

11. This permit is transferable only upon Department approval in accordance with Florida Administrative Code Rules 17-4.120 and 17-730.300, F.A.C., as applicable. The permittee shall be liable for any non-compliance of the permitted activity until the transfer is approved by the Department.

GENERAL CONDITIONS:

12. This permit or a copy thereof shall be kept at the work site of the permitted activity.

13. This permit also constitutes:

( ) Determination of Best Available Control Technology (BACT)
( ) Determination of Prevention of Significant Deterioration (PSD)
( ) Compliance with New Source Performance Standards (NSPS)

14. The permittee shall comply with the following:

a. Upon request, the permittee shall furnish all records and plans required under Department rules. During enforcement actions, the retention period for all records will be extended automatically unless otherwise stipulated by the Department.

b. The permittee shall hold at the facility or other location designated by this permit records of all monitoring information (including all calibration and maintenance records and all original strip chart recordings for continuous monitoring instrumentation) required by the permit, copies of all reports required by this permit, and records of all data used to complete the application for this permit. These materials shall be retained at least three years from the date of the sample, measurement, report, or application unless otherwise specified by Department rule.

c. Records of monitoring information shall include:

- the date, exact place, and time of sampling or measurements;
- the person responsible for performing the sampling or measurements;
- the dates analyses were performed;
- the person responsible for performing the analyses;
- the analytical techniques or methods used; and
- the results of such analyses.

15. When requested by the Department, the permittee shall within a reasonable time furnish any information required by law which is needed to determine compliance with the permit. If the permittee becomes aware that relevant facts were not submitted or were incorrect in the permit application or in any report to the Department, such facts or information shall be corrected promptly.

BEST AVAILABLE COPY

FLORIDA

Department of Environmental Protection

Rec'd 21.10.94

RECEIVED JAN 2 1 1995

Lawton Chiles
Governor

Southwest District
3804 Coconut Palm Drive
Tampa, Florida 33619

Virginia B. Wetherell
Secretary

NOTICE OF PERMIT

RECEIVED 10 1994

OCT - 6 1994

Ms. Nancy McCann
Environmental Coordinator
City of Tampa
City Hall Plaza, 5N
Tampa, Florida 33602

FOR YOUR

Nancy McCann

Dear Ms. McCann:

Enclosed is the modification #256823 to existing Permit Number SO29-204205, issued pursuant to Section(s) 403.087(1), Florida Statues.

Persons whose substantial interests are affected by this permit have a right, pursuant to Section 120.57, Florida Statutes, to petition for an administrative determination (hearing) on it. The petition must conform to the requirements of Chapters 17-103 and 28-5.201, F.A.C., and must be filed (received) in the Department's Office of General Counsel, 2600 Blair Stone Road, Tallahassee, 32399-2400, within fourteen (14) days of receipt of this notice. Failure to file a petition within fourteen (14) days constitutes a waiver of any right such person has to an administrative determination (hearing) pursuant to Section 120.57, Florida Statutes. This permit is final and effective on the date filed with the Clerk of the Department unless a request for extension of time in which to file a petition is filed within the time specified for filing a petition and conforms to Rule 17-103.070, F.A.C. Upon timely filing of a petition or a request for an extension of time this permit will not be effective until further Order of the Department.

When the Order (Permit) is final, any party to the Department has the right to seek judicial review of the Order pursuant to Section 120.68, Florida Statutes, by the filing of a Notice of Appeal pursuant to Rule 9.110, Florida Rules of Appellate Procedure, with the Clerk of the Department in the Office of General Counsel, 2600 Blair Stone Road, Tallahassee, 32399-2400; and by filing a copy of the Notice of Appeal accompanied by the applicable filing fees with the appropriate District Court of Appeal. The Notice of Appeal must be filed within 30 days from the date the Final Order is filed with the Clerk of the Department.

Executed in Tampa Florida.

STATE OF FLORIDA DEPARTMENT
OF ENVIRONMENTAL PROTECTION

Kim B. Ford, P.E.
Solid Waste Section
Division of Waste Management

KBF/ab
Attachment

cc: Greig Grotecloss, City of Tampa
Paul Schipfer, HCEPC
Kathy Anderson, FDEP Tallahassee
Robert Butera, P.E., FDEP Tampa
Steve Morgan, FDEP Tampa

CERTIFICATE OF SERVICE

This is to certify that this NOTICE OF PERMIT and all copies were mailed before the close of business on OCT - 6 1994 to the listed persons.

FILING AND ACKNOWLEDGMENT FILED, on this date, pursuant to §120.52(10), Florida Statutes, with the designated Department Clerk, receipt of which is hereby acknowledged.

Clerk

OCT - 6 1994
Date

BEST AVAILABLE COPY

Department of Environmental Protection

Lawton Chiles
Governor

Southwest District
3804 Coconut Palm Drive
Tampa, Florida 33619

Virginia B. Wetherell
Secretary

OCT - 6 1994

PERMITTEE
Ms. Nancy McCann
Environmental Coordinator
City of Tampa
City Hall Plaza, 5N
Tampa, Florida 33602

RE: Modification to existing permit
Permit No. SO29-204205, Hillsborough County
McKay Bay Refuse-to-Energy Facility

Dear Ms. McCann:

We are in receipt of the City of Tampa's August 29, 1994 request for permit modification #256823 to modify the solid waste permit #SO29-204205.

SPECIFIC CONDITIONS	FROM	TO	TYPE OF MODIFICATION
#13.		New	Ash Conditioning System

This letter and its attachments constitute a complete permit and replace all previous permits and permit modifications for the above referenced facility.

Sincerely,

Richard D. Garrity, Ph.D.
Director of District Management
Southwest District

RDG/kbfb
Attachments

Printed on recycled paper.

Department of Environmental Protection

Lawton Chiles
Governor

Southwest District
3804 Coconut Palm Drive
Tampa, Florida 33619

Virginia B. Wetherell
Secretary

PERMITTEE
Ms. Nancy McCann
Environmental Coordinator
City of Tampa
City Hall Plaza, 5N
Tampa, FL 33602

PERMIT/CERTIFICATION
GMS ID No: 4029M30071
Permit No: SO29-204205
Date of Issue: 07/30/92
Expiration Date: 07/01/97
County: Hillsborough
Lat/Long: 27°56'51"N
82°25'14"W
Sec/Town/Rge: 20/29S/19E
Project: McKay Bay Refuse-to-Energy Facility

This permit is issued under the provisions of Chapter 403, Florida Statutes, and Florida Administrative Code Rule(s) 17-3, 17-4, 17-701, and 17-702. The above named permittee is hereby authorized to perform the work or operate the facility shown on the application and approved drawing(s), plans and other documents, attached hereto or on file with the Department and made a part hereof and specifically described as follows:

To operate a solid waste volume reduction and resource recovery facility, referred to as McKay Bay Refuse-to-Energy Facility, subject to the specific conditions attached, burning solid waste and producing electricity, near 34th Street and Clark Street, Tampa, Hillsborough County, Florida.

Replaces Permit No.: SO29-116391

GENERAL CONDITIONS:

1. The terms, conditions, requirements, limitations and restrictions set forth in this permit, are "permit conditions" and are binding and enforceable pursuant to Sections 403.141, 403.161, 403.727, or 403.861, Florida Statutes. The permittee is placed on notice that the Department will review this permit periodically and may initiate enforcement action for any violation of these conditions.

2. This permit is valid only for the specific processes and operations applied for and indicated in the approved drawings or exhibits. Any unauthorized deviation from the approved drawings, exhibits, specifications, or conditions of this permit may constitute grounds for revocation and enforcement action by the Department.

3. As provided in subsections 403.087(6) and 403.722(5), F.S., the issuance of this permit does not convey any vested rights or any exclusive privileges. Neither does it authorize any injury to public or private property or any invasion of rights, nor any infringement of federal, State, or local laws or regulations. This permit is not a waiver of or approval of any other Department permit that may be required for other aspects of the total project which are not addressed in this permit.

4. This permit conveys no title to land or water, does not constitute State recognition or acknowledgment of title, and does not constitute authority for the use of submerged lands unless herein provided and the necessary title or leasehold interests have been obtained from the State. Only the Trustees of the Internal Improvement Trust Fund may express State opinion as to title.

5. This permit does not relieve the permittee from liability for harm or injury to human health or welfare, animal, or plant life, or property caused by the construction or operation of this permitted source, or from penalties therefore; nor does it allow the permittee to cause pollution in contravention of Florida Statutes and Department rules, unless specifically authorized by an order from the Department.

6. The permittee shall properly operate and maintain the facility and systems of treatment and control (and related appurtenances) that are installed and used by the permittee to achieve compliance with the conditions of this permit, are required by Department rules. This provision includes the operation of backup or auxiliary facilities or similar systems when necessary to achieve compliance with the conditions of the permit and when required by Department rules.

GENERAL CONDITIONS:

7. The permittee, by accepting this permit, specifically agrees to allow authorized Department personnel, upon presentation of credentials or other documents as may be required by law and at reasonable times, access to the premises where the permitted activity is located or conducted to:

(a) Have access to and copy any records that must be kept under conditions of the permit;

(b) Inspect the facility, equipment, practices, or operations regulated or required under this permit; and

(c) Sample or monitor any substances or parameters at any location reasonably necessary to assure compliance with this permit or Department rules.

Reasonable time may depend on the nature of the concern being investigated.

8. If, for any reason, the permittee does not comply with or will be unable to comply with any condition or limitation specified in this permit, the permittee shall immediately provide the Department with the following information:

(a) A description of and cause of noncompliance; and

(b) The period of noncompliance, including dates and times; or, if not corrected, the anticipated time the noncompliance is expected to continue, and steps being taken to reduce, eliminate, and prevent recurrence of the noncompliance.

The permittee shall be responsible for any and all damages which may result and may be subject to enforcement action by the Department for penalties or for revocation of this permit.

9. In accepting this permit, the permittee understands and agrees that all records, notes, monitoring data and other information relating to the construction or operation of this permitted source which are submitted to the Department may be used by the Department as evidence in any enforcement case involving the permitted source arising under the Florida Statutes or Department rules, except where such use is prescribed by Sections 403.111 and 403.73, F.S. Such evidence shall only be used to the extent it is consistent with the Florida Rules of Civil Procedure and appropriate evidentiary rules.

10. The permittee agrees to comply with changes in Department rules and Florida Statues after a reasonable time for compliance; provided, however, the permittee does not waive any other rights granted by Florida Statutes or Department rules.

GENERAL CONDITIONS:

11. This permit is transferable only upon Department approval in accordance with Rule 17-4.120 and 17-730.300, Florida Administrative Code, as applicable. The permittee shall be liable for any non-compliance of the permitted activity until the transfer is approved by the Department.

12. This permit or a copy thereof shall be kept at the work site of the permitted activity.

13. This permit also constitutes:

(a) Determination of Best Available Control Technology (BACT)

(b) Determination of Prevention of Significant Deterioration (PSD)

(c) Certification of compliance with State Water Quality Standards (Section 401, PL 92-500)

(d) Compliance with New Source Performance Standards

14. The permittee shall comply with the following:

(a) Upon request, the permittee shall furnish all records and plans required under Department rules. During enforcement actions, the retention period for all records will be extended automatically unless otherwise stipulated by the Department.

(b) The permittee shall hold at the facility or other location designated by this permit records of all monitoring information (including all calibration and maintenance records and all original strip chart recordings for continuous monitoring instrumentation) required by the permit, copies of all reports required by this permit, and records of all data used to complete the application for this permit. These materials shall be retained at least three years from the date of the sample, measurement, report, or application unless otherwise specified by Department rule.

GENERAL CONDITIONS:

(c) Records of monitoring information shall include:

1. the date, exact place, and time of sampling or measurements;
2. the person responsible for performing the sampling or measurements;
3. the dates analyses were performed;
4. the person responsible for performing the analyses;
5. the analytical techniques or methods used;
6. the results of such analyses.

15. When requested by the Department, the permittee shall within a reasonable time furnish any information required by law which is needed to determine compliance with the permit. If the permittee becomes aware the relevant facts were not submitted or were incorrect in the permit application or in any report to the Department, such facts or information shall be corrected promptly.

SPECIFIC CONDITIONS:

1. This facility is classified as a solid waste volume reduction and resource recovery facility, and shall be operated in accordance with all application requirements of Chapters 17-2, 17-3, 17-4, 17-701, and 17-702, Florida Administrative Code.

2. The refuse-to-energy facility shall be operated so as to handle solid waste on a first-in, first-out basis. At no time shall any stored solid waste be allowed to remain unprocessed for more than forty-eight (48) hours unless adequate provisions are made to control flies, rodents and odors.

3. All solid waste, recovered materials or residues handled at the refuse-to-energy facility, shall be stored in a manner so as not to create a fire or safety hazard or a sanitary nuisance, and shall comply with all applicable local and state regulations. Adequate fire control facilities shall be provided. The fire protection monitoring equipment required by the local fire protection authorities shall be installed and in service by October 15, 1992. An updated fire safety survey shall be provided to verify facility compliance.

4. The operating authority shall be responsible for the control of odors and fugitive particulates arising from this operation. Such control shall prevent the creation of these nuisance conditions on adjoining property.

5. Prior to ninety days before the expiration of the Department permit, the permittee shall apply for a renewal of the permit on forms, and in a manner prescribed by the Department.

6. The ash residue from this facility shall be analyzed every three months as specified in F.A.C. Rule 17-702.570. The results shall be submitted annually to the Southwest District Office, C/O the Solid Waste Section, Tampa, Florida.

7. The facility shall be operated to comply with the August 1, 1991 Ash Residue Management Plan by HDR.

8. The permittee shall not accept hazardous waste or any hazardous substance at this site. Hazardous waste is a solid waste identified by the Department as a hazardous waste in Chapter 17-730, Florida Administrative Code. Hazardous substances are those defined in Section 403.703, Florida Statute or in any other applicable state or federal law or administrative rule.

SPECIFIC CONDITIONS:

9. This permit allows the storage and processing of waste tires in accordance with all applicable requirements of Department rules. Fire protection shall be assured by the local fire protection authorities. The operator shall keep the emergency preparedness manual at the site. Waste tires may be processed through the facility up to 3%, by weight, of the permitted capacity subject to the requirements of the DEP air rules.

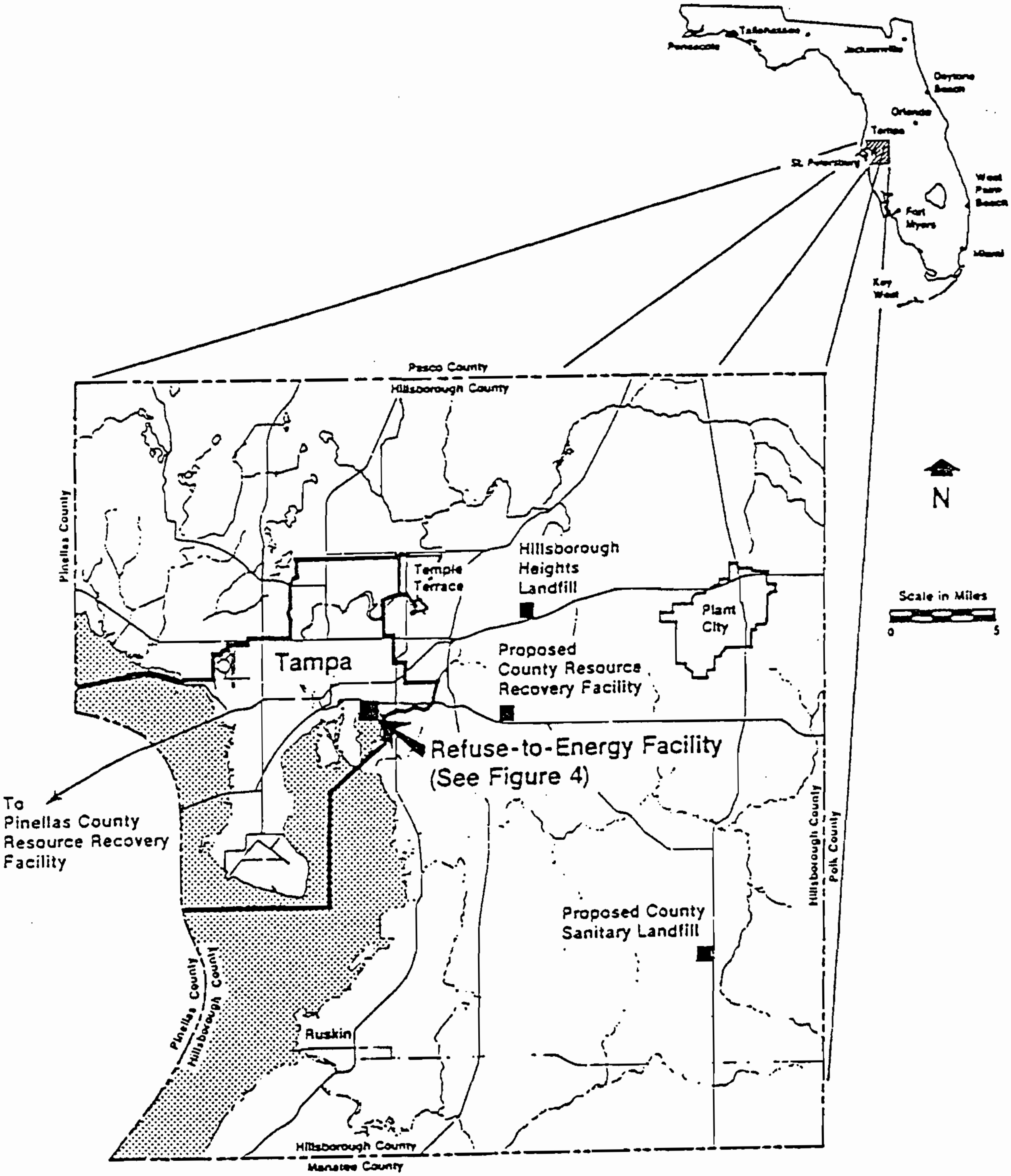
10. Where required by Chapter 471 (P.E.) or Chapter 492 (P.G.), Florida Statutes applicable portions of permit applications and supporting documents which are submitted to the Department for public record shall be signed and sealed by the professionals who prepared or approved them.

11. The permittee shall be aware of and operate under the attached "General Conditions". General Conditions are binding upon the permittee and enforceable pursuant to Chapter 403, Florida Statutes.

12. By acceptance of this Permit, the permittee certifies that he/she has read and understands the obligations imposed by the Specific and General Conditions contained herein.

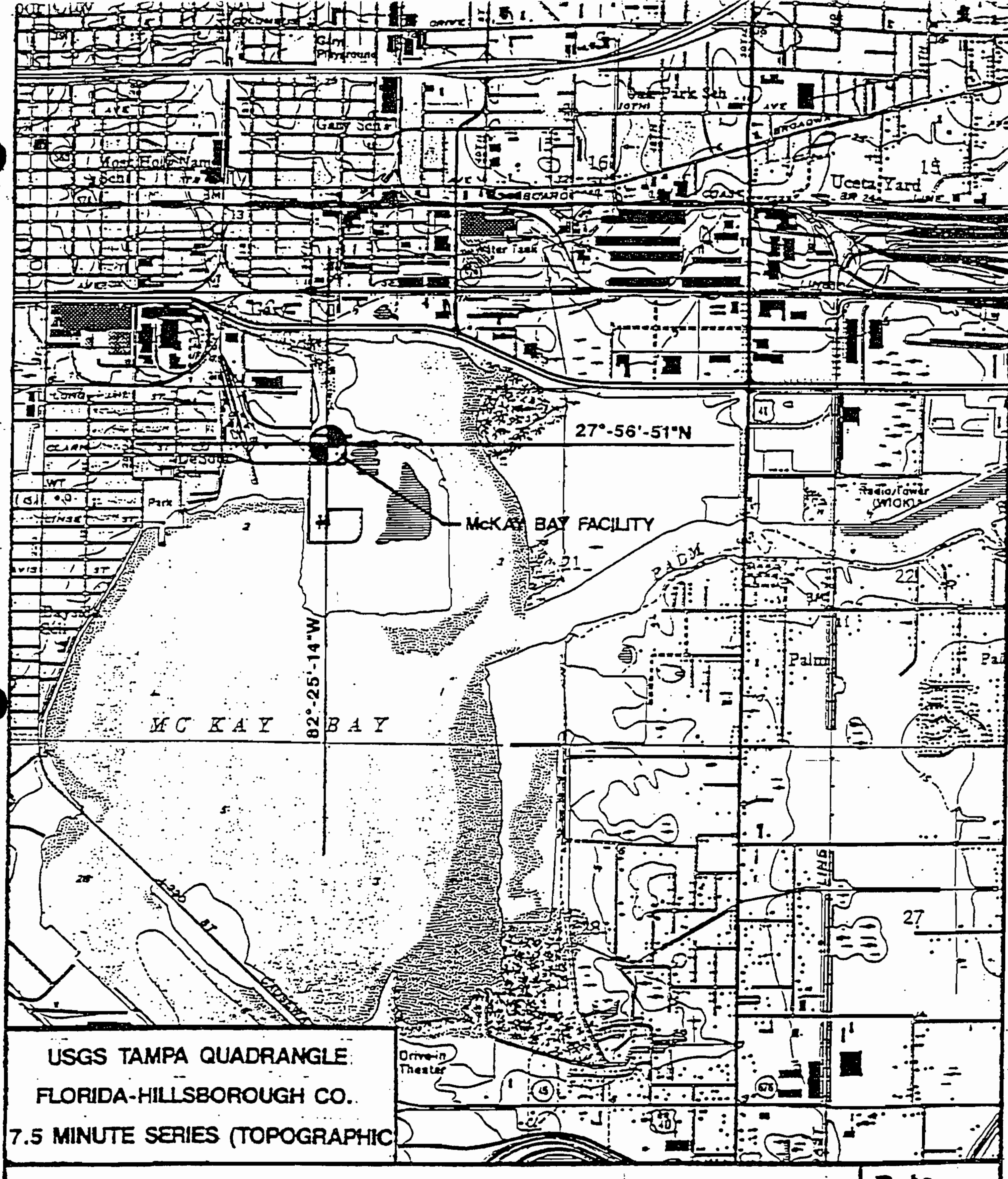
13. This permit is valid for construction and operation of the ash conditioning system submitted by the City of Tampa on August 29, 1994. Construction shall be completed by November 1, 1994. Certification of Construction Completion, Form 17-701.900(2), and Record Drawings shall be submitted within ninty (90) days after all specified construction has been completed.

New OCT - 6 1994 .



Site Location Map

Figure 1



CITY OF TAMPA , FLORIDA McKAY BAY REFUSE TO ENERGY FACILITY LOCATION PLAN	Date JAN 95 Figure L-1

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION IV

345 COURTLAND STREET
ATLANTA, GEORGIA 30365

JUL - 2 1982

REF: 4AW-AM

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

Dr. Richard D. Garrity, Ph.D
Urban Environmental Coordinator
City of Tampa
306 East Jackson Street
Tampa, Florida 33602

Re: PSD-FL-086

Dear Dr. Garrity:

Review of your July and October, 1981, applications to construct a municipal incinerator-cogeneration facility in Tampa, Florida has been completed. The construction is subject to rules for the Prevention of Significant Air Quality Deterioration (PSD) contained in 40 CFR §52.21. The Florida Department of Environmental Regulation performed the preliminary determination concerning the proposed construction and published a request for public comment on March 22, 1982. Comments were submitted by the City of Tampa, the Department of Interior, and the U. S. Environmental Protection Agency and are contained and responded to in the final determination issued May 28, 1982.

Authority to construct a stationary source is hereby granted for the facility described above, subject to the conditions in the permit to construct (enclosed). This authority to construct is based solely on the requirements of 40 CFR §52.21, the federal regulations governing significant deterioration of air quality. It does not apply to NPDES or other permits issued by this agency or by other agencies. The complete analysis which justifies this approval has been fully documented for future reference, if necessary. Please be advised that a violation of any condition issued as part of this approval, as well as any construction which proceeds in material variance with information submitted in your application, will be subject to enforcement action.

This final permitting decision is subject to appeal under 40 CFR §124.19 by petitioning the Administrator of the U. S. EPA within 30 days after receipt of this letter of approval to construct. The petitioner must submit a statement of reasons for the appeal and the Administrator must decide on the petition within a reasonable time period. If the petition is denied, the permit becomes immediately effective. The petitioner may then seek judical review.

Any questions concerning this approval may be directed to Richard S. DuBose, Chief, Air Engineering Section, Air and Waste Management Division at (404) 881-7654.

Sincerely yours,

for John A. Little, Deputy

Charles R. Jeter
Regional Administrator

Enclosures

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION IV

345 COURTLAND STREET
ATLANTA, GEORGIA 30365

PERMIT TO CONSTRUCT UNDER THE RULES FOR THE
PREVENTION OF SIGNIFICANT DETERIORATION OF AIR QUALITY

PSD-FL-086

Pursuant to and in accordance with the provisions of Part C, Subpart 1 of the Clean Air Act, as amended, 42 U.S.C. S7470 et seq., and the regulations promulgated thereunder at 40 C.F.R. S52.21, as amended at 45 Fed. Reg. 52676, 52735-41 (August 7, 1980),

The City of Tampa
306 East Jackson Street
Tampa, Florida 33602

is hereby authorized to construct/modify a stationary source at the following location:

Adjacent McKay Bay
South of Florida Route 60
Tampa, Florida

UTM Coordinates: 360.0 km East, 3091.9 km North

Upon completion of this authorized construction and commencement of operation/production, this stationary source shall be operated in accordance with the emission limitations, sampling requirements, monitoring requirements and other conditions set forth in the attached Specific Conditions (Part I) and General Conditions (Part II).

This permit shall become effective on JUL 2 1982

If construction does not commence within 18 months after the effective date of this permit, or if construction is discontinued for a period of 18 months or more, or if construction is not completed within a reasonable time this permit shall expire and authorization to construct shall become invalid.

This authorization to construct/modify shall not relieve the owner or operator of the responsibility to comply fully with all applicable provisions of Federal, State, and Local law.

July 2, 1982
Date Signed

[signature], Deputy for
Charles R. Jeter
Regional Administrator

SPECIFIC CONDITIONS

1. The maximum allowable emissions from the resource recovery facility no. 1 shall be:

Pollutant		Emission Limitation
Sulfur dioxide		170.0 lb/hr
Nitrogen Oxides		300.0 lb/hr
Lead		3.1 lb/hr
Fluoride		6.0 lb/hr
Mercury (vaporous and particulate)		0.6 lb/hr
Beryllium	5 grams/24-hour period	0.00046 lb/hr

2. Municipal waste only shall be burned in the facility. Wastewater treatment plant sludges or hazardous wastes shall not be incinerated.

3. Electric output for sale to Tampa Electric Company (TECO) shall not exceed 25 MW.

4. Hours of operation for the facility shall be 24 hours per day, 7 days per week, 52 weeks per year.

5. An operation and maintenance plan shall be submitted with the state operating permit application and be made part of this permit.

6. Compliance testing for all criteria and NESHAPS pollutants shall be conducted in accordance with the methods contained in 40 CFR 60 and 61. A source testing plan shall be submitted to the Department of Environmental Regulation for approval 90 days prior to testing. The Department shall be notified of compliance testing at least 30 days prior to the testing.

7. The applicant shall record and keep on file the daily charging rate of the facility and the hours of operation of the facility and shall report this information quarterly to the permitting authority.

8. The applicant shall install and operate continuous opacity monitoring equipment.

GENERAL CONDITIONS

1. The permittee shall notify the permitting authority in writing of the beginning of construction of the permitted source within 30 days of such action and the estimated date of start-up of operation.

2. The permittee shall notify the permitting authority in writing of the actual start-up of the permitted source within 30 days of such action and the estimated date of demonstration of compliance as required in the specific conditions.

3. Each emission point for which an emission test method is established in this permit shall be tested in order to determine compliance with the emission limitations contained herein within sixty (60) days of achieving the maximum production rate but in no event later than 180 days after initial start-up of the permitted source. The permittee shall notify the permitting authority of the scheduled date of compliance testing at least thirty (30) days in advance of such test. Compliance test results shall be submitted to the permitting authority within forty-five (45) days after the complete testing. The permittee shall provide (1) sampling ports adequate for test methods applicable to such facility, (2) safe sampling platforms, (3) safe access to sampling platforms, and (4) utilities for sampling and testing equipment.

4. The permittee shall retain records for all information resulting from monitoring activities and information indicating operating parameters as specified in the specific

conditions of this permit for a minimum of two (2) years from the date of recording.

5. If, for any reason, the permittee does not comply with or will not be able to comply with the emission limitations specified in this permit, the permittee shall provide the permitting authority with the following information in writing within ten (10) business days of such conditions:

(a) description of noncomplying emission(s).

(b) cause of noncompliance,

(c) anticipated time the noncompliance is expected to continue or, if corrected, the duration of the period of noncompliance,

(d) steps taken by the permittee to reduce and eliminate the noncomplying emission,

and

(e) steps taken by the permittee to prevent recurrence of the noncomplying emission.

Failure to provide the above information when appropriate shall constitute a violation of the terms and conditions of this permit. Submittal of this report does not constitute a waiver of the emission limitations contained within this permit.

6. Any change in the information submitted in the application regarding facility emissions or changes in the quantity or quality of materials processed that will result in new or increased emissions must be reported to the permitting authority. If appropriate, modifications to the permit

may then be made by the permitting authority to reflect any necessary changes in the permit conditions.

7. In the event of any change in control or ownership of the source described in the permit, the permittee shall notify the succeeding owner of the existence of this permit by letter and forward a copy of such letter to the permitting authority.

8. The permittee shall allow representatives of the State environmental control agency or representatives of the Environmental Protection Agency, upon the presentation of credentials:

(a) To be allowed reasonable access to the permittee's premises, or other premises under the control of the permittee, where an air pollutant source is located or in which any records are required to be kept under the terms and conditions of the permit;

(b) to have access to and copy at reasonable times any records required to be kept under the terms and conditions of this permit, or the Act;

(c) to inspect at reasonable times any monitoring equipment of monitoring methods required in this permit;

(d) to sample at reasonable times any emission of pollutants; and

(e) to perform at reasonable times an operation and maintenance inspection of the permitted source.

9. All correspondence required to be submitted by this permit to the permitting agency shall be mailed to:

Chief, Air Management Branch
U. S. Environmental Protection Agency
Region IV
345 Courtland Street
Atlanta, Georgia 30365

10. The conditions of this permit are severable, and if any provision of this permit, or the application of any provision of this permit to any circumstance, is held invalid, the application of such provision to other circumstances, and the remainder of this permit, shall not be affected thereby.

The emission of any pollutant more frequently or at a level in excess of that authorized by this permit shall constitute a violation of the terms and conditions of this permit.

Appendix B
Emission Factor
Calculations

Appendix B
Emission Factor Calculations

B.1 Introduction

In this Appendix, the emission factors for the Tampa McKay Bay Refuse-to-Energy Facility ("Facility") Retrofit stack are based on:

- The Emissions Guidelines (EG) for Municipal Waste Combustors (MWCs), 40 CFR 60 Subpart Cb, as revised (62 FR 45116, August 25, 1997), requirements for the following pollutants. Note that the County proposes to comply with the revised Pb, SO_2, HCl and NO_x limits in this air permit, even though the formal compliance deadline for these pollutants is delayed until August 26, 2002.

  - Particulate Matter (PM)
  - Sulfur Dioxide (SO_2)
  - Hydrogen Chloride (HCl)
  - Carbon Monoxide (CO)
  - Nitrogen Oxides (NOx)
  - Mercury (Hg)
  - Lead (Pb)
  - Cadmium (Cd)
  - Dioxins and furans (total tetra- through octa- PCDD and PCDF)

- The existing Facility's state air operating permit (AO 29-206279) limits for two pollutants not regulated by the EG:

  - Hydrogen Fluoride (HF)
  - Beryllium (Be)

- Permit limits for ammonia slip from comparable facilities using Selective Non-Catalytic Reduction (SNCR) for NOx removal.

- Stack test data for the existing Facility for maximum inlet (uncontrolled) Hg concentrations, and for representing existing Facility emissions in the netting analysis for NOx and SO_2. Stack test data summaries are presented in Appendix E.

As described in the December, 1995, Federal Register announcement promulgating the EG (60 FR 65387, December 19, 1995), the emissions limits in the EG are based on the best demonstrated performance at operating MWC facilities. The Federal Register references EPA studies showing that MWCs with Maximum Achievable Control Technology (MACT) standard air pollution control equipment consisting of a spray dryer absorber (SDA), fabric filter (FF), activated carbon injection, and selective non-catalytic reduction (SNCR) can meet these limits. Since the Facility will have this MACT air pollution control system for each of the four units, and is being designed to meet or exceed the EG, the EG represent a reasonable upper limit on the Facility's emissions.

The flue gas flow rates and composition used to calculate the following air pollutant emission factors are based on the output of the BURN combustion model. BURN is a CDM proprietary mathematical model used to analyze combustion systems by specifying operational parameters and fuel (municipal solid waste) characteristics. The output for this analysis, shown in Appendix C, is based on the Retrofitted Facility's worst-case operating load (see Section 6): combustion of 239.6 tons per day of waste with a higher heating value of 6,000 British Thermal Units per pound of refuse (Btu/lb) in a single combustor unit (furnace and boiler). "Actual" (as opposed to "worst-case") conditions for the existing Facility were also necessary for the netting modeling analysis. This was represented in the BURN run as 250 tons per day of waste with a higher heating value of 5,000 Btu/lb in a single unit. In both the Retrofit and existing cases, the Facility has four units.

Section 4 in the main text discusses the formation mechanisms, air pollution control equipment, and emission limit basis for each of these pollutants.

B.2 Particulate Matter and PM_{10}

For conservatism, all PM was assumed to be respirable particulate matter less than 10 microns in diameter (PM_{10}).

Basis: 0.012 grains per dry standard cubic foot corrected to 7 percent oxygen (gr/dscf @ 7% O_2), consistent with the 1995 EG limit.

1. Dry volumetric flow rate for the Retrofit unit, as calculated by BURN:

   27,289.8 dry standard cubic feet per minute corrected to 7 percent oxygen (dscfm @ 7% O_2)

2. Calculate PM emission rate per unit.

   $$0.012\ \frac{gr}{dscf}\ (27289.8)\ \frac{dscf}{min}\ \left(\frac{g}{15.43\ gr}\right)\ \left(\frac{min}{60\ sec}\right) = 0.354\ g/s$$

3. Calculate PM emission rate for Facility.

   0.354 g/s/unit (4 units) = 1.41 g/s

   $$1.41\ \frac{g}{sec}\ \frac{(1\ ton)}{907{,}185\ g}\ \frac{(60\ sec)}{min}\ \frac{(60\ min)}{hour}\ \frac{(24\ hours)}{day}\ \frac{(365\ days)}{year} = 49.2 \text{ tons per year}$$

B.3 MWC Acid Gases

Sulfur Dioxide

The SDA/FF will control SO_2 emissions to meet the EG limits: 29 parts per million by volume (ppmv), or reduce emissions by 75 percent, whichever is less stringent (corrected to 7% O_2, dry basis), both over a 24-hour geometric mean, as determined by continuous emissions monitors.

The uncontrolled inlet SO_2 concentration of 600 ppmv (corrected to 7% O_2, dry basis) is roughly equivalent to an upper bound refuse sulfur content of 0.32 percent with 100 percent conversion of sulfur to SO_2. The control system will reduce this inlet concentration by 75 percent to achieve an outlet SO_2 concentration of 150 ppmv (dry, @ 7% O_2) over a 24-hour average. Emission rates based on the two emissions limitations are calculated as follows:

Basis: 29 parts per million on a dry volume basis corrected to 7 percent oxygen (ppmdv @ 7% O_2)

1. Dry volumetric flow rate for the Retrofit unit, as calculated by BURN:

   27,289.8 dry standard cubic feet per minute corrected to 7 percent oxygen (dscfm @ 7% O_2)

   $$27{,}289.8\ \frac{\text{dscf}}{\text{min}} \left(\frac{1\ \text{dscm}}{35.31\ \text{dscf}}\right) \left(\frac{1\ \text{min}}{60\ \text{sec}}\right) = 12.881\ \text{dscm/sec}$$

2. Calculate SO_2 emission rate for the Retrofit unit.

   $$\frac{29\ \text{moles}\ SO_2}{1 \times 10^6\ \text{moles}} \left(\frac{41.6\ \text{moles}}{\text{dscm}}\right) \left(\frac{64.07\ \text{g}}{\text{mole}}\right) \left(\frac{1 \times 10^6\ \mu\text{g}}{\text{g}}\right) = 77{,}294\ \frac{\mu\text{g}}{\text{dscm}}$$

   $$77{,}294\ \frac{\mu\text{g}}{\text{dscm}} \left(\frac{1\ \text{g}}{1 \times 10^6\ \mu\text{g}}\right) \left(\frac{12.881\ \text{dscm}}{\text{sec}}\right) = 0.996\ \text{g/sec}$$

3. Calculate SO_2 emission rate for Retrofit Facility.

   0.996 g/s/unit (4 units) = 3.982 g/s

   $$3.982\ \frac{\text{g}}{\text{sec}} \left(\frac{1\ \text{ton}}{907{,}185\ \text{g}}\right) \left(\frac{60\ \text{sec}}{\text{min}}\right) \left(\frac{60\ \text{min}}{\text{hour}}\right) \left(\frac{24\ \text{hours}}{\text{day}}\right) \left(\frac{365\ \text{days}}{\text{year}}\right) = 138.4\ \text{tons per year}$$

Basis: 600 parts per million on a dry volume basis corrected to 7 percent oxygen (ppmdv @ 7% O_2)

1. Apply 75 percent control efficiency.

   $$\underset{\text{uncontrolled}}{600\ \text{ppmdv}\ SO_2\ @\ 7\%\ O_2}\ (100\% - 75\%) = \underset{\text{controlled}}{150\ \text{ppmdv}\ SO_2\ @\ 7\%\ O_2}$$

2. Calculate SO_2 emission rate for the Retrofit unit.

   $$\frac{150\ \text{moles}\ SO_2}{1 \times 10^6\ \text{moles}} \left(\frac{41.6\ \text{moles}}{\text{dscm}}\right) \left(\frac{64.07\ \text{g}}{\text{mole}}\right) \left(\frac{1 \times 10^6\ \mu\text{g}}{\text{g}}\right) = 399{,}797\ \frac{\mu\text{g}}{\text{dscm}}$$

   $$399{,}797\ \frac{\mu\text{g}}{\text{dscm}} \left(\frac{1\ \text{g}}{1 \times 10^6\ \mu\text{g}}\right) \left(\frac{12.881\ \text{dscm}}{\text{sec}}\right) = 5.150\ \text{g/sec}$$

3. Calculate SO_2 emission rate for Retrofit Facility.

   5.150 g/s/unit (4 units) = 20.60 g/s

   $$20.60\ \frac{g}{sec}\ \frac{(1\ ton)}{907{,}185\ g}\ \frac{(60\ sec)}{min}\ \frac{(60\ min)}{hour}\ \frac{(24\ hours)}{day}\ \frac{(365\ days)}{year} = 716.1\ \text{tons per year}$$

Because SO_2 emission rates based on the percent removal efficiency approach result in higher calculated values, the SO_2 emission rate of 20.60 g/s was used in the worst-case dispersion modeling and compliance demonstrations for the Retrofit Facility.

The actual emissions of the existing Facility were used in the modeling analysis to show the net change in SO_2 impacts. Emissions for the existing Facility were based on the highest Facility (4-unit total) stack test result, which occurred in the September, 1985, compliance test run. This result was 139.9 pounds per hour (lb/hr) for the Facility as a whole, or 4.407 g/s/unit.

Hydrogen Chloride

The SDA/FF will control HCl emissions to meet the EG limits: 29 parts per million by volume (ppmv), or reduce emissions by 95 percent, whichever is less stringent (corrected to 7% O_2, dry basis), both as a 3-hour average, as determined by annual stack tests using EPA Method 26.

The uncontrolled inlet HCl concentration of 2,000 ppmv (corrected to 7% O_2, dry basis) is roughly equivalent to an upper bound refuse chlorine content of 0.65 percent with 100 percent conversion of chlorine to HCl. The control system will reduce this inlet concentration by 95 percent to achieve an outlet HCl concentration of 100 ppmv (dry, @ 7% O_2) over a 24-hour average. Emission rates based on the two emissions limitations are calculated as follows:

Basis: 29 parts per million on a dry volume basis corrected to 7 percent oxygen (ppmdv @ 7% O_2)

1. Dry volumetric flow rate for the Retrofit unit, as calculated by BURN:

   27,289.8 dry standard cubic feet per minute corrected to 7 percent oxygen (dscfm @ 7% O_2)

   $$27{,}289.8\ \frac{dscf}{min}\ \frac{(1\ dscm)}{35.31\ dscf}\ \frac{(1\ min)}{60\ sec} = 12.881\ dscm/sec$$

2. Calculate HCl emission rate for the unit.

   $$\frac{29\ moles\ SO_2}{1 \times 10^6\ moles}\ \frac{(41.6\ moles)}{dscm}\ \frac{(36.46\ g)}{mole}\ \frac{(1 \times 10^6\ \mu g)}{g} = 43{,}985\ \frac{\mu g}{dscm}$$

   $$43{,}985\ \frac{\mu g}{dscm}\ \frac{(1\ g)}{1 \times 10^6\ \mu g}\ \frac{(12.881\ dscm)}{sec} = 0.567\ g/sec$$

3. Calculate HCl emission rate for Facility.

0.567 g/s/unit (4 units) = 2.266 g/s

$$2.266 \frac{g}{sec} \left(\frac{1\ ton}{907{,}185\ g}\right) \left(\frac{60\ sec}{min}\right) \left(\frac{60\ min}{hour}\right) \left(\frac{24\ hours}{day}\right) \left(\frac{365\ days}{year}\right) = 78.8 \text{ tons per year}$$

Basis: 2,000 parts per million on a dry volume basis corrected to 7 percent oxygen (ppmdv @ 7% O_2)

1. Apply 95 percent control efficiency.

   2,000 ppmdv HCl @ 7% O_2 uncontrolled (100% - 95%) = 100 ppmdv HCl @ 7% O_2 controlled

2. Calculate HCl emission rate for the unit.

$$\frac{100 \text{ moles HCl}}{1 \times 10^6 \text{ moles}} \left(\frac{41.6 \text{ moles}}{dscm}\right) \left(\frac{36.46\ g}{mole}\right) \left(\frac{1 \times 10^6\ \mu g}{g}\right) = 151{,}674 \frac{\mu g}{dscm}$$

$$151{,}674 \frac{\mu g}{dscm} \left(\frac{1\ g}{1 \times 10^6\ \mu g}\right) \left(\frac{12.881\ dscm}{sec}\right) = 1.954 \text{ g/sec}$$

3. Calculate HCl emission rate for Facility.

   1.954 g/s/unit (4 units) = 7.815 g/s

$$7.815 \frac{g}{sec} \left(\frac{1\ ton}{907{,}185\ g}\right) \left(\frac{60\ sec}{min}\right) \left(\frac{60\ min}{hour}\right) \left(\frac{24\ hours}{day}\right) \left(\frac{365\ days}{year}\right) = 271.7 \text{ tons per year}$$

Because HCl emission rates based on the percent removal efficiency approach result in higher calculated values, the HCl emission rate of 7.82 g/s was used in the worst-case dispersion modeling and compliance demonstrations for the Facility.

Hydrogen Fluoride

The SDA/FF will be used to reduce HF emissions. The maximum potential emissions of HF are estimated to be 6.0 pounds per hour for the Facility, as a whole, consistent with the current permit limit.

Basis: 6.0 pounds per hour for the Facility

1. Calculate HF emission rate for the unit.

$$6.0 \frac{lb}{hr} \text{ Facility} \div 4 \text{ units} = 1.5 \text{ lb/hr/unit}$$

$$1.5 \frac{lb}{hr} \left(\frac{453.6\ g}{lb}\right) \left(\frac{1\ hr}{60\ min}\right) \left(\frac{1\ min}{60\ sec}\right) = 0.189 \text{ g/s}$$

2. Calculate HF emission rate for the Facility.

$$6.0\ \frac{lb}{hr}\ \left(\frac{453.6\ g}{lb}\right)\left(\frac{1\ hr}{60\ min}\right)\left(\frac{1\ min}{60\ sec}\right) = 0.756\ g/s$$

$$6.0\ \frac{lb}{hr}\ \left(\frac{1\ ton}{2{,}000\ lb}\right)\left(\frac{24\ hr}{day}\right)\left(\frac{365\ days}{year}\right) = 26.3\ \text{tons per year}$$

B.4 Carbon Monoxide

The combustion controls at the Facility will be upgraded and good combustion practices (as described in Section 3 in the main text) will be used to improve combustion efficiency, and reduce CO generation. The resulting 4-hour arithmetic block average CO concentration in the flue gases will be less than or equal to 100 parts per million by volume (ppmv) (corrected to 7% O_2, dry basis), as determined by continuous emissions monitors (CEMs), consistent with the EG.

Basis: 100 parts per million on a dry volume basis corrected to 7 percent oxygen (ppmdv @ 7% O_2)

1. Dry volumetric flow rate for the Retrofit unit, as calculated by BURN:

   27,289.8 dry standard cubic feet per minute corrected to 7 percent oxygen (dscfm @ 7% O_2)

$$27{,}289.8\ \frac{dscf}{min}\ \left(\frac{1\ dscm}{35.31\ dscf}\right)\left(\frac{1\ min}{60\ sec}\right) = 12.881\ dscm/sec$$

2. Calculate CO emission rate for the unit.

$$\frac{100\ \text{moles CO}}{1 \times 10^6\ \text{moles}}\ \left(\frac{41.6\ \text{moles}}{dscm}\right)\left(\frac{28.01\ g}{mole}\right)\left(\frac{1 \times 10^6\ \mu g}{g}\right) = 116{,}522\ \frac{\mu g}{dscm}$$

$$116{,}522\ \frac{\mu g}{dscm}\ \left(\frac{1\ g}{1 \times 10^6\ \mu g}\right)\left(\frac{12.881\ dscm}{sec}\right) = 1.501\ g/sec$$

3. Calculate CO emission rate for Facility.

   1.501 g/s/unit (4 units) = 6.004 g/s

$$6.004\ \frac{g}{sec}\ \left(\frac{1\ ton}{907{,}185\ g}\right)\left(\frac{60\ sec}{min}\right)\left(\frac{60\ min}{hour}\right)\left(\frac{24\ hours}{day}\right)\left(\frac{365\ days}{year}\right) = 208.7\ \text{tons per year}$$

B.5 Nitrogen Oxides

The combustion controls at the Facility will be upgraded and good combustion practices (as described in Section 3 in the main text) will be used to improve combustion efficiency, and reduce NO_X generation. The resulting 24-hour block arithmetic mean NOx concentration in the flue gases will be at or below equal to 205 parts per million by volume (ppmv) (corrected to 7% O_2, dry basis), as determined by continuous emissions monitors (CEMs), consistent with the EG.

Basis: 205 parts per million on a dry volume basis corrected to 7 percent oxygen (ppmdv @ 7% O_2)

1. Dry volumetric flow rate for the Retrofit unit, as calculated by BURN:

   27,289.8 dry standard cubic feet per minute corrected to 7 percent oxygen (dscfm @ 7% O_2)

   $$27{,}289.8\ \frac{\text{dscf}}{\text{min}}\ \left(\frac{1\ \text{dscm}}{35.31\ \text{dscf}}\right)\ \left(\frac{1\ \text{min}}{60\ \text{sec}}\right) = 12.881\ \text{dscm/sec}$$

2. Calculate NO_2 emission rate for the Retrofit unit.

   $$\frac{205\ \text{moles CO}}{1 \times 10^6\ \text{moles}}\ \left(\frac{41.6\ \text{moles}}{\text{dscm}}\right)\ \left(\frac{46.01\ \text{g}}{\text{mole}}\right)\ \left(\frac{1 \times 10^6\ \mu\text{g}}{\text{g}}\right) = 392{,}373\ \frac{\mu\text{g}}{\text{dscm}}$$

   $$392{,}373\ \frac{\mu\text{g}}{\text{dscm}}\ \left(\frac{1\ \text{g}}{1 \times 10^6\ \mu\text{g}}\right)\ \left(\frac{12.881\ \text{dscm}}{\text{sec}}\right) = 5.054\ \text{g/sec}$$

3. Calculate NO_2 emission rate for Retrofit Facility.

   5.054 g/s/unit (4 units) = 20.216 g/s

   $$20.22\ \frac{\text{g}}{\text{sec}}\ \left(\frac{1\ \text{ton}}{907{,}185\ \text{g}}\right)\ \left(\frac{60\ \text{sec}}{\text{min}}\right)\ \left(\frac{60\ \text{min}}{\text{hour}}\right)\ \left(\frac{24\ \text{hours}}{\text{day}}\right)\ \left(\frac{365\ \text{days}}{\text{year}}\right) = 702.8\ \text{tons per year}$$

The actual emissions of the existing Facility were used in the modeling analysis to show the net change in NO_2 impacts. Emissions for the existing Facility were based on the highest Facility (4-unit total) stack test result, which occurred in the October, 1989, compliance test run. This result was 230.8 pounds per hour (lb/hr) for the Facility as a whole, or 7.270 g/s/unit.

B.6 MWC Metals

Mercury

Mercury (Hg) is made a metallic vapor at the combustion temperatures for municipal solid waste. The activated carbon injection system will adsorb mercury onto the carbon. In addition, the SDA will reduce flue gas temperatures, encouraging mercury condensation onto particulate matter. The downstream FF will then effectively remove particulate matter and carbon particles containing mercury. This system will control Hg emissions to meet the state and EG limits: 70 micrograms per dry standard cubic meter (μg/dscm), or reduce emissions by 85 percent, whichever is less stringent (corrected to 7% O_2), both over a 3-hour arithmetic mean, as determined by annual stack tests using EPA Method 29.

The maximum inlet concentration was estimated from stack test data for the existing Facility. The uncontrolled inlet Hg concentration of 900 μg/dscm (corrected to 7% O_2, dry basis) is the highest single-unit one-hour average stack test result of 875.7 μg/dscm, rounded up, from the October 1996 test series. The control system will reduce this inlet concentration by 85 percent to achieve an outlet

Hg concentration of 135 μg/dscm (corrected to 7% O_2) or less. Emission rates based on the two emissions limitations are calculated as follows:

Basis: 70 micrograms per dry standard cubic meter corrected to 7 percent oxygen (μg/dscm @ 7% O_2)

1. Dry volumetric flow rate for the Retrofit unit, as calculated by BURN:

   27,289.8 dry standard cubic feet per minute corrected to 7 percent oxygen (dscfm @ 7% O_2)

   $$27{,}289.8\ \frac{\text{dscf}}{\text{min}}\ \frac{(1\ \text{dscm})}{35.31\ \text{dscf}}\ \frac{(1\ \text{min})}{60\ \text{sec}} = 12.881\ \text{dscm/sec}$$

2. Calculate Hg emission rate for the unit.

   $$70\ \frac{\mu g}{\text{dscm}}\ \frac{(1\ g)}{1 \times 10^{6}\ \mu g}\ \frac{(12.881\ \text{dscm})}{\text{sec}} = 0.000902\ \text{g/sec}$$

3. Calculate Hg emission rate for Facility.

   0.000902 g/s/unit (4 units) = 0.0036 g/s

   $$0.0036\ \frac{g}{\text{sec}}\ \frac{(1\ \text{ton})}{907{,}185\ g}\ \frac{(60\ \text{sec})}{\text{min}}\ \frac{(60\ \text{min})}{\text{hour}}\ \frac{(24\ \text{hours})}{\text{day}}\ \frac{(365\ \text{days})}{\text{year}} = 0.125\ \text{tons/year}$$

Basis: 900 micrograms per dry standard cubic meter corrected to 7 percent oxygen (μg/dscm @ 7% O_2)

1. Apply 85 percent control efficiency.

   900 μg/dscm Hg (100% - 85%) = 135 μg/dscm Hg
   @ 7% O_2 uncontrolled = @ 7% O_2 controlled

2. Calculate Hg emission rate for the unit.

   $$135\ \frac{\mu g}{\text{dscm}}\ \frac{(1\ g)}{1 \times 10^{6}\ \mu g}\ \frac{(12.881\ \text{dscm})}{\text{sec}} = 0.00174\ \text{g/sec}$$

3. Calculate Hg emission rate for Facility.

   0.00174 g/s/unit (4 units) = 0.0070 g/s

   $$0.0070\ \frac{g}{\text{sec}}\ \frac{(1\ \text{ton})}{907{,}185\ g}\ \frac{(60\ \text{sec})}{\text{min}}\ \frac{(60\ \text{min})}{\text{hour}}\ \frac{(24\ \text{hours})}{\text{day}}\ \frac{(365\ \text{days})}{\text{year}} = 0.242\ \text{tons/year}$$

Because Hg emission rates based on the percent removal efficiency approach result in higher calculated values, the Hg emission rate of 0.0070 g/s was used in the worst-case dispersion modeling and compliance demonstrations for the Facility.

Lead

Lead (Pb) liquefies at the combustion temperatures for municipal solid waste, but condenses onto fly ash in the flue gases. This process is assisted by the cooling provided by the SDA. The downstream FF will then effectively remove the particulate matter containing Pb. The SDA/FF will control Pb emissions to at or below the EG limit: 440 micrograms per dry standard cubic meter corrected to 7 percent oxygen (μg/dscm @ 7% O_2). Compliance will be based on a 3-hour arithmetic mean, as determined by annual stack tests using EPA Method 29.

Basis: 440 micrograms per dry standard cubic meter corrected to 7 percent oxygen (μg/dscm @ 7% O_2)

1. Dry volumetric flow rate for the Retrofit unit, as calculated by BURN:

   27,289.8 dry standard cubic feet per minute corrected to 7 percent oxygen (dscfm @ 7% O_2)

   $$27{,}289.8\ \frac{\text{dscf}}{\text{min}}\ \left(\frac{1\ \text{dscm}}{35.31\ \text{dscf}}\right)\ \left(\frac{1\ \text{min}}{60\ \text{sec}}\right) = 12.881\ \text{dscm/sec}$$

2. Calculate Pb emission rate for the unit.

   $$440\ \frac{\mu\text{g}}{\text{dscm}}\ \left(\frac{1\ \text{g}}{1 \times 10^6\ \mu\text{g}}\right)\ \left(\frac{12.881\ \text{dscm}}{\text{sec}}\right) = 0.005671\ \text{g/sec}$$

3. Calculate Pb emission rate for Facility.

   0.00567 g/s/unit (4 units) = 0.0227 g/s

   $$0.0227\ \frac{\text{g}}{\text{sec}}\ \left(\frac{1\ \text{ton}}{907{,}185\ \text{g}}\right)\ \left(\frac{60\ \text{sec}}{\text{min}}\right)\ \left(\frac{60\ \text{min}}{\text{hour}}\right)\ \left(\frac{24\ \text{hours}}{\text{day}}\right)\ \left(\frac{365\ \text{days}}{\text{year}}\right) = 0.788\ \text{tons/year}$$

Cadmium

Cadmium (Cd) is in the flue gases primarily as particulate matter, and will be controlled by the FF to at or below the EG limit: 40 micrograms per dry standard cubic meter corrected to 7 percent oxygen (μg/dscm @ 7% O_2). Compliance will be based on a 3-hour arithmetic mean, as determined by annual stack tests using EPA Method 29.

Basis: 40 micrograms per dry standard cubic meter corrected to 7 percent oxygen (μg/dscm @ 7% O_2)

1. Dry volumetric flow rate for the Retrofit unit, as calculated by BURN:

   27,289.8 dry standard cubic feet per minute corrected to 7 percent oxygen (dscfm @ 7% O_2)

   $$27{,}289.8\ \frac{\text{dscf}}{\text{min}}\left(\frac{1\ \text{dscm}}{35.31\ \text{dscf}}\right)\left(\frac{1\ \text{min}}{60\ \text{sec}}\right) = 12.881\ \text{dscm/sec}$$

2. Calculate Cd emission rate for the unit.

   $$40\ \frac{\mu g}{\text{dscm}}\ \frac{(1\ g)}{1 \times 10^{6}\ \mu g}\ \frac{(12.881\ \text{dscm})}{\text{sec}} = 0.000515\ \text{g/sec}$$

3. Calculate Cd emission rate for Facility.

   0.000515 g/s/unit (4 units) = 0.0021 g/s

   $$0.0021\ \frac{g}{\text{sec}}\ \frac{(1\ \text{ton})}{907{,}185\ g}\ \frac{(60\ \text{sec})}{\text{min}}\ \frac{(60\ \text{min})}{\text{hour}}\ \frac{(24\ \text{hours})}{\text{day}}\ \frac{(365\ \text{days})}{\text{year}} = 0.072\ \text{tons/year}$$

Beryllium

Beryllium (Be) can be present in the flue gases as particulate matter, and will be controlled by the FF. The maximum potential emissions of Be are estimated to be 0.00046 pounds per hour for the Facility, as a whole, consistent with the current permit limit.

Basis: 0.00046 pounds per hour for the Facility

1. Calculate Be emission rate for the unit.

   $$0.00046\ \frac{\text{lb}}{\text{hr}}\ \text{Facility} \div 4\ \text{units} = 0.000115\ \text{lb/hr/unit}$$

   $$0.000115\ \frac{\text{lb}}{\text{hr}}\ \frac{(453.6\ g)}{\text{lb}}\ \frac{(1\ \text{hr})}{60\ \text{min}}\ \frac{(1\ \text{min})}{60\ \text{sec}} = 1.45 \times 10^{-5}\ \text{g/s}$$

2. Calculate Be emission rate for the Facility.

   $$0.00046\ \frac{\text{lb}}{\text{hr}}\ \frac{(453.6\ g)}{\text{lb}}\ \frac{(1\ \text{hr})}{60\ \text{min}}\ \frac{(1\ \text{min})}{60\ \text{sec}} = 5.80 \times 10^{-5}\ \text{g/s}$$

   $$0.00046\ \frac{\text{lb}}{\text{hr}}\ \frac{(1\ \text{ton})}{2{,}000\ \text{lb}}\ \frac{(24\ \text{hr})}{\text{day}}\ \frac{(365\ \text{days})}{\text{year}} = 0.00201\ \text{tons per year}$$

B.7 MWC Organics

Dioxins and Furans

The Retrofit Facility will use good combustion practices (see Section 3 in the main text) to reduce formation of dioxins and furans (PCDD/PCDF), the SDA to condense PCDD/PCDF onto particulate matter in the flue gas, and the FF to remove the particulate matter containing PCDD/PCDF. PCDD/PCDF concentrations will be controlled by this system to at or below the EG limit: 30 nanograms per dry standard cubic meter corrected to 7 percent oxygen (ng/dscm @ 7% O_2). Compliance will be based on a 4-hour arithmetic mean, as determined by annual stack tests using EPA Reference Method 26.

Basis: 30 nanograms per dry standard cubic meter corrected to 7 percent oxygen (ng/dscm @ 7% O_2)

1. Dry volumetric flow rate for the Retrofit unit, as calculated by BURN:

   27,289.8 dry standard cubic feet per minute corrected to 7 percent oxygen (dscfm @ 7% O_2)

   $$27{,}289.8 \frac{\text{dscf}}{\text{min}} \left(\frac{1 \text{ dscm}}{35.31 \text{ dscf}}\right) \left(\frac{1 \text{ min}}{60 \text{ sec}}\right) = 12.881 \text{ dscm/sec}$$

2. Calculate PCDD/PCDF emission rate for the unit.

   $$30 \frac{\text{ng}}{\text{dscm}} \left(\frac{1 \text{ g}}{1 \times 10^{9} \text{ ng}}\right) \left(\frac{12.881 \text{ dscm}}{\text{sec}}\right) = 3.864 \times 10^{-7} \text{ g/sec}$$

3. Calculate PCDD/PCDF emission rate for Facility.

   $$3.864 \times 10^{-7} \text{ g/s/unit} \quad (4 \text{ units}) = 1.546 \times 10^{-6} \text{ g/s}$$

   $$1.546 \times 10^{-6} \frac{\text{g}}{\text{sec}} \left(\frac{1 \text{ ton}}{907{,}185 \text{ g}}\right) \left(\frac{60 \text{ sec}}{\text{min}}\right) \left(\frac{60 \text{ min}}{\text{hour}}\right) \left(\frac{24 \text{ hrs}}{\text{day}}\right) \left(\frac{365 \text{ days}}{\text{year}}\right) = 5.37 \times 10^{-5} \frac{\text{tons}}{\text{year}}$$

B.8 Ammonia

The Retrofit Facility will have SNCR for NO_X control. The vendor for this system has not been selected, and it is not currently known whether the reagent will be ammonia or urea. With either ammonia or urea, there will be some unreacted reagent that will "slip" out of the stack. Ammonia is regulated as a hazardous air pollutant, and the FDEP has a guideline Ambient Reference Concentration for ammonia. Urea is not regulated as a hazardous air pollutant and does not have an Ambient Reference Concentration. Therefore, for the purposes of performing a worst-case impacts analysis for the Facility Retrofit, it was assumed that ammonia would be the SNCR reagent. A maximum upper bound concentration for unreacted ammonia in the flue gases was estimated to be 50 parts per million by volume (ppmv) (corrected to 7% O_2, dry basis), based on recent permit approvals for ammonia-based SNCR systems (FDEP PSD Permit, Lee County Solid Waste Energy Recovery Facility, No. PSD-FL-151, July 20, 1992; NYSDEC Permit to Operate, Onandaga County, NY, Resource Recovery Facility, No. 7-3142-00028, November 16, 1995; and NJDEP Permit to Construct, Mercer and Atlantic Counties, NJ, Resource Recovery Facility, Log No. 01-92-1730, July 24, 1996). It is likely that the Retrofit Tampa McKay Bay Facility will have stack concentrations substantially less than this.

Basis: 50 parts per million on a dry volume basis corrected to 7 percent oxygen (ppmdv @ 7% O_2)

1. Dry volumetric flow rate for the Retrofit unit, as calculated by BURN:

   27,289.8 dry standard cubic feet per minute corrected to 7 percent oxygen (dscfm @ 7% O_2)

   $$27{,}289.8\ \frac{\text{dscf}}{\text{min}}\ \left(\frac{1\ \text{dscm}}{35.31\ \text{dscf}}\right)\ \left(\frac{1\ \text{min}}{60\ \text{sec}}\right) = 12.881\ \text{dscm/sec}$$

2. Calculate ammonia (NH_3) emission rate for the Retrofit unit.

   $$\frac{50\ \text{moles}\ NH_3}{1 \times 10^6\ \text{moles}}\ \left(\frac{41.6\ \text{moles}}{\text{dscm}}\right)\ \left(\frac{17.03\ \text{g}}{\text{mole}}\right)\ \left(\frac{1 \times 10^6\ \mu\text{g}}{\text{g}}\right) = 35{,}422\ \frac{\mu\text{g}}{\text{dscm}}$$

   $$35{,}422\ \frac{\mu\text{g}}{\text{dscm}}\ \left(\frac{1\ \text{g}}{1 \times 10^6\ \mu\text{g}}\right)\ \left(\frac{12.881\ \text{dscm}}{\text{sec}}\right) = 0.456\ \text{g/sec}$$

3. Calculate NH_3 emission rate for Retrofit Facility.

   0.456 g/s/unit (4 units) = 1.825 g/s

   $$1.825\ \frac{\text{g}}{\text{sec}}\ \left(\frac{1\ \text{ton}}{907{,}185\ \text{g}}\right)\ \left(\frac{60\ \text{sec}}{\text{min}}\right)\ \left(\frac{60\ \text{min}}{\text{hour}}\right)\ \left(\frac{24\ \text{hours}}{\text{day}}\right)\ \left(\frac{365\ \text{days}}{\text{year}}\right) = 63.4\ \text{tons per year}$$

Appendix C
BURN Model Runs

Appendix C
BURN Model Runs

CDM's proprietary combustion model, BURN, was run to estimate flue gas composition, temperature, and flow rates for seven combinations of waste heat content and feed rate, for both the existing Facility, and the future Facility after the proposed upgrade. Section 6.0 describes these cases, and the input and output information for the BURN model itself.

This appendix contains the output for the three most pertinent cases of the 14 modeled:

- 100 percent of nominal load with a reference waste of 5,000 Btu/lb for the existing Facility.
- 115 percent of nominal load with a waste of 6,000 Btu/lb for the future Facility (this was determined to be the worst case for dispersion modeling).
- 100 percent of nominal load with a reference waste of 5,000 Btu/lb for the future Facility.

The parameters and output information shown in each of these print-outs are for a single unit (out of the total of four units at the Facility).

Nominal Case

BURN - Version 4.01 COMBUSTION ANALYSIS: RUN ___ FOR Tampa ___/___/___

100% MCR
5,000 Btu/lb

DATA FILE USED FOR THIS ANALYSIS: T231.IN

Existing Conditions 250 tpd

WASTE FEED STREAMS

PERCENT (DRY BASIS)

NAME	WEIGHT FIRED in Wet LB/Hr	Carbon	Hydrogen	Sulfur	Fe(OH)3	Al(OH)3	Oxygen
WASTE	20833.0	35.939	4.792	.126	00.000	00.000	31.653
COMPOSITE (LB)	20833.	5933.67	791.17	20.83	.00	.00	5225.88
COMPOSITE MOLS	0.	494.06	392.44	.65	.00	.00	163.31
COMPOSITE (% DRY BASIS)		35.94	4.79	.13	.00	.00	31.65

PERCENT (DRY BASIS)

	Nitrogen	Chlorine	CaCO3	Inert	Iron	Aluminum	Bromine	Pct.H2O	BTU/LB
# 1	.631	.504	00.000	26.356	00.000	00.000	00.000	20.750	6309.6
(LB)	104.11	83.29	.00	4351.35	.00	.00	.00	4322.85	5000.4
MOLS	3.72	2.35	.00	4351.35	.00	.00	.00	240.16	
% DRY	.63	.50	.00	26.36	.00	.00	.00		

	DRY BASIS		WET BASIS	
THE MODIFIED DULONG HEATING VALUE IS:	6294.1	BTU/LB	4988.1	BTU/LB
THE MODIFIED CHANG HEATING VALUE IS:	6392.9	BTU/LB	5066.4	BTU/LB
THE BOIE HEATING VALUE IS:	6309.6	BTU/LB	5000.4	BTU/LB
THE MODIFIED VONDRACEK HEATING VALUE IS:	4600.2	BTU/LB	3645.7	BTU/LB
THE AVERAGE ESTIMATED HEATING VALUE IS:	5899.2	BTU/LB	4675.1	BTU/LB
THE INPUT WASTE HEATING VALUE IS:	6309.6	BTU/LB	5000.4	BTU/LB

DAILY CHARGE RATE EQUALS: 250.0 TONS PER 24-HOUR DAY.

RUN CONDITIONS AS INPUT
======================

AMBIENT AIR: 73.0 DEG. F ; PRESSURE 1.0 ATM; ABSOLUTE HUMIDITY .013000
AMBIENT AIR HAS A RELATIVE HUMIDITY OF: 74.5 PERCENT
AVAILABLE PREHEATED AIR .0 ACTUAL CFM AT 73.0 DEG. F
OPERATING TEMPERATURES: MINIMUM OF .0, MAXIMUM OF 50000.0 DEG. F
FURNACE WATER COOLED, 100.00 % OF AREA; BOILER WATER COOLED, 100.00 % OF AREA
TEMPERATURES MODERATED WITH AIR AND ELEVATED WITH GAS
STEAM CONDITIONS: PRESSURE - 1000. PSIA ; TEMPERATURE - 900. DEG. F
TEMPERATURE (DEG. F): PROCESS WATER 60. FEEDWATER 60.
FLUE GASES LEAVE THE BOILER AT: 525.0 DEG. F , QUENCHER AT .0 DEG. F
FLUE GASES LEAVE THE SUBCOOLER AT: .0 DEG. F
MAXIMUM SUBCOOLER WATER DISCHARGE TEMPERATURE IS: 95.0 DEG. F
STACK DIAM. IS 1.2 F, HEIGHT 160.0 F, VELOCITY = 45.0 FT/SEC
0. BTU/HR IS ABSORBED IN THE PRIMARY COMBUSTION CHAMBER
RESIDUE IS WATER QUENCHED AND LEAVES SYSTEM AT 350.0 DEG. F
UNBURNED PERCENTAGES OF FEED - CARBON .5, IRON 00.0, ALUMINUM 00.0
AFTERBURNER TEMPERATURE: .0 DEG. F ;OPERATING FACTOR: 100.00 % OF DESIGN
ATMOSPHERIC STABILITY CLASS IS: 0; DESIGN % EXCESS AIR IS: 115.0

NOTE: GAS FLOW RATES EXPRESSED IN SCFM ARE AT 60 Deg. F AND 1.0 Atm.

SUMMARY OF FURNACE OPERATIONS

Furnace Flue Gas Sensible Heat Content (SENH) as a Function of Tgas

SENH = A + B*T + C*T*T + D*T*T*T

A = -.2583374E+07 C = .3963910E+01

B = .4281965E+05 D = -.3493828E-03

At Tgas = 1910.26 DEG. F , SENH = .9124278E+08 BTU/HR

GAS ANALYSIS AFTER FURNACE

COMPONENT	VOLUME % DRY BASIS	VOLUME % WET BASIS	MOLS PER MINUTE	LB/HR	
CO2	9.217	8.090	8.193	21634.9	
SO2	.1220E-01	.1071E-01	.1085E-01	41.7	107. PPMV - WET
N2	79.44	69.73	70.62	118705.8	
O2	11.29	9.905	10.03	19260.8	
HCl	.4404E-01	.3866E-01	.3915E-01	85.7	387. PPMV - WET
HBr	.0000	.0000	.0000	.0	0. PPMV - WET
H2O		12.23	12.38	13374.6	
TOTAL	100.0	100.0	101.3	173103.4	

	PERCENT SO2 TO SO3	DEWPOINT DEG. F	EQUIVALENT SO3 ppmw	EQUIVALENT SO3 ppmd
SULFURIC ACID	1	245.41	1.	1.
DEWPOINT FROM	3	263.36	3.	4.
OXIDATION OF	5	272.03	5.	6.
SO2 TO SO3	8	280.19	9.	10.
AT THIS LOCATION	10	284.12	11.	12.
IN THE SYSTEM	15	291.39	16.	18.

EQUILIBRIUM SO3 (USUALLY NOT ATTAINED) AT 1910.3 DEG. F

EQUILIBRIUM CONSTANT FOR SO2+0.5O2-->SO3 IS: .125

EQUILIBRIUM SO3 IS THEN: 53. ppm (wet basis)

PREHEATED AIR	.00	ACFM	(ENTHALPY: 0. BTU/HR)	
	.00	SCFM	.00	LB/HR
COMBUSTION AIR	35434.50	ACFM		
	34569.71	SCFM	156516.50	LB/HR
BURNER AIR	.00	ACFM		
	.00	SCFM	.00	LB/HR
COOLING AIR	.00	ACFM		
	.00	SCFM	.00	LB/HR
COOLING WATER	.00	GAL/MIN	.00	LB/HR

WITHOUT COOLING OR FUEL USE BUT USING 0. ACFM OF PREHEATED AIR, THE FURNACE TEMPERATURE IS: 1910. DEG. F ; A TEMPERATURE OF 1788. DEG. F WAS USED TO JUDGE POTENTIAL DISSOCIATION OF $CaCO_3$, $Fe(OH)_3$, AND $Al(OH)_3$.

FLUE GAS	175132.10	ACFM	AT	1910.3	DEG. F
	38402.29	SCFM	AT	60.0	DEG. F

BURNER FUEL USE .00 CFM (.00 FT3/HR) GAS
EQUAL TO .0 BTU/HR

QUENCH TANK MAKEUP 2.92 GAL/MIN

RESIDUE ASSUMED TO LEAVE HOT ZONE AT 350.0 DEG. F
RESIDUE WEIGHT (75.00 % SOLIDS) 5841.36 LB/HR
(DRY) 4381.02 LB/HR

UNBURNED CARBON IN ASH: .677 PERCENT OF TOTAL ASH (INCLUDING CARBON)
HEATING VALUE OF RESIDUE (DRY BASIS): 95.5 BTU/LB OR 418206. BTU/HR

NET HEAT RELEASE (BTU/HR)

1. PRIMARY

FEED	103754300.
FUEL	0.
AIR HEAT	2619104.
TOTAL	106373400.

2. AFTERBURNER

FUEL	0.
AIR HEAT	0.
GRAND TOTAL	106373400.

HEAT LOSSES	BTU/HR	PERCENT OF FEED HEAT CONTENT	PERCENT OF TOTAL HEAT RELEASE
RADIATION	698987.	.67 PERCENT	.7 PERCENT
MOISTURE	14188290.	13.62 PERCENT	13.3 PERCENT
DRY GAS	91242780.	87.59 PERCENT	85.4 PERCENT
RESIDUE	773339.	.74 PERCENT	.7 PERCENT

DESIGN EXCESS AIR (ON FEED) IS 115.00 PERCENT
ACTUAL EXCESS AIR (ON FEED) IS 115.01 PERCENT
ACTUAL EXCESS AIR (ON TOTAL COMBUSTIBLE) IS 115.01 PERCENT

EQUILIBRIUM THERMAL NOX CONCENTRATION IS 306.0 PPM (VOLUME)
PERCENT FUEL NITROGEN CONVERTED TO NOx= 69.672 PERCENT
FUEL NITROGEN NOx (Estimated by Soete) = 852.173 PPM (VOLUME)

THE EQUILIBRIUM CONSTANT FOR $2HCl + .5O_2 \rightarrow Cl_2 + H_2O$ IS: .0697
THE EQUILIBRIUM CONSTANT FOR $2HBr + .5O_2 \rightarrow Br_2 + H_2O$ IS: .0104

EQUILIBRIUM CHLORINE CONCENTRATION AT 1910.3 DEG. F IS:
.657 ppm (Wet Basis)
.748 ppm (Dry Basis)

SO2 UNCONTROLLED EMISSION RATE IS	5.26 GM/SEC	EQUAL TO	41.65 LB/HR
HCl UNCONTROLLED EMISSION RATE IS	10.80 GM/SEC	EQUAL TO	85.56 LB/HR
HBr UNCONTROLLED EMISSION RATE IS	.00 GM/SEC	EQUAL TO	.00 LB/HR

WITH ACID GAS CONTROL AT .0 PERCENT,
SO2 CONTROLLED EMISSION RATE IS 5.26 GM/SEC EQUAL TO 41.65 LB/HR

HCl CONTROLLED EMISSION RATE IS 10.80 GM/SEC EQUAL TO 85.56 LB/HR

HBr CONTROLLED EMISSION RATE IS .00 GM/SEC EQUAL TO .00 LB/HR

	PERCENT SO2 TO SO3	DEWPOINT DEG. F	EQUIVALENT SO3 ppmw	EQUIVALENT SO3 ppmd
SULFURIC ACID	1	245.41	1.	1.
DEWPOINT FROM	3	263.36	3.	4.
OXIDATION OF	5	272.03	5.	6.
SO2 TO SO3	8	280.19	9.	10.
AT THIS LOCATION	10	284.12	11.	12.
IN THE SYSTEM	15	291.39	16.	18.

EQUILIBRIUM SO3 (USUALLY NOT ATTAINED) AT 1910.3 DEG. F
EQUILIBRIUM CONSTANT FOR SO2+0.5O2-->SO3 IS: .125
EQUILIBRIUM SO3 IS THEN: 53. ppm (wet basis)

SUMMARY OF BOILER OPERATION CALCULATIONS

BOILER STEAM PRODUCTION 49035.0 LB/HR
PRESSURE 1000.0 PSIA
TEMPERATURE 900.0 DEG. F

FEEDWATER TEMPERATURE: 60.0 DEG. F
FEEDWATER ENTHALPY: 28.4 BTU/LB
PRODUCT STEAM ENTHALPY: 1448.2 BTU/LB
ENTHALPY CHANGE: 1419.7 BTU/LB

NOTE: THE PERCENT OXIDATION OF FLUE GAS SO2 AT WHICH THE SULFURIC ACID DEWPOINT EQUALS THE FEEDWATER TEMPERATURE IS: .00 PERCENT.

PRODUCT STEAM USE TO HEAT CONDENSATE RETURN
FROM 0. DEG. F TO FEEDWATER TEMPERATURE IS: 1987.7 LB/HR

NET STEAM PRODUCTION AFTER FEEDWATER HEATING IS: 47047.3 LB/HR

NOTE!! - IF ACTUAL CONDENSATE RETURN IS ALREADY AT FEEDWATER TEMPERATURE, ADD BACK THE FEEDWATER HEATING STEAM USE TO THE NET STEAMING RATE!!

SATURATION TEMPERATURE AT PRODUCT STEAM PRESSURE: 544.6 DEG. F

THE STEAM CARRIES: 355.4 DEG. F OF SUPERHEAT

FLUE GAS TEMPERATURE AT BOILER EXIT 525. DEG. F

RADIATION LOSS 688090. BTU/HR OR .75 % OF SENSIBLE HEAT AT BOILER INLET

WITH REFERENCE TO TOTAL ENTHALPY INPUT TO THE COMBUSTION SYSTEM,
THE BOILER EFFICIENCY IS: 65.19 PERCENT

WITH REFERENCE TO FEED HHV ENTHALPY INPUT TO THE COMBUSTION SYSTEM,
THE BOILER EFFICIENCY IS: 66.57 PERCENT

MEAN MOLECULAR WEIGHT OF GASES
(DRY BASIS) 29.95
(WET BASIS) 28.49

TOTAL GAS FLOW RATE	LB/MIN	LB/HR	ACFM
(DRY BASIS)	2662.15	159728.90	--
(WET BASIS)	2885.25	173115.30	72814.9

EFFLUENT GAS HUMIDITY .0838 (MASS H2O/MASS BONE DRY GAS)

GAS DEW POINT IS 122.1 DEG. F

SUMMARY OF STACK REHEATING OPERATION
===================================
TARGET STACK TEMPERATURE IS: .0 DEG. F

NO STACK REHEAT ANALYSIS REQUESTED.

SUMMARY OF STACK CALCULATIONS AFTER SYSTEM

STACK DIAMETER OF 5.86 FEET USED FOR CALCULATIONS

NATURAL DRAFT 1.052E+00 IN H2O
FRICTION LOSS 4.498E-01 IN H2O
VELOCITY HEAD 2.470E-02 IN H2O
MINIMUM FAN PRESSURE-5.772E-01 IN H2O
EXIT VELOCITY 45.0 FT/SEC

TOTAL FLOW @ STACK CONDITIONS 72694.8 CFM
STACK TEMPERATURE IS: 524.1 DEG. F

FLOW CORRECTED TO 12% CO2 (DRY, 1 ATM, 68 F/20 C)) 26304.2 CFM
FLOW CORRECTED TO 7% O2 (DRY, 1 ATM, 68 F/20 C)) 23764.6 CFM

MEAN MOLECULAR WEIGHT OF GASES
(DRY BASIS) 29.95
(WET BASIS) 28.49

TOTAL GAS FLOW RATE	LB/MIN	LB/HR	ACFM
(DRY BASIS)	2662.15	159728.90	--
(WET BASIS)	2885.25	173115.30	72814.9

EFFLUENT GAS HUMIDITY .0838 (MASS H2O/MASS BONE DRY GAS)

GAS DEW POINT IS 122.1 DEG. F

SUMMARY OF STACK VISIBILITY ANALYSIS
===================================

THIS ANALYSIS DETERMINES THE DISTANCE ABOVE THE STACK TOP WHERE THE PLUME (AFTER REHEAT) JUST VANISHES. FOR FINITE WINDSPEED, THERE WILL BE A HORIZONTAL DISPLACEMENT. ALSO, THE STACK REHEAT VIA USE OF AVAILABLE PREHEATED AIR, FUEL AND STEAM WHICH JUST RENDERS THE PLUME NON-VISIBLE ARE CALCULATED (STARTING AFTER ANY PROGRAMMED REHEAT).

THE FLUE GAS TEMPERATURE IS HIGH ENOUGH AND/OR THE HUMIDITY LOW ENOUGH THAT THE PLUME-AMBIENT INTERACTION SHOULD NOT PRODUCE A VISIBLE PLUME. VISIBILITY ANALYSIS DISCONTINUED.

CALCULATIONS COMPLETE

BURN - Version 4.01 COMBUSTION ANALYSIS: RUN ___ FOR Tampa ___ __/__/__

DATA FILE USED FOR THIS ANALYSIS: T112.IN

115% MCR
6,000 Btu/lb
Future Case

WASTE FEED STREAMS

NAME	WEIGHT FIRED in Wet LB/Hr	Carbon	Hydrogen	Sulfur	Fe(OH)3	Al(OH)3	Oxygen
		PERCENT (DRY BASIS)					
WASTE	19966.0	35.939	4.792	.126	00.000	00.000	31.653
COMPOSITE (LB)	19966.	6823.33	909.79	23.95	.00	.00	6009.42
COMPOSITE MOLS	0.	568.14	451.28	.75	.00	.00	187.79
COMPOSITE (% DRY BASIS)		35.94	4.79	.13	.00	.00	31.65

PERCENT (DRY BASIS)

	Nitrogen	Chlorine	CaCO3	Inert	Iron	Aluminum	Bromine	Pct.H2O	BTU/LB
# 1	.631	.504	00.000	26.356	00.000	00.000	00.000	4.910	6309.6
(LB)	119.72	95.78	.00	5003.77	.00	.00	.00	980.39	5999.8
MOLS	4.27	2.70	.00	5003.77	.00	.00	.00	54.47	
% DRY	.63	.50	.00	26.36	.00	.00	.00		

	DRY BASIS		WET BASIS	
THE MODIFIED DULONG HEATING VALUE IS:	6294.1	BTU/LB	5985.1	BTU/LB
THE MODIFIED CHANG HEATING VALUE IS:	6392.9	BTU/LB	6079.0	BTU/LB
THE BOIE HEATING VALUE IS:	6309.6	BTU/LB	5999.8	BTU/LB
THE MODIFIED VONDRACEK HEATING VALUE IS:	4600.2	BTU/LB	4374.3	BTU/LB
THE AVERAGE ESTIMATED HEATING VALUE IS:	5899.2	BTU/LB	5609.5	BTU/LB
THE INPUT WASTE HEATING VALUE IS:	6309.6	BTU/LB	5999.8	BTU/LB ✓

DAILY CHARGE RATE EQUALS: 239.6 TONS PER 24-HOUR DAY. ✓

RUN CONDITIONS AS INPUT

AMBIENT AIR: 73.0 DEG. F ; PRESSURE 1.0 ATM; ABSOLUTE HUMIDITY .013000
AMBIENT AIR HAS A RELATIVE HUMIDITY OF: 74.5 PERCENT
AVAILABLE PREHEATED AIR .0 ACTUAL CFM AT 73.0 DEG. F
OPERATING TEMPERATURES: MINIMUM OF .0, MAXIMUM OF 50000.0 DEG. F
FURNACE WATER COOLED, 100.00 % OF AREA; BOILER WATER COOLED, 100.00 % OF AREA
TEMPERATURES MODERATED WITH AIR AND ELEVATED WITH GAS
STEAM CONDITIONS: PRESSURE - 1000. PSIA ; TEMPERATURE - 900. DEG. F
TEMPERATURE (DEG. F): PROCESS WATER 60. FEEDWATER 400.
FLUE GASES LEAVE THE BOILER AT: 450.0 DEG. F , QUENCHER AT 290.0 DEG. F
FLUE GASES LEAVE THE SUBCOOLER AT: .0 DEG. F
MAXIMUM SUBCOOLER WATER DISCHARGE TEMPERATURE IS: 95.0 DEG. F
STACK DIAM. IS 1.2 F, HEIGHT 160.0 F, VELOCITY = 45.0 FT/SEC
0. BTU/HR IS ABSORBED IN THE PRIMARY COMBUSTION CHAMBER
RESIDUE IS WATER QUENCHED AND LEAVES SYSTEM AT 350.0 DEG. F
UNBURNED PERCENTAGES OF FEED - CARBON .5, IRON 00.0, ALUMINUM 00.0
AFTERBURNER TEMPERATURE: .0 DEG. F ;OPERATING FACTOR: 115.00 % OF DESIGN
ATMOSPHERIC STABILITY CLASS IS: 0; DESIGN % EXCESS AIR IS: 100.0

NOTE: GAS FLOW RATES EXPRESSED IN SCFM ARE AT 60 Deg. F AND 1.0 Atm.

SUMMARY OF FURNACE OPERATIONS

Furnace Flue Gas Sensible Heat Content (SENH) as a Function of Tgas

SENH = A + B*T + C*T*T + D*T*T*T

A =	-.2687891E+07	C =	.4145047E+01
B =	.4455083E+05	D =	-.3744222E-03

At Tgas = 2161.98 DEG. F , SENH = .1092207E+09 BTU/HR

GAS ANALYSIS AFTER FURNACE

COMPONENT	VOLUME % DRY BASIS	VOLUME % WET BASIS	MOLS PER MINUTE	LB/HR	
CO2	9.912	8.935	9.422	24878.7	
SO2	.1312E-01	.1183E-01	.1247E-01	48.0	118. PPMV - WET
N2	79.47	71.64	75.55	126988.8	
O2	10.55	9.513	10.03	19259.8	
HCl	.4736E-01	.4270E-01	.4502E-01	98.5	427. PPMV - WET
HBr	.0000	.0000	.0000	.0	0. PPMV - WET
H2O		9.859	10.40	11228.1	
TOTAL	100.0	100.0	105.5	182501.8	

	PERCENT SO2 TO SO3	DEWPOINT DEG. F	EQUIVALENT SO3 ppmw	EQUIVALENT SO3 ppmd
SULFURIC ACID	1	242.66	1.	1.
DEWPOINT FROM	3	260.90	4.	4.
OXIDATION OF	5	269.71	6.	7.
SO2 TO SO3	8	278.00	9.	10.
AT THIS LOCATION	10	282.01	12.	13.
IN THE SYSTEM	15	289.40	18.	20.

EQUILIBRIUM SO3 (USUALLY NOT ATTAINED) AT 2162.0 DEG. F
EQUILIBRIUM CONSTANT FOR SO2+0.5O2-->SO3 IS: .055
EQUILIBRIUM SO3 IS THEN: 35. ppm (wet basis)

PREHEATED AIR	.00	ACFM	(ENTHALPY: 0. BTU/HR)	
	.00	SCFM	.00	LB/HR
COMBUSTION AIR	37904.55	ACFM		
	36979.47	SCFM	167426.80	LB/HR
BURNER AIR	.00	ACFM		
	.00	SCFM	.00	LB/HR
COOLING AIR	.00	ACFM		
	.00	SCFM	.00	LB/HR
COOLING WATER	.00	GAL/MIN	.00	LB/HR

WITHOUT COOLING OR FUEL USE BUT USING 0. ACFM OF PREHEATED AIR, THE FURNACE TEMPERATURE IS: 2162. DEG. F ; A TEMPERATURE OF 2029. DEG. F WAS USED TO JUDGE POTENTIAL DISSOCIATION OF CaCO3, Fe(OH)3, AND Al(OH)3.

FLUE GAS	201720.20	ACFM	AT	2162.0	DEG. F
	39985.55	SCFM	AT	60.0	DEG. F

BURNER FUEL USE .00 CFM (.00 FT3/HR) GAS
EQUAL TO .0 BTU/HR

QUENCH TANK MAKEUP 3.35 GAL/MIN

RESIDUE ASSUMED TO LEAVE HOT ZONE AT 350.0 DEG. F
RESIDUE WEIGHT (75.00 % SOLIDS) 6717.18 LB/HR
(DRY) 5037.89 LB/HR

UNBURNED CARBON IN ASH: .677 PERCENT OF TOTAL ASH (INCLUDING CARBON)
HEATING VALUE OF RESIDUE (DRY BASIS): 95.5 BTU/LB OR 480910. BTU/HR

NET HEAT RELEASE (BTU/HR)

1. PRIMARY

FEED	119310700.
FUEL	0.
AIR HEAT	2801675.
TOTAL	122112400.

2. AFTERBURNER

FUEL	0.
AIR HEAT	0.
GRAND TOTAL	122112400.

HEAT LOSSES	BTU/HR	PERCENT OF FEED HEAT CONTENT	PERCENT OF TOTAL HEAT RELEASE
RADIATION	698205.	.58 PERCENT	.6 PERCENT
MOISTURE	11911240.	9.94 PERCENT	9.7 PERCENT
DRY GAS	109220700.	91.18 PERCENT	89.1 PERCENT
RESIDUE	889290.	.74 PERCENT	.7 PERCENT

DESIGN EXCESS AIR (ON FEED) IS 100.00 PERCENT
ACTUAL EXCESS AIR (ON FEED) IS 100.01 PERCENT
ACTUAL EXCESS AIR (ON TOTAL COMBUSTIBLE) IS 100.01 PERCENT

EQUILIBRIUM THERMAL NOX CONCENTRATION IS 674.3 PPM (VOLUME)
PERCENT FUEL NITROGEN CONVERTED TO NOx= 73.152 PERCENT
FUEL NITROGEN NOx (Estimated by Soete) = 988.146 PPM (VOLUME)

THE EQUILIBRIUM CONSTANT FOR 2HCl+.5O2-->Cl2+H2O IS: .0425
THE EQUILIBRIUM CONSTANT FOR 2HBr+.5O2-->Br2+H2O IS: .0020

EQUILIBRIUM CHLORINE CONCENTRATION AT 2162.0 DEG. F IS:
.594 ppm (Wet Basis)
.659 ppm (Dry Basis)

SO2 UNCONTROLLED EMISSION RATE IS	6.05	GM/SEC	EQUAL TO	47.89	LB/HR
HCl UNCONTROLLED EMISSION RATE IS	12.42	GM/SEC	EQUAL TO	98.39	LB/HR
HBr UNCONTROLLED EMISSION RATE IS	.00	GM/SEC	EQUAL TO	.00	LB/HR

WITH ACID GAS CONTROL AT .0 PERCENT,

SO2 CONTROLLED EMISSION RATE IS	6.05	GM/SEC	EQUAL TO	47.89 LB/HR
HCl CONTROLLED EMISSION RATE IS	12.42	GM/SEC	EQUAL TO	98.39 LB/HR
HBr CONTROLLED EMISSION RATE IS	.00	GM/SEC	EQUAL TO	.00 LB/HR

	PERCENT SO2 TO SO3	DEWPOINT DEG. F	EQUIVALENT SO3 ppmw	ppmd
SULFURIC ACID	1	242.66	1.	1.
DEWPOINT FROM	3	260.90	4.	4.
OXIDATION OF	5	269.71	6.	7.
SO2 TO SO3	8	278.00	9.	10.
AT THIS LOCATION	10	282.01	12.	13.
IN THE SYSTEM	15	289.40	18.	20.

EQUILIBRIUM SO3 (USUALLY NOT ATTAINED) AT 2162.0 DEG. F
EQUILIBRIUM CONSTANT FOR SO2+0.5O2-->SO3 IS: .055
EQUILIBRIUM SO3 IS THEN: 35. ppm (wet basis)

SUMMARY OF BOILER OPERATION CALCULATIONS

BOILER STEAM PRODUCTION 84191.4 LB/HR
PRESSURE 1000.0 PSIA
TEMPERATURE 900.0 DEG. F

FEEDWATER TEMPERATURE:	400.0	DEG. F
FEEDWATER ENTHALPY:	374.8	BTU/LB
PRODUCT STEAM ENTHALPY:	1448.2	BTU/LB
ENTHALPY CHANGE:	1073.4	BTU/LB

NOTE: THE PERCENT OXIDATION OF FLUE GAS SO2 AT WHICH THE SULFURIC ACID DEWPOINT EQUALS THE FEEDWATER TEMPERATURE IS: 100.00 PERCENT.

PRODUCT STEAM USE TO HEAT CONDENSATE RETURN
FROM 300. DEG. F TO FEEDWATER TEMPERATURE IS: 7133.9 LB/HR

NET STEAM PRODUCTION AFTER FEEDWATER HEATING IS: 77057.5 LB/HR

NOTE!! - IF ACTUAL CONDENSATE RETURN IS ALREADY AT FEEDWATER TEMPERATURE, ADD BACK THE FEEDWATER HEATING STEAM USE TO THE NET STEAMING RATE!!

SATURATION TEMPERATURE AT PRODUCT STEAM PRESSURE: 544.6 DEG. F

THE STEAM CARRIES: 355.4 DEG. F OF SUPERHEAT

FLUE GAS TEMPERATURE AT BOILER EXIT 450. DEG. F

RADIATION LOSS 688065. BTU/HR OR .63 % OF SENSIBLE HEAT AT BOILER INLET

WITH REFERENCE TO TOTAL ENTHALPY INPUT TO THE COMBUSTION SYSTEM,
THE BOILER EFFICIENCY IS: 73.71 PERCENT

WITH REFERENCE TO FEED HHV ENTHALPY INPUT TO THE COMBUSTION SYSTEM,
THE BOILER EFFICIENCY IS: 75.14 PERCENT

MEAN MOLECULAR WEIGHT OF GASES

(DRY BASIS)	30.03
(WET BASIS)	28.85

TOTAL GAS FLOW RATE	LB/MIN	LB/HR	ACFM
(DRY BASIS)	2854.56	171273.70	--
(WET BASIS)	3041.86	182511.80	70042.2

EFFLUENT GAS HUMIDITY .0656 (MASS H2O/MASS BONE DRY GAS)

GAS DEW POINT IS 114.4 DEG. F

SUMMARY OF DRY SCRUBBER OPERATIONS

DRY SCRUBBER EXIT TEMPERATURE 290.0 DEG. F

DRY SCRUBBER OPERATIONS SUMMARY

CONTROL EFFICIENCY: 99.50 PERCENT HCl + HBr REMOVAL
95.00 PERCENT SO2 REMOVAL

LIME ASSAY: 90.00 PERCENT ACTIVE CaO
SLURRY FEED STOICHIOMETRY: 250.00 PERCENT OF HCl,HBr +SO2
SLURRY FEED AT: 5.00 PERCENT SOLIDS

LIME FEED RATE AT: 327.00 LB/HR
SLURRY FEED RATE AT: 744.51 GAL/HR

GAS ANALYSIS AFTER DRY SCRB

COMPONENT	VOLUME % DRY BASIS	VOLUME % WET BASIS	MOLS PER MINUTE	LB/HR	
CO2	9.918	8.453	9.422	24878.7	
SO2	.6565E-03	.5596E-03	.6237E-03	2.4	6. PPMV - WET
N2	79.52	67.78	75.55	126988.8	
O2	10.56	8.999	10.03	19259.8	
HCl	.2370E-03	.2020E-03	.2251E-03	.5	2. PPMV - WET
HBr	.0000	.0000	.0000	.0	0. PPMV - WET
H2O		14.77	16.46	17781.6	
TOTAL	100.0	100.0	111.5	188911.8	

SUPPLEMENTAL WATER USE .63 GAL/MIN

	PERCENT SO2 TO SO3	DEWPOINT DEG. F	EQUIVALENT SO3 ppmw	EQUIVALENT SO3 ppmd
SULFURIC ACID	1	205.54	0.	0.
DEWPOINT FROM	3	221.17	0.	0.
OXIDATION OF	5	228.69	0.	0.
SO2 TO SO3	8	235.76	0.	1.

AT THIS LOCATION	10	239.16	1.	1.
IN THE SYSTEM	15	245.44	1.	1.

EQUILIBRIUM SO3 (USUALLY NOT ATTAINED) AT 2162.0 DEG. F
EQUILIBRIUM CONSTANT FOR SO2+0.5O2-->SO3 IS: .055
EQUILIBRIUM SO3 IS THEN: 2. ppm (wet basis)

SUMMARY OF STACK REHEATING OPERATION
====================================
TARGET STACK TEMPERATURE IS: .0 DEG. F

NO STACK REHEAT ANALYSIS REQUESTED.

SUMMARY OF STACK CALCULATIONS AFTER SYSTEM

STACK DIAMETER OF 5.36 FEET USED FOR CALCULATIONS

NATURAL DRAFT 6.625E-01 IN H2O
FRICTION LOSS 6.456E-01 IN H2O
VELOCITY HEAD 3.245E-02 IN H2O
MINIMUM FAN PRESSURE 1.550E-02 IN H2O
EXIT VELOCITY 45.0 FT/SEC

TOTAL FLOW @ STACK CONDITIONS 60894.2 CFM
STACK TEMPERATURE IS: 289.1 DEG. F

FLOW CORRECTED TO 12% CO2 (DRY, 1 ATM, 68 F/20 C)) 30248.2 CFM
FLOW CORRECTED TO 7% O2 (DRY, 1 ATM, 68 F/20 C)) 27289.8 CFM

MEAN MOLECULAR WEIGHT OF GASES
(DRY BASIS) 30.02
(WET BASIS) 28.25

TOTAL GAS FLOW RATE	LB/MIN	LB/HR	ACFM
(DRY BASIS)	2852.17	171130.20	--
(WET BASIS)	3148.79	188927.60	61013.1

EFFLUENT GAS HUMIDITY .1040 (MASS H20/MASS BONE DRY GAS)

GAS DEW POINT IS 129.1 DEG. F

SUMMARY OF STACK VISIBILITY ANALYSIS
====================================

THIS ANALYSIS DETERMINES THE DISTANCE ABOVE THE STACK TOP WHERE THE PLUME (AFTER REHEAT) JUST VANISHES. FOR FINITE WINDSPEED, THERE WILL BE A HORIZONTAL DISPLACEMENT. ALSO, THE STACK REHEAT VIA USE OF AVAILABLE PREHEATED AIR, FUEL AND STEAM WHICH JUST RENDERS THE PLUME NON-VISIBLE ARE CALCULATED (STARTING AFTER ANY PROGRAMMED REHEAT).

THE FLUE GAS TEMPERATURE IS HIGH ENOUGH AND/OR THE HUMIDITY LOW ENOUGH THAT THE PLUME-AMBIENT INTERACTION SHOULD NOT PRODUCE A VISIBLE PLUME. VISIBILITY ANALYSIS DISCONTINUED.

CALCULATIONS COMPLETE

Nominal Case

BURN - Version 4.01 COMBUSTION ANALYSIS: RUN ___ FOR Tampa ___/___/___

Future
100% MCR
5,000 Btu/lb

DATA FILE USED FOR THIS ANALYSIS: T232.IN

WASTE FEED STREAMS

PERCENT (DRY BASIS)

NAME	WEIGHT FIRED in Wet LB/Hr	Carbon	Hydrogen	Sulfur	Fe(OH)3	Al(OH)3	Oxygen
WASTE	20833.0	35.939	4.792	.126	00.000	00.000	31.653
COMPOSITE (LB)	20833.	5933.67	791.17	20.83	.00	.00	5225.88
COMPOSITE MOLS	0.	494.06	392.44	.65	.00	.00	163.31
COMPOSITE (% DRY BASIS)		35.94	4.79	.13	.00	.00	31.65

PERCENT (DRY BASIS)

	Nitrogen	Chlorine	CaCO3	Inert	Iron	Aluminum	Bromine	Pct.H2O	BTU/LB
# 1	.631	.504	00.000	26.356	00.000	00.000	00.000	20.750	6309.6
(LB)	104.11	83.29	.00	4351.35	.00	.00	.00	4322.85	5000.4
MOLS	3.72	2.35	.00	4351.35	.00	.00	.00	240.16	
% DRY	.63	.50	.00	26.36	.00	.00	.00		

	DRY BASIS	WET BASIS
THE MODIFIED DULONG HEATING VALUE IS:	6294.1 BTU/LB	4988.1 BTU/LB
THE MODIFIED CHANG HEATING VALUE IS:	6392.9 BTU/LB	5066.4 BTU/LB
THE BOIE HEATING VALUE IS:	6309.6 BTU/LB	5000.4 BTU/LB
THE MODIFIED VONDRACEK HEATING VALUE IS:	4600.2 BTU/LB	3645.7 BTU/LB
THE AVERAGE ESTIMATED HEATING VALUE IS:	5899.2 BTU/LB	4675.1 BTU/LB
THE INPUT WASTE HEATING VALUE IS:	6309.6 BTU/LB	5000.4 BTU/LB

DAILY CHARGE RATE EQUALS: 250.0 TONS PER 24-HOUR DAY.

RUN CONDITIONS AS INPUT

AMBIENT AIR: 73.0 DEG. F ; PRESSURE 1.0 ATM; ABSOLUTE HUMIDITY .013000
AMBIENT AIR HAS A RELATIVE HUMIDITY OF: 74.5 PERCENT
AVAILABLE PREHEATED AIR .0 ACTUAL CFM AT 73.0 DEG. F
OPERATING TEMPERATURES: MINIMUM OF .0, MAXIMUM OF 50000.0 DEG. F
FURNACE WATER COOLED, 100.00 % OF AREA; BOILER WATER COOLED, 100.00 % OF AREA
TEMPERATURES MODERATED WITH AIR AND ELEVATED WITH GAS
STEAM CONDITIONS: PRESSURE - 1000. PSIA ; TEMPERATURE - 900. DEG. F
TEMPERATURE (DEG. F): PROCESS WATER 60. FEEDWATER 400.
FLUE GASES LEAVE THE BOILER AT: 450.0 DEG. F , QUENCHER AT 290.0 DEG. F
FLUE GASES LEAVE THE SUBCOOLER AT: .0 DEG. F
MAXIMUM SUBCOOLER WATER DISCHARGE TEMPERATURE IS: 95.0 DEG. F
STACK DIAM. IS 1.2 F, HEIGHT 160.0 F, VELOCITY = 45.0 FT/SEC
0. BTU/HR IS ABSORBED IN THE PRIMARY COMBUSTION CHAMBER
RESIDUE IS WATER QUENCHED AND LEAVES SYSTEM AT 350.0 DEG. F
UNBURNED PERCENTAGES OF FEED - CARBON .5, IRON 00.0, ALUMINUM 00.0
AFTERBURNER TEMPERATURE: .0 DEG. F ;OPERATING FACTOR: 100.00 % OF DESIGN
ATMOSPHERIC STABILITY CLASS IS: 0; DESIGN % EXCESS AIR IS: 100.0

NOTE: GAS FLOW RATES EXPRESSED IN SCFM ARE AT 60 Deg. F AND 1.0 Atm.

SUMMARY OF FURNACE OPERATIONS

Furnace Flue Gas Sensible Heat Content (SENH) as a Function of Tgas

SENH = A + B*T + C*T*T + D*T*T*T

A = -.2427097E+07 C = .3771068E+01
B = .4022654E+05 D = -.3324059E-03

At Tgas = 2014.76 DEG. F , SENH = .9120874E+08 BTU/HR

GAS ANALYSIS AFTER FURNACE

COMPONENT	VOLUME % DRY BASIS	VOLUME % WET BASIS	MOLS PER MINUTE	LB/HR	
CO2	9.912	8.632	8.193	21634.9	
SO2	.1312E-01	.1143E-01	.1085E-01	41.7	114. PPMV - WET
N2	79.47	69.21	65.70	110431.3	
O2	10.55	9.190	8.723	16748.6	
HCl	.4736E-01	.4125E-01	.3915E-01	85.7	412. PPMV - WET
HBr	.0000	.0000	.0000	.0	0. PPMV - WET
H2O		12.91	12.25	13234.4	
TOTAL	100.0	100.0	94.92	162176.4	

	PERCENT SO2 TO SO3	DEWPOINT DEG. F	EQUIVALENT SO3 ppmw	EQUIVALENT SO3 ppmd
SULFURIC ACID	1	247.54	1.	1.
DEWPOINT FROM	3	265.50	3.	4.
OXIDATION OF	5	274.17	6.	7.
SO2 TO SO3	8	282.33	9.	10.
AT THIS LOCATION	10	286.27	11.	13.
IN THE SYSTEM	15	293.53	17.	20.

EQUILIBRIUM SO3 (USUALLY NOT ATTAINED) AT 2014.8 DEG. F
EQUILIBRIUM CONSTANT FOR SO2+0.5O2-->SO3 IS: .087
EQUILIBRIUM SO3 IS THEN: 43. ppm (wet basis)

PREHEATED AIR	.00	ACFM	(ENTHALPY:	0. BTU/HR)
	.00	SCFM	.00	LB/HR
COMBUSTION AIR	32962.33	ACFM		
	32157.87	SCFM	145596.70	LB/HR
BURNER AIR	.00	ACFM		
	.00	SCFM	.00	LB/HR
COOLING AIR	.00	ACFM		
	.00	SCFM	.00	LB/HR
COOLING WATER	.00	GAL/MIN	.00	LB/HR

WITHOUT COOLING OR FUEL USE BUT USING 0. ACFM OF PREHEATED AIR, THE FURNACE TEMPERATURE IS: 2015. DEG. F ; A TEMPERATURE OF 1908. DEG. F WAS USED TO JUDGE POTENTIAL DISSOCIATION OF CaCO3, Fe(OH)3, AND Al(OH)3.

FLUE GAS	171369.50	ACFM	AT	2014.8	DEG. F
	35990.40	SCFM	AT	60.0	DEG. F

BURNER FUEL USE .00 CFM (.00 FT3/HR) GAS
EQUAL TO .0 BTU/HR

QUENCH TANK MAKEUP 2.92 GAL/MIN

RESIDUE ASSUMED TO LEAVE HOT ZONE AT 350.0 DEG. F
RESIDUE WEIGHT (75.00 % SOLIDS) 5841.36 LB/HR
(DRY) 4381.02 LB/HR

UNBURNED CARBON IN ASH: .677 PERCENT OF TOTAL ASH (INCLUDING CARBON)
HEATING VALUE OF RESIDUE (DRY BASIS): 95.5 BTU/LB OR 418206. BTU/HR

NET HEAT RELEASE (BTU/HR)

1. PRIMARY	
FEED	103754300.
FUEL	0.
AIR HEAT	2436376.
TOTAL	106190600.
2. AFTERBURNER	
FUEL	0.
AIR HEAT	0.
GRAND TOTAL	106190600.

HEAT LOSSES	BTU/HR	PERCENT OF FEED HEAT CONTENT	PERCENT OF TOTAL HEAT RELEASE
RADIATION	698230.	.67 PERCENT	.7 PERCENT
MOISTURE	14039610.	13.48 PERCENT	13.2 PERCENT
DRY GAS	91208740.	87.56 PERCENT	85.6 PERCENT
RESIDUE	773339.	.74 PERCENT	.7 PERCENT

DESIGN EXCESS AIR (ON FEED) IS 100.00 PERCENT
ACTUAL EXCESS AIR (ON FEED) IS 100.01 PERCENT
ACTUAL EXCESS AIR (ON TOTAL COMBUSTIBLE) IS , 100.01 PERCENT

EQUILIBRIUM THERMAL NOX CONCENTRATION IS 416.9 PPM (VOLUME)
PERCENT FUEL NITROGEN CONVERTED TO NOx= 69.755 PERCENT
FUEL NITROGEN NOx (Estimated by Soete) = 910.365 PPM (VOLUME)

THE EQUILIBRIUM CONSTANT FOR 2HCl+.5O2-->Cl2+H2O IS: .0560
THE EQUILIBRIUM CONSTANT FOR 2HBr+.5O2-->Br2+H2O IS: .0051

EQUILIBRIUM CHLORINE CONCENTRATION AT 2014.8 DEG. F IS:
.512 ppm (Wet Basis)
.587 ppm (Dry Basis)

SO2 UNCONTROLLED EMISSION RATE IS	5.26	GM/SEC EQUAL TO	41.65	LB/HR
HCl UNCONTROLLED EMISSION RATE IS	10.80	GM/SEC EQUAL TO	85.56	LB/HR
HBr UNCONTROLLED EMISSION RATE IS	.00	GM/SEC EQUAL TO	.00	LB/HR

WITH ACID GAS CONTROL AT .0 PERCENT,

SO2 CONTROLLED EMISSION RATE IS	5.26	GM/SEC	EQUAL TO	41.65 LB/HR
HCl CONTROLLED EMISSION RATE IS	10.80	GM/SEC	EQUAL TO	85.56 LB/HR
HBr CONTROLLED EMISSION RATE IS	.00	GM/SEC	EQUAL TO	.00 LB/HR

	PERCENT SO2 TO SO3	DEWPOINT DEG. F	EQUIVALENT SO3 ppmw	EQUIVALENT SO3 ppmd
SULFURIC ACID	1	247.54	1.	1.
DEWPOINT FROM	3	265.50	3.	4.
OXIDATION OF	5	274.17	6.	7.
SO2 TO SO3	8	282.33	9.	10.
AT THIS LOCATION	10	286.27	11.	13.
IN THE SYSTEM	15	293.53	17.	20.

EQUILIBRIUM SO3 (USUALLY NOT ATTAINED) AT 2014.8 DEG. F
EQUILIBRIUM CONSTANT FOR SO2+0.5O2-->SO3 IS: .087
EQUILIBRIUM SO3 IS THEN: 43. ppm (wet basis)

SUMMARY OF BOILER OPERATION CALCULATIONS

BOILER STEAM PRODUCTION 69047.4 LB/HR
PRESSURE 1000.0 PSIA
TEMPERATURE 900.0 DEG. F

FEEDWATER TEMPERATURE:	400.0	DEG. F
FEEDWATER ENTHALPY:	374.8	BTU/LB
PRODUCT STEAM ENTHALPY:	1448.2	BTU/LB
ENTHALPY CHANGE:	1073.4	BTU/LB

NOTE: THE PERCENT OXIDATION OF FLUE GAS SO2 AT WHICH THE SULFURIC ACID DEWPOINT EQUALS THE FEEDWATER TEMPERATURE IS: 100.00 PERCENT.

PRODUCT STEAM USE TO HEAT CONDENSATE RETURN
FROM 300. DEG. F TO FEEDWATER TEMPERATURE IS: 5850.7 LB/HR

NET STEAM PRODUCTION AFTER FEEDWATER HEATING IS: 63196.7 LB/HR

NOTE!! - IF ACTUAL CONDENSATE RETURN IS ALREADY AT FEEDWATER TEMPERATURE, ADD BACK THE FEEDWATER HEATING STEAM USE TO THE NET STEAMING RATE!!

SATURATION TEMPERATURE AT PRODUCT STEAM PRESSURE: 544.6 DEG. F

THE STEAM CARRIES: 355.4 DEG. F OF SUPERHEAT

FLUE GAS TEMPERATURE AT BOILER EXIT 450. DEG. F

RADIATION LOSS 688090. BTU/HR OR .75 % OF SENSIBLE HEAT AT BOILER INLET

WITH REFERENCE TO TOTAL ENTHALPY INPUT TO THE COMBUSTION SYSTEM,
THE BOILER EFFICIENCY IS: 69.52 PERCENT

WITH REFERENCE TO FEED HHV ENTHALPY INPUT TO THE COMBUSTION SYSTEM, THE BOILER EFFICIENCY IS: 70.86 PERCENT

MEAN MOLECULAR WEIGHT OF GASES
(DRY BASIS) 30.03
(WET BASIS) 28.48

TOTAL GAS FLOW RATE	LB/MIN	LB/HR	ACFM
(DRY BASIS)	2482.37	148942.00	--
(WET BASIS)	2703.14	162188.20	63043.9

EFFLUENT GAS HUMIDITY .0889 (MASS H20/MASS BONE DRY GAS)

GAS DEW POINT IS 124.1 DEG. F

SUMMARY OF DRY SCRUBBER OPERATIONS

DRY SCRUBBER EXIT TEMPERATURE 290.0 DEG. F

DRY SCRUBBER OPERATIONS SUMMARY

CONTROL EFFICIENCY: 99.50 PERCENT HCl + HBr REMOVAL
95.00 PERCENT SO2 REMOVAL

LIME ASSAY: 90.00 PERCENT ACTIVE CaO
SLURRY FEED STOICHIOMETRY: 250.00 PERCENT OF HCl,HBr +SO2
SLURRY FEED AT: 5.00 PERCENT SOLIDS

LIME FEED RATE AT: 284.36 LB/HR
SLURRY FEED RATE AT: 647.44 GAL/HR

GAS ANALYSIS AFTER DRY SCRB

COMPONENT	VOLUME % DRY BASIS	VOLUME % WET BASIS	MOLS PER MINUTE	LB/HR	
CO2	9.918	8.165	8.193	21634.9	
SO2	.6565E-03	.5405E-03	.5424E-03	2.1	5. PPMV - WET
N2	79.52	65.47	65.70	110431.3	
O2	10.56	8.693	8.723	16748.6	
HCl	.2370E-03	.1951E-03	.1958E-03	.4	2. PPMV - WET
HBr	.0000	.0000	.0000	.0	0. PPMV - WET
H2O		17.67	17.74	19154.2	
TOTAL	100.0	100.0	100.3	167971.4	

SUPPLEMENTAL WATER USE .99 GAL/MIN

	PERCENT SO2 TO SO3	DEWPOINT DEG. F	EQUIVALENT SO3 ppmw	EQUIVALENT SO3 ppmd
SULFURIC ACID	1	209.14	0.	0.
DEWPOINT FROM	3	224.62	0.	0.
OXIDATION OF	5	232.07	0.	0.
SO2 TO SO3	8	239.07	0.	1.

AT THIS LOCATION	10	242.44	1.	1.
IN THE SYSTEM	15	248.65	1.	1.

EQUILIBRIUM SO3 (USUALLY NOT ATTAINED) AT 2014.8 DEG. F
EQUILIBRIUM CONSTANT FOR SO2+0.5O2-->SO3 IS: .087
EQUILIBRIUM SO3 IS THEN: 2. ppm (wet basis)

SUMMARY OF STACK REHEATING OPERATION
=====================================
TARGET STACK TEMPERATURE IS: .0 DEG. F

NO STACK REHEAT ANALYSIS REQUESTED.

SUMMARY OF STACK CALCULATIONS AFTER SYSTEM

STACK DIAMETER OF 5.09 FEET USED FOR CALCULATIONS

NATURAL DRAFT 6.625E-01 IN H2O
FRICTION LOSS 6.804E-01 IN H2O
VELOCITY HEAD 3.245E-02 IN H2O
MINIMUM FAN PRESSURE 5.031E-02 IN H2O
EXIT VELOCITY 45.0 FT/SEC

TOTAL FLOW @ STACK CONDITIONS 54821.6 CFM
STACK TEMPERATURE IS: 289.1 DEG. F

FLOW CORRECTED TO 12% CO2 (DRY, 1 ATM, 68 F/20 C)) 26304.2 CFM
FLOW CORRECTED TO 7% O2 (DRY, 1 ATM, 68 F/20 C)) 23732.5 CFM

MEAN MOLECULAR WEIGHT OF GASES
(DRY BASIS) 30.02
(WET BASIS) 27.90

TOTAL GAS FLOW RATE	LB/MIN	LB/HR	ACFM
(DRY BASIS)	2480.29	148817.20	--
(WET BASIS)	2799.81	167988.40	54928.7

EFFLUENT GAS HUMIDITY .1288 (MASS H20/MASS BONE DRY GAS)

GAS DEW POINT IS 135.9 DEG. F

SUMMARY OF STACK VISIBILITY ANALYSIS
=====================================

THIS ANALYSIS DETERMINES THE DISTANCE ABOVE THE STACK TOP WHERE THE PLUME (AFTER REHEAT) JUST VANISHES. FOR FINITE WINDSPEED, THERE WILL BE A HORIZONTAL DISPLACEMENT. ALSO, THE STACK REHEAT VIA USE OF AVAILABLE PREHEATED AIR, FUEL AND STEAM WHICH JUST RENDERS THE PLUME NON-VISIBLE ARE CALCULATED (STARTING AFTER ANY PROGRAMMED REHEAT).

THE FLUE GAS TEMPERATURE IS HIGH ENOUGH AND/OR THE HUMIDITY LOW ENOUGH THAT THE PLUME-AMBIENT INTERACTION SHOULD NOT PRODUCE A VISIBLE PLUME. VISIBILITY ANALYSIS DISCONTINUED.

CALCULATIONS COMPLETE

Appendix D
Tampa International Airport
Wind Roses

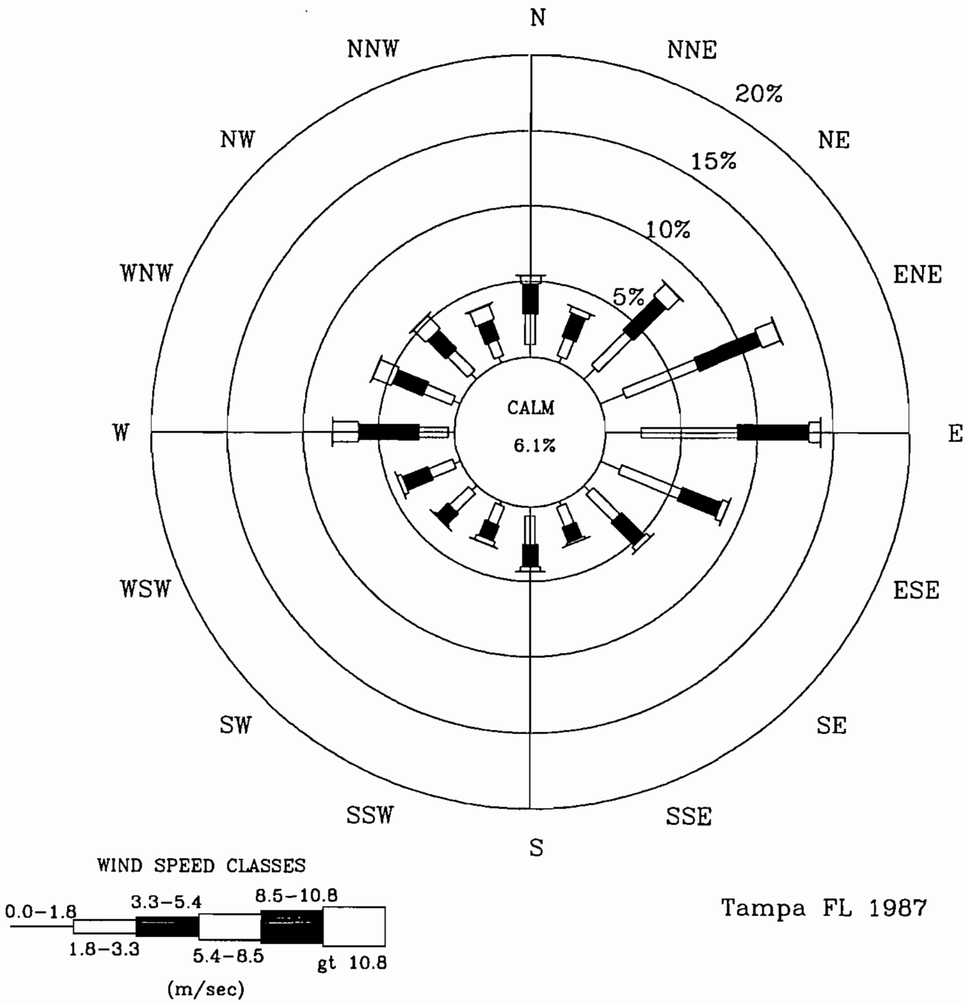


Figure 1. 1987 Windrose for Tampa International Airport, Florida.

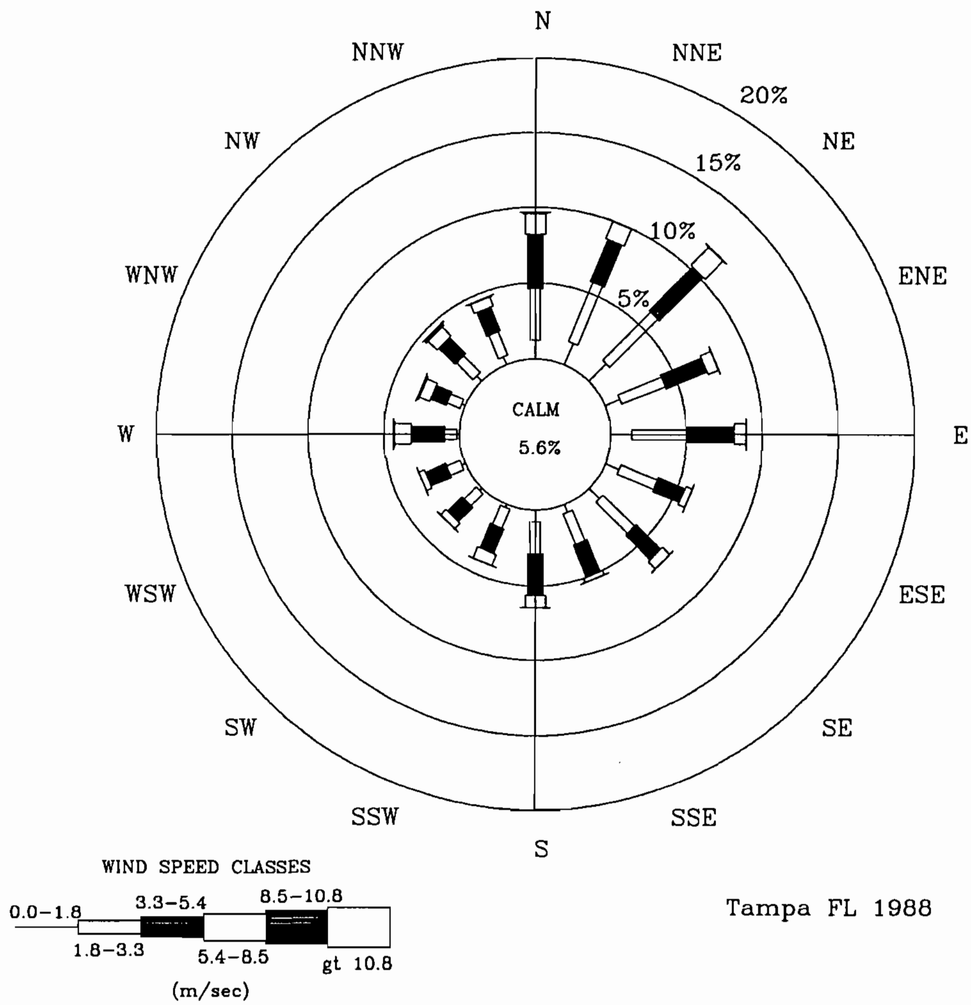


Figure 2. 1988 Windrose for Tampa International Airport, Florida.

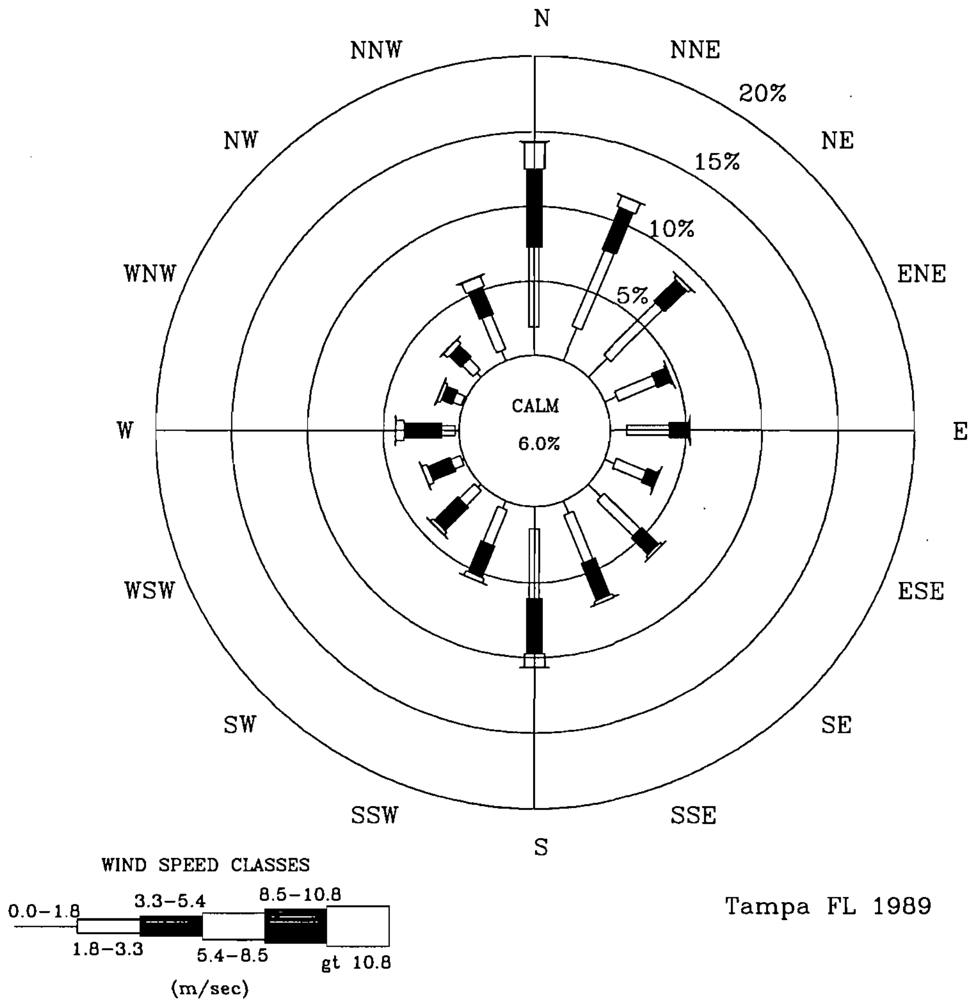


Figure 3. 1989 Windrose for Tampa International Airport, Florida.

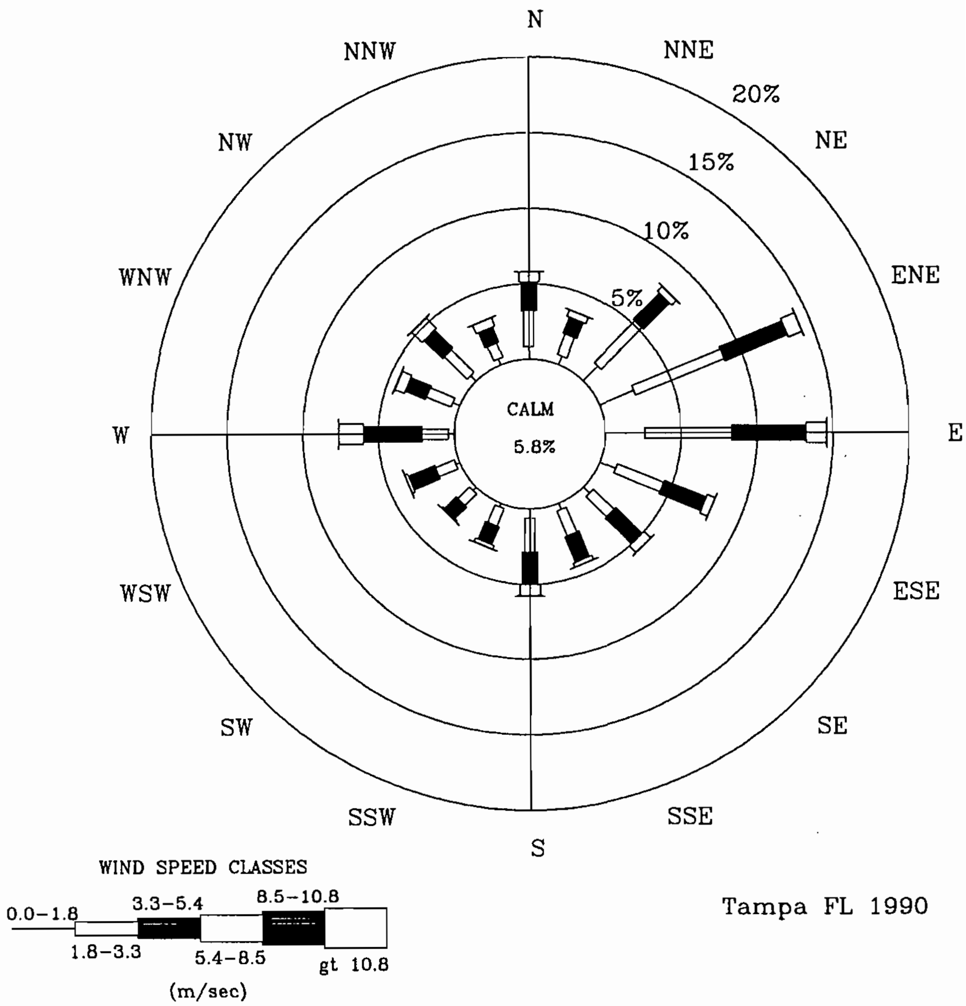


Figure 4. 1990 Windrose for Tampa International Airport, Florida.

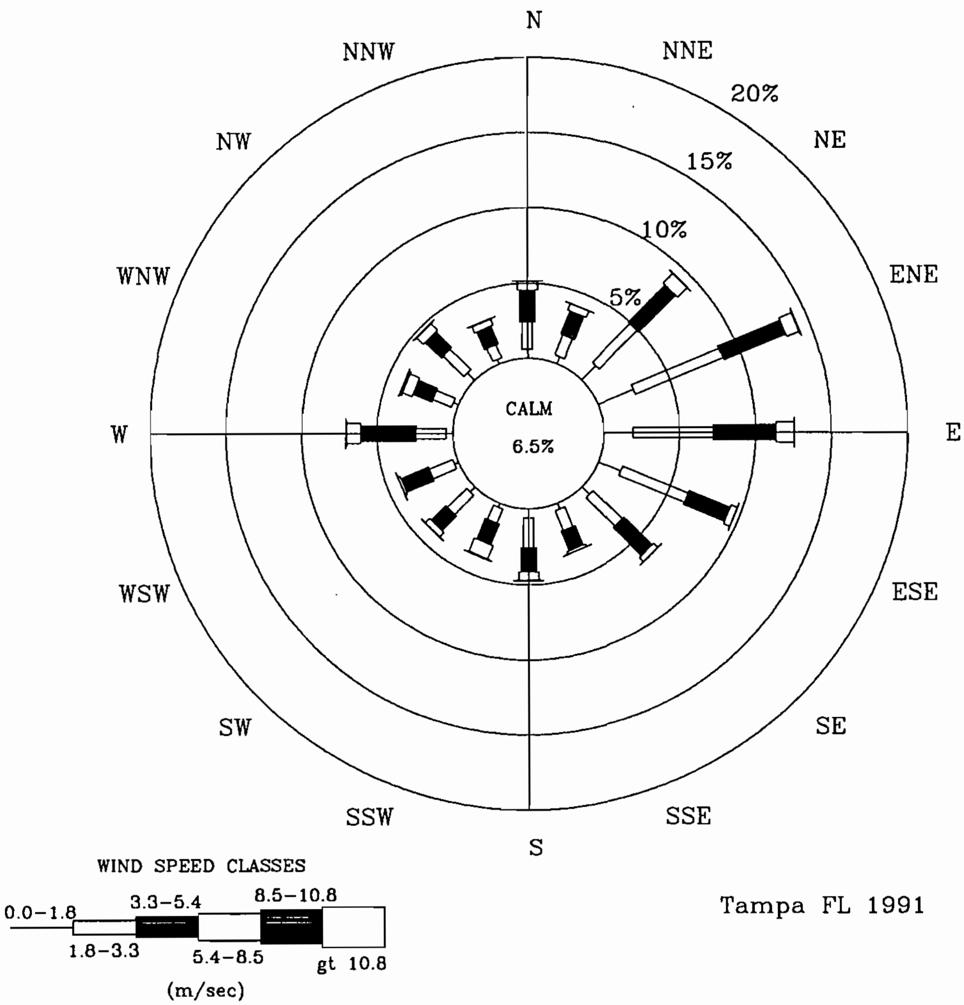


Figure 5. 1991 Windrose for Tampa International Airport, Florida.

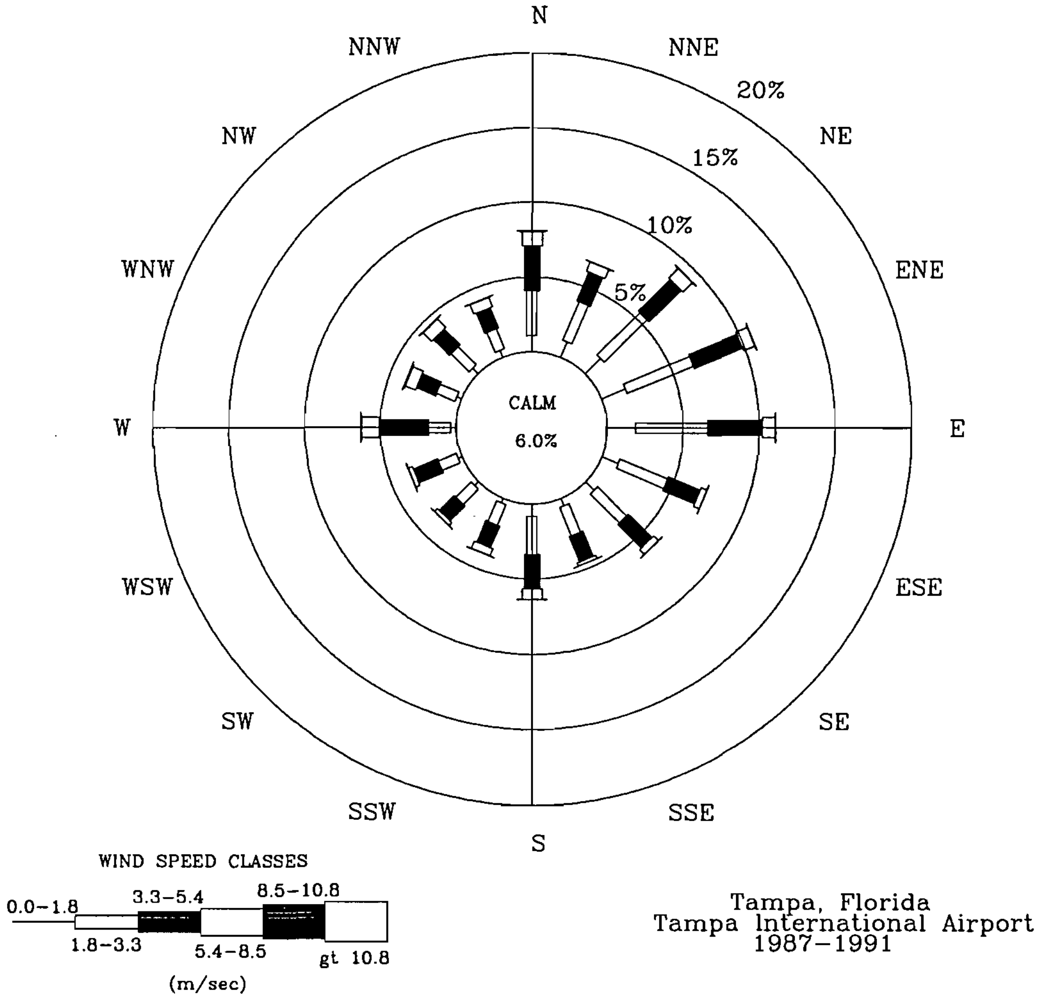


Figure 6. 1987-1991 Windrose for Tampa International Airport, Florida.

Appendix E
Stack Test Data
Summary Sheets

MCKAY BAY REFUSE-TO-ENERGY FACILITY
EMISSIONS SUMMARY

	Permit Limits	September 1985	October 1987
Particulate	27.9 lb/hr 0.025 gr/dscf at 12% CO_2	8.07 lb/hr 0.0088 gr/dscf at 12% CO_2	10.4 lb/hr 0.012 gr/dscf at 12% CO_2
SO_2	170.0 lb/hr	139.9 lb/hr	79.7 lb/hr
NO_x	300.0 lb/hr	94.8 lb/hr	135.8 lb/hr
Lead	3.1 lb/hr	0.4 lb/hr	0.3 lb/hr
Fluoride	6.0 lb/hr	2.3 lb/hr	
Mercury	0.6 lb/hr	0.36 lb/hr	
VOC	9.0 lb/hr	2.7 lb/hr	
Beryllium	0.00046 lb/hr	<0.00008 lb/hr	

	December 1988	October 1989	October 1990
Particulate	13.6 lb/hr 0.016 gr/dscf at 12% CO_2	9.4 lb/hr 0.009 gr/dscf at 12% CO_2	7.3 lb/hr 0.008 gr/dscf at 12% CO_2
SO_2	92.1 lb/hr	111.6 lb/hr	123.2 lb/hr
NO_x	173.2 lb/hr	230.7 lb/hr	169.2 lb/hr
Lead	0.3 lb/hr	0.3 lb/hr	0.13 lb/hr
Fluoride			
Mercury			
VOC			
Beryllium			

	August 1991	October 1991	November 1992
Particulate		10.8 lb/hr 0.014 gr/dscf at 12% CO^2	8.87 lb/hr 0.012 gr/dscf at 12% CO^2
SO^2		88.5 lb/hr	
NO^x		148.8 lb/hr	
Lead		0.32 lb/hr	.193 lb/hr
Fluroide	1.60 lb/hr		
Mercury	0.053 lb/hr		
VOC	1.21 lb/hr		
Beryllium	<0.000041 lb/hr		

g:emission.sum

	November 1993	October 1994	October 1995
Particulate	12.2 lb/hr 0.016 gr/dscf at 12% CO^2	11.9 lb/hr 0.0166 gr/dscf at 12% CO^2	18.5 lb/hr 0.0213 gr/dscf at 12% CO^2
SO^2			
NO^x			
Lead	0.24 lb/hr	0.325 lb/hr	0.366 lb/hr
Fluoride			
Mercury	0.079 lb/hr	0.093 lb/hr	0.059 lb/hr
VOC			
Beryllium			
Cadmium		0.0206 lb/hr	0/0216 lb/hr

g:em.sum
g:emission.sum

October 1996

Particulate	4.1 lb/hr 0.0048 gr/dscf at 12% CO^2
SO^2	
NO^x	
Lead	0.079 lb/hr
Fluoride	
Mercury	0.068 lb/hr
VOC	
Beryllium	

g:emission.sum

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Acceptance Test, 1985
Facility at max load.

Clean Air Engineering, Inc.

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LIST OF TABLES (Continued)

LIST OF FIGURES

Clean Air Engineering, Inc.

INTRODUCTION

This report presents the test data and results of the test program conducted by Clean Air Engineering, Inc. for Waste Management, Inc.

The testing took place at the McKay Bay Refuse-to-Energy Project located in Tampa, Florida.

The work is authorized by Waste Management, Inc.'s purchase order number 211076.

The purpose of the testing was to determine if each unit was in compliance with the applicable state and federal codes.

The field portion of the testing was coordinated among the following personnel:

Mr. W. Hooper	Waste Management, Inc.
Mr. M. Schioth	F.L. Smidth & Company
Mr. R. Nestechal	Volund, USA
Mr. C. Gonzalez	Hillsborough County Environmental Protection Commission
Mr. G. Grotecloss	Office of Environmental Coordination, City of Tampa, Florida
Mr. J. Chapman	Clean Air Engineering, Inc.

The tests were conducted during the week of September 16, 1985.

DESCRIPTION OF INSTALLATION AND PROCESS

The tests described in this report were conducted on the flue gases from four (4) refuse-fired boilers. The boilers are designated as Units 1 through 4 at the McKay Bay Refuse to Energy Project.

The particulate emissions of flyash are controlled by four (4) electrostatic precipitators.

Information concerning the operating conditions of the precipitators and boilers is held by plant personnel.

DISCUSSION OF RESULTS

The test conditions and results are presented in the Summary of Results Tables beginning on page 2 - 2. Additional results and test parameters are given in Section 5.

A complete copy of the raw test data and a computer analysis of that data showing the point by point isokinetic percentages are included in the appendix.

Emission Rates

The emission rate results can be summarized as follows:

1) The sulfur dioxide emission rate averaged 28.2, 33.3, 27.5, and 50.9 lb/hr for units 1 - 4 respectively.

2) The fluoride emission rate averaged 0.35, 0.41, 0.64, and 0.90 lb/hr for units 1 - 4 respectively.

3) The mercury emission rate averaged 0.07, 0.08, 0.10, and 0.11 lb/hr for units 1 - 4 respectively.

4) The lead emission rate averaged 0.10, 0.10, 0.09, and 0.11 lb/hr for units 1 - 4 respectively.

5) The beryllium emission rates were less than the detectable limits of the method used. This limit averaged less than 0.0013 lb/hr for each unit.

6) The carbon monoxide emission rates averaged 5.3, 6.1, 4.8, and 5.7 lb/hr for units 1 - 4 respectively.

7) The total hydrocarbon (propane basis) emission rates averaged 0.87, 0.37, 0.71, and 0.72 lb/hr for units 1 - 4 respectively.

8) The nitrogen oxide emission rates, averaged 11.1, 25.0, and 30.4 lb/hr for units 2 - 4 respectively. The results from unit 1 were inconclusive due to a problem with the samping apparatus.

DISCUSSION OF RESULTS (Continued)

Outlet Particulate Emission Rates

The outlet particulate concentration, in gr/dscf @ 12% CO_2, had a three test run average of 0.0153, 0.0218, 0.0028, and 0.0124 for units 1, 2, 3, and 4 respectively for testing performed September 16-18, 1985. During a second set of three test runs performed on September 19, 1985 the average particulate concentration, in gr/dscf @ 12% CO_2, was .0130, .0115, .0028, and .0077 for units 1-4 respectively.

Several problems were encountered during the testing progam some of which were resolved on site, some of which resulted in the elimination of incorrect data.

For the first set of runs (1-6) performed on September 16-18. 1985, a black tar like substance was observed on the glassware leading to the filter media. Attempts to locate the source of this substance indicated that it was a result of the glass tape used in the test probe construction. Due to the high flue gas temperature and negative pressure, the glass tape adhesive apparently volitalized and leaked through the asbestos packing into the gas sampling system. The problem was corrected prior to the testing on September 19, 1985. Therefore, the particulate results obtained during runs 1-6 may be biased high and the particulate result from the September 19 testing should be used.

DISCUSSION OF RESULTS (Continued)

Problems In The Field

Isolated conditions and other problems experienced in the field are summarized here according to unit number and test run affected.

Unit 2

- Run 1 failed its final leak check. However, the data was reported without correction since the $\%O_2$ and moisture indicate the leak developed when the sampling train was bumped after the completion of sampling.

- Runs 1-3 contained some flue gas temperatures that were outliers due to the cooling effect from outside air leaking past the test port seals and lowering the temperature reading. These temperatures were adjusted to meet the average of the majority of temperatures.

Unit 3

- Runs 4-6 exceeded the allowable isokinetic variance. This situation baises the particulate and fluoride concentration toward the low side but does not effect the sulfur dioxide results.

- Run 6 filter weight was lower after testing. Apparently some of of the filter was not recovered after the test. A zero weight gain was assumed for that test run.

Unit 4

- Runs 4-6 contained some flue gas temperatures that were outlyers due to the cooling effect from outside air leaking past the test port seals and lowering the temperature reading. These temperatures were adjusted to meet the average of the majority of temperatures.

- The results of run 5 are not reported because the final leak check failed.

To the best of our knowledge the enclosed data is representative and complete.

Respectfully submitted,

CLEAN AIR ENGINEERING, INC.

John A. Chapman
Vice President,
Research & Development

Daniel H. Pepoon
Manager,
Special Projects

JAC/DHP/cef
345101/84

TABLE I
SUMMARY OF RESULTS
UNIT #1 - OUTLET

Run No.	1	2	3
Date, 1985	September 16	September 17	September 17
Time (Approx.)	6:35 PM to 8:40 PM	11:20 AM to 1:30 PM	4:00 PM to 6:00 PM
Test Method	EPA M5	EPA M5	EPA M5
Gas Temperature, °F	570	564	560
Gas Moisture, Volume %	14.1	14.0	13.6
Gas Volume			
ACFM	97,990	86,970	91,220
DSCFM	43,260	38,720	40,850
Particulate			
GR/DSCF	.0084	.0177	.0042
GR/DSCF @ 12% CO_2	.0121	.0272	.0067
Sulfur Dioxide			
$LB\times10^{-5}$/DSCF	1.580	1.330	.3727
PPM, dry	95.1	80.0	22.4
LB/HR	41.0	34.5	9.13
Fluorides			
$LB\times10^{-7}$/DSCF	1.95	1.49	.749
LB/HR	.51	.35	.18

TABLE II
SUMMARY OF RESULTS
UNIT #2 - OUTLET

Run No.	1	2	3
Date, 1985	September 16	September 17	September 17
Time (Approx.)	6:35 PM to 9:00 PM	11:00 AM to 1:05 PM	4:00 PM to 6:00 PM
Test Method	EPA M5	EPA M5	EPA M5
Gas Temperature, °F	540	542	544
Gas Moisture, Volume %	16.0	14.8	12.0
Gas Volume			
ACFM	87,170	85,560	88,160
DSCFM	38,840	38,590	40,940
Particulate			
GR/DSCF	.0120	.0093	.0232
GR/DSCF @ 12% CO_2	.0187	.0123	.0340
Sulfur Dioxide			
$LB \times 10^{-5}$/DSCF	1.635	1.560	1.052
PPM, dry	98.3	93.9	63.3
LB/HR	38.1	36.1	25.8
Fluorides			
$LB \times 10^{-7}$/DSCF	1.02	2.03	2.11
LB/HR	.24	.47	.52

TABLE III
SUMMARY OF RESULTS
UNIT #3 - OUTLET

Run No.	4	5	6
Date, 1985	September 18	September 18	September 18
Time (Approx.)	11:35 AM to 1:20 PM	5:30 PM to 7:30 PM	8:25 PM to 10:30 PM
Test Method	EPA M5	EPA M5	EPA M5
Gas Temperature, °F	540	543	548
Gas Moisture, Volume %	15.8	15.4	14.9
Gas Volume			
ACFM	77,670	82,320	79,300
DSCFM	34,740	36,850	35,550
Particulate			
GR/DSCF	.0029	.0018	.0010
GR/DSCF @ 12% CO_2	.0042	.0027	.0014
Sulfur Dioxide			
LBx10-^{5}/DSCF	.9016	1.202	1.745
PPM, dry	54.2	72.3	105
LB/HR	18.8	26.6	37.2
Fluorides			
LBx10-^{7}/DSCF	2.27	4.07	2.61
LB/HR	.47	.90	.56

TABLE IV
SUMMARY OF RESULTS
UNIT #4 - OUTLET

Run No.	4	5	6
Date, 1985	September 18	September 18	September 18
Time (Approx.)	11:35 AM to 1:30 PM	4:30 PM to 6:30 PM	8:25 PM to 11:00 PM
Test Method	EPA M5	EPA M5	EPA M5
Gas Temperature, °F	535	522	533
Gas Moisture, Volume %	14.1	-----	15.2
Gas Volume			
ACFM	92,720	86,320	94,750
DSCFM	42,430	39,820	42,850
Particulate			
GR/DSCF	.0115	-----	.0040
GR/DSCF @ 12% CO_2	.0192	-----	.0055
Sulfur Dioxide			
LBx10-^{5}/DSCF	1.441	-----	2.528
PPM, dry	86.7	-----	152
LB/HR	36.7	-----	65.0
Fluorides			
LBx10-^{7}/DSCF	3.69	-----	3.32
LB/HR	.94	-----	.85

TABLE V
SUMMARY OF RESULTS
UNIT #1 - OUTLET

Run No.	7	8	9
Date, 1985	September 19	September 19	September 19
Time (Approx.)	1:20 PM to 3:20 PM	6:20 PM to 7:55 PM	9:30 PM to 11:05 PM
Test Method	EPA M5	EPA M5	EPA M5
Gas Temperature, °F	530	547	558
Gas Moisture, Volume %	11.8	10.6	15.1
Gas Volume			
ACFM	81,960	86,650	89,370
DSCFM	38,680	40,730	39,470
Particulate			
GR/DSCF	.0081	.0105	.0080
GR/DSCF @ 12% CO_2	.0152	.0134	.0103
Mercury			
LBx10^{-8}/DSCF	1.88	2.09	4.59
LB/HR	.044	.051	.109
Lead			
LBx10^{-8}/DSCF	5.33	3.53	3.70
LB/HR	.124	.086	.088
Beryllium			
LBx10^{-10}/DSCF	<5.38	<4.97	<4.69
LB/HR	<.0012	<.0012	<.0011

Mercury Avg: $\frac{8.56}{3}$ lbx10^{-8}/dscf × 35.31 cu ft/cu meter × 453.59 g/lb × 10^6 ug/g

$= \frac{1371}{3}$ ug/dscm

= 457 ug/dscm

TABLE VI
SUMMARY OF RESULTS
UNIT #2 - OUTLET

Run No.	7	8	9
Date, 1985	September 19	September 19	September 19
Time (Approx.)	1:30 PM to 3:05 PM	5:50 PM to 8:50 PM	9:15 PM to 10:50 PM
Test Method	EPA M5	EPA M5	EPA M5
Gas Temperature, °F	532	540	540
Gas Moisture, Volume %	14.5	12.9	13.1
Gas Volume			
ACFM	82,390	82,660	82,490
DSCFM	37,610	38,160	37,970
Particulate			
GR/DSCF	.0068	.0072	.0082
GR/DSCF @ 12% CO_2	.0117	.0123	.0107
Mercury			
LBx10^{-8}/DSCF	4.50	1.83	4.06
LB/HR	.102	.042	.092
Lead			
LBx10^{-8}/DSCF	4.34	3.98	4.63
LB/HR	.098	.091	.106
Beryllium			
LBx10^{-10}/DSCF	<5.49	<5.24	<5.20
LB/HR	<.0012	<.0012	<.0012

Mercury Avg = 3.46 $\frac{lb \times 10^{-8}}{dscf} \times 35.31 \frac{dscf}{dscm} \times 453.59 \frac{g}{lb} \times 10^6 \frac{\mu g}{g} = 554.7 \frac{\mu g}{dscm}$

TABLE VII
SUMMARY OF RESULTS
UNIT #3 - OUTLET

Run No.	7	8	9
Date, 1985	September 19	September 19	September 19
Time (Approx.)	12:20 PM to 1:50 PM	4:15 PM to 5:45 PM	8:00 PM to 9:25 PM
Test Method	EPA M5	EPA M5	EPA M5
Gas Temperature, °F	546	545	552
Gas Moisture, Volume %	16.9	17.3	14.2
Gas Volume			
ACFM	77,330	77,330	77,330
DSCFM	33,860	33,720	34,750
Particulate			
GR/DSCF	.0033	.0041	.0029
GR/DSCF @ 12% CO_2	.0040	.0049	.0036
Mercury			
$LBx10^{-8}$/DSCF	6.09	5.10	3.19
LB/HR	.124	.103	.067
Lead			
$LBx10^{-8}$/DSCF	4.42	4.41	4.79
LB/HR	.090	.089	.100
Beryllium			
$LBx10^{-10}$/DSCF	<6.22	<6.30	<6.14
LB/HR	<.0013	<.0013	<.0013

Mercury Avg = 4.79 $\frac{lb \times 10^{-8}}{dscf}$ × 35.31 dscf/dscm × 453.59 g/lb × 10^6 ug/g = 767.7 ug/dscm

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TABLE VIII
SUMMARY OF RESULTS
UNIT #4 - OUTLET

Run No.	7	8	9
Date, 1985	September 19	September 19	September 19
Time (Approx.)	12:05 PM to 1:45 PM	4:20 PM to 5:50 PM	7:55 PM to 9:25 PM
Test Method	EPA M5	EPA M5	EPA M5
Gas Temperature, °F	546	537	528
Gas Moisture, Volume %	13.0	14.9	11.6
Gas Volume			
ACFM	91,150	90,080	84,640
DSCFM	41,730	40,690	40,130
Particulate			
GR/DSCF	.0077	.0018	.0047
GR/DSCF @ 12% CO_2	.0116	.0024	.0094
Mercury			
$LBx10^{-8}$/DSCF	6.76	2.99	3.08
LB/HR	.169	.073	.074
Lead			
$LBx10^{-8}$/DSCF	4.70	4.68	4.35
LB/HR	.118	.114	.105
Beryllium			
$LBx10^{-10}$/DSCF	<5.28	<5.25	<5.50
LB/HR	<.0013	<.0013	<.0013

mercury avg = $4.28 \ lb \times 10^{-8}/dscf \times 35.31 \ dscf/dscm \times 453.59 \ g/lb \times 10^{6} \ \mu g/g = 685.0 \ \mu g/dscm$

TABLE IX
SUMMARY OF RESULTS
UNIT #1 - OUTLET

Run #	1	2	3
Date, 1985	September 16	Spetember 17	September 17
Time (Approx.)	6:35 PM to 7:40 PM	10:20 AM to 11:20 AM	11:50 AM to 12:50 PM
Test Method	EPA M10/25A	EPA M10/25A	EPA M10/25A
Gas Temperature, °F	570	564	564
Gas Moisture, Volume %	14.1	14.0	14.0
Gas Volume			
ACFM	97,990	86,970	86,970
DSCFM	43,260	38,720	38,720
Carbon Monoxide			
PPM, Dry	40	25	25
LB x 10^{-6}/DSCF	2.9	1.8	1.8
LB/HR	7.5	4.2	4.2
Total Hydrocarbons**			
PPM, Wet	5	1.5	1.5
LB x 10^{-6}/SCF	.57	.17	.17
LB/HR	1.7	.46	.46

**Propane Basis

TABLE X
SUMMARY OF RESULTS
UNIT #2 - OUTLET

Run #	1	2	3
Date, 1985	September 17	Spetember 17	September 17
Time (Approx.)	1:40 PM to 2:40 PM	3:30 PM to 4:30 PM	5:00 PM to 6:00 PM
Test Method	EPA M10/25A	EPA M10/25A	EPA M10/25A
Gas Temperature, °F	542	542	544
Gas Moisture, Volume %	14.8	13.4	12.0
Gas Volume			
ACFM	85,560	86,860	88,160
DSCFM	38,590	39,765	40,940
Carbon Monoxide			
PPM, Dry	40	30	35
LB x 10^{-6}/DSCF	2.9	2.2	2.5
LB/HR	6.7	5.2	6.3
Total Hydrocarbons**			
PPM, Wet	1.5	1.0	1.0
LB x 10^{-6}/SCF	.17	.11	.11
LB/HR	.47	.32	.32

**Propane Basis

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TABLE XI
SUMMARY OF RESULTS
UNIT #3 - OUTLET

Run #	1	2	3*
Date, 1985	September 18	Spetember 18	September 18
Time (Approx.)	10:25 AM to 11:25 AM	12:00 PM to 1:00 PM	1:25 PM to 2:50 PM
Test Method	EPA M10/25A	EPA M10/25A	EPA M10/25A
Gas Temperature, °F	540	540	540
Gas Moisture, Volume %	15.8	15.8	15.8
Gas Volume			
ACFM	77,570	77,570	77,570
DSCFM	34,740	34,740	34,740
Carbon Monoxide			
PPM, Dry	40	30	25
LB x 10^{-6}/DSCF	2.9	2.2	1.8
LB/HR	6.1	4.5	3.8
Total Hydrocarbons**			
PPM, Wet	2.5	1.5	3.5
LB x 10^{-6}/SCF	.29	.17	.40
LB/HR	.71	.42	.99

*Inclement weather disturbed test equipment extending test run.
**Propane Basis

Clean Air Engineering, Inc.

TABLE XII
SUMMARY OF RESULTS
UNIT #4 - OUTLET

Run #	1	2*	3
Date, 1985	September 18	Spetember 18	September 18
Time (Approx.)	6:20 PM to 7:20 PM	7:20 PM to 8:40 PM	8:40 PM to 9:40 PM
Test Method	EPA M10/25A	EPA M10/25A	EPA M10/25A
Gas Temperature, °F	522	528	533
Gas Moisture, Volume %	15.2	15.2	15.2
Gas Volume			
ACFM	86,320	90,535	94,750
DSCFM	39,820	41,335	42,850
Carbon Monoxide			
PPM, Dry	30	30	35
LB x 10^{-6}/DSCF	2.2	2.2	2.5
LB/HR	5.2	5.4	6.5
Total Hydrocarbons**			
PPM, Wet	1.5	3.0	2.0
LB x 10^{-6}/ SCF	.17	.34	.23
LB/HR	.48	1.00	.69

*Test equipment malfunction extending run.
**Propane Basis

TABLE XIII
SUMMARY OF RESULTS
NOx TESTING - UNIT #2
SEPTEMBER 17, 1985

Run #	Time	LBx10-^{5}/DSCF	Average LBx10-^{5}/DSCF	PPM Dry	Average PPM Dry	Avg. LB/HR
1A	1:46 PM	.4875		40.8		
B	1:58 PM	.7063		59.2		
C	2:10 PM	.5238		43.9		
D	2:22 PM	.0000*		.0*		
E	2:36 PM	.4258	.5359	35.7	44.9	12.8
2A	2:56 PM	.3744		31.4		
B	3:10 PM	.5801		48.6		
C	3:23 PM	.6492		54.4		
D	3:35 PM	.0000*		.0*		
E	3:49 PM	.2671	.4677	22.4	39.2	11.2
3A	4:06 PM	.2978		24.9		
B	4:18 PM	.4570		38.3		
C	4:20 PM	.3582		30.0		
D	4:45 PM	.4710		39.4		
E	4:57 PM	.3805	.3929	31.9	32.9	9.4

*Not included in average.

Note: 39,765 DSCFM used to calculate LB/HR.

TABLE XIV
SUMMARY OF RESULTS
NOx TESTING - UNIT #3
SEPTEMBER 18, 1985

Run #	Time	$LB \times 10^{-5}$/DSCF	Average $LB \times 10^{-5}$/DSCF	PPM Dry	Average PPM Dry	Avg. LB/HR
1A	10:51 AM	1.8554		155.4		
B	11:02 AM	1.4035		117.6		
C	11:17 AM	1.0743		90.0		
D	11:29 AM	1.3568	1.4225	113.6	119.1	29.7
2A	11:49 AM	1.8674		156.4		
B	12:04 PM	.8330		69.8		
C	12:18 PM	1.5338		128.5		
D	12:31 PM	1.5709		131.6		
E	12:45 PM	1.6999	1.5010	142.4	125.7	31.3
3A	1:50 PM	.8331		69.8		
B	2:04 PM	.2265		19.0		
C	2:19 PM	.9464		79.3		
D	2:35 PM	.6882	.6736	57.6	56.4	14.0

Note: 34,740 DSCFM used to calculate LB/HR.

TABLE XV
SUMMARY OF RESULTS
NOx TESTING - UNIT #4
SEPTEMBER 18, 1985

Run #	Time	$LBx10^{-5}$/DSCF	Average $LBx10^{-5}$/DSCF	PPM Dry	Average PPM Dry	Avg. LB/HR
1A	5:45 PM	1.8673		156.4		
B	5:57 PM	1.2384		103.7		
C	6:09 PM	.6011		50.3		
D	6:21 PM	1.0889		91.2		
E	6:33 PM	1.2191	1.2030	102.1	100.7	28.7
2A	6:45 PM	1.6099		134.8		
B	6:57 PM	1.3876		116.2		
C	7:09 PM	1.4937		125.1		
D	7:21 PM	1.5281		128.0		
E	7:33 PM	.9714	1.3981	81.4	117.1	33.4
3A	7:45 PM	1.0740		90.0		
B	7:57 PM	.9070		76.0		
C	8:09 PM	1.3785		115.5		
D	8:21 PM	1.4920	1.2129	125.0	101.6	29.0

Note: 39,820 DSCFM used to calculate LB/HR.

PARAMETER SHEET

UNIT #1 - OUTLET

RUN NO.	1	2	3
P_b	30.20	30.24	30.24
P_s	30.02	30.06	29.98
V_m	50.13	43.88	46.40
$\overline{DH}$	1.14	.920	1.000
$\overline{T_m}$	120	114	108
V_{mstd}	46.68	41.32	44.16
V_{lc}	163	143	148
V_{wstd}	7.68	6.74	6.97
B_{wo}	.1412	.1402	.1363
$\%O_2$	11.8	12.4	12.4
$\%CO_2$	8.3	7.8	7.5
M_d	29.80	29.74	29.70
M_s	28.13	28.10	28.10
C_p	.840	.840	.840
$\overline{T_s}$	570	564	560
$\overline{(DP)^{1/2}}$	.792	.705	.740
V_s	62.81	55.75	58.47
A_s	26	26	26
A_n	.000341	.000341	.000341
%I	98.0	96.9	98.2
Y_d	1.0110	1.0110	1.0110
θ	84.0	84.0	84.0
M_n	.0253	.0475	.0121
DH@	1.750	1.750	1.750

Clean Air Engineering, Inc.

SAMPLE CALCULATIONS - Unit #2 NOx Test Run 1A

13. Sample Volume, Standard Conditions, Dry Basis

Vsc = 17.64 (Vf - 25) [(Pf/Tf) - (Pi/Ti)]

= 17.64 (2084 - 25) [(29.50/460 + 76) - (2.34/460 + 94)]

= 1845.6

14. Total NO_2 Per Sample

NO_2 = 2 (Kc) (A) (Df)

= 2 (774.8) (.093) (1)

= 144.1

15. Sample Concentration, LB/DSCF

$$LB/DSCF = \frac{(6.243 \times 10\quad)(\quad NO_2)}{(Vsc)}$$

$$= \frac{(6.243 \times 10^{-5})(144.1)}{(1845.6)}$$

$= .4875 \times 10^{-5}$

16. Sample Concentration, PPM, Dry

PPM, Dry = (LB/DCSF) (8.376×10^{6})

$= (.4875 \times 10^{-5})(8.376 \times 10^{6})$

= 40.8

17. NOx Emission Rate, LB/HR

LB/HR = (LB/DSCF*) (Qstd) (60)

$= (.5359 \times 10^{-5})$ (39,765) (60)

= 12.8

*Average of 4 flasks.

PARAMETER SHEET

UNIT #2 - OUTLET

RUN NO.	1	2	3
P_b	30.20	30.24	30.24
P_s	30.05	30.06	30.02
V_m	41.33	42.29	53.88
$\overline{DH}$	.930	.930	1.07
$\overline{T_m}$	108	112	115
V_{mstd}	38.96	39.64	50.26
V_{lc}	157	146	145
V_{wstd}	7.39	6.88	6.83
B_{wo}	.1595	.1478	.1196
$\%O_2$	12.0	11.4	11.9
$\%CO_2$	7.7	8.8	8.2
M_d	29.71	29.86	29.79
M_s	27.84	28.11	28.38
C_p	.840	.840	.840
$\overline{T_s}$	540	542	544
$\overline{(DP)^{1/2}}$	.712	.701	.725
V_s	55.88	54.85	56.51
A_s	26	26	26
A_n	.000341	.000341	.000349
%I	91.1	93.3	108.9
Y_d	1.0029	1.0029	1.0029
Θ	84.0	84.0	84.0
M_n	.0303	.0238	.0756
DH@	1.920	1.920	1.920

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PARAMETER SHEET

UNIT #3 - OUTLET

RUN NO.	4	5	6
P_b	30.30	30.30	30.30
P_s	30.11	30.08	30.09
V_m	51.02	55.11	48.72
$\overline{DH}$	.820	.910	.860
$\overline{T_m}$	105	103	98
V_{mstd}	48.50	52.59	46.90
V_{lc}	193	203	174
V_{wstd}	9.09	9.56	8.20
B_{wo}	.1578	.1538	.1487
$\%O_2$	11.7	12.0	11.1
$\%CO_2$	8.3	8.0	8.8
M_d	29.80	29.76	29.85
M_s	27.93	27.95	28.09
C_p	.840	.840	.840
$\overline{T_s}$	540	543	548
$\overline{(DP)^{1/2}}$	.636	.673	.648
V_s	49.79	52.77	50.84
A_s	26	26	26
A_n	.000341	.000341	.000341
%I	126.8	129.6	119.8
Y_d	1.0029	1.0029	1.0029
θ	84.0	84.0	84.0
M_n	.0090	.0063	.0031
DH@	1.920	1.920	1.920

Clean Air Engineering, Inc.

PARAMETER SHEET

UNIT #4 - OUTLET

RUN NO.	4	5	6
P_b	30.30	30.30	30.30
P_s	30.04	30.08	30.01
V_m	46.43	1.96**	47.66
$\overline{DH}$	1.05	.930	1.10
$\overline{T_m}$	114	118	115
V_{mstd}	43.82	1.84	44.91
V_{lc}	152.4	88.0	170.5
V_{wstd}	7.18	4.14	8.03
B_{wo}	.1407	.6930	.1517
$\%O_2$	12.8	16.0	11.1
$\%CO_2$	7.2	4.0	8.8
M_d	29.66	29.28	29.85
M_s	28.02	21.46	28.05
C_p	.840	.840	.840
$\overline{T_s}$	535	522	533
$\overline{(DP)^{1/2}}$	.761	.714	.779
V_s	59.44	63.26	60.74
A_s	26	26	26
A_n	.000341	.000341	.000341
%I	93.8	10.2	95.2
Y_d	1.0110	1.0110	1.0110
Θ	84.0	84.0	84.0
M_n	.0327	.0384	.0116
DH@	1.750	1.750	1.750

** Corrected for final leak rate per EPA Method 5

Clean Air Engineering, Inc.

PARAMETER SHEET

UNIT #1 - OUTLET

RUN NO.	7	8	9
P_b	30.26	30.26	30.26
P_s	30.02	30.03	30.03
V_m	43.80	45.68	48.46
$\overline{DH}$	.850	.940	1.000
$\overline{T_m}$	113	92	92
V_{mstd}	40.94	44.33	47.03
V_{lc}	116	112	178
V_{wstd}	5.46	5.28	8.38
B_{wo}	.1177	.1063	.1513
$\%O_2$	13.6	10.6	10.7
$\%CO_2$	6.4	9.4	9.3
M_d	29.57	29.93	29.92
M_s	28.21	28.66	28.11
C_p	.840	.840	.840
$\overline{T_s}$	530	547	558
$\overline{(DP)^{1/2}}$	.677	.715	.727
V_s	52.54	55.54	57.29
A_s	26	26	26
A_n	.000341	.000341	.000341
$\%I$	96.1	98.8	108.2
Y_d	1.0013	1.0013	1.0013
Θ	84.0	84.0	84.0
M_n	.0215	.0303	.0244
DH@	1.834	1.834	1.834

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PARAMETER SHEET

UNIT #2 - OUTLET

RUN NO.	7	8	9
P_b	30.26	30.26	30.26
P_s	30.04	30.04	30.04
V_m	43.83	44.52	45.12
$\overline{DH}$	.830	.830	.840
$\overline{T_m}$	123	105	109
V_{mstd}	40.16	42.09	42.36
V_{lc}	145	132	136
V_{wstd}	6.83	6.22	6.41
B_{wo}	.1453	.1287	.1314
$\%O_2$	13.1	13.1	11.0
$\%CO_2$	7.0	7.0	9.2
M_d	29.64	29.64	29.91
M_s	27.95	28.15	28.35
C_p	.840	.840	.840
$\overline{T_s}$	532	540	540
$\overline{(DP)^{1/2}}$	.677	.678	.679
V_s	52.81	52.99	52.88
A_s	26	26	26
A_n	.000341	.000341	.000341
$\%I$	97.0	100.2	101.3
Y_d	.9987	.9987	.9987
θ	84.0	84.0	84.0
M_n	.0176	.0196	.0225
DN0	1.725	1.725	1.725

Clean Air Engineering, Inc.

PARAMETER SHEET

UNIT #3 - OUTLET

RUN NO.	7	8	9
P_b	30.26	30.26	30.26
P_s	30.05	30.05	30.04
V_m	37.75	36.70	37.32
$\overline{DH}$	.730	.730	.730
$\overline{T_m}$	111	102	97
V_{mstd}	35.45	35.02	35.93
V_{lc}	153	156	126
V_{wstd}	7.21	7.35	5.93
B_{wo}	.1689	.1734	.1418
$\%O_2$	9.8	9.8	10.4
$\%CO_2$	10.0	10.0	9.8
M_d	29.99	29.99	29.93
M_s	27.97	27.91	28.29
C_p	.840	.840	.840
$\overline{T_s}$	546	545	552
$\overline{(DP)^{½}}$	.631	.631	.633
V_s	49.57	49.57	49.57
A_s	26	26	26
A_n	.000341	.000341	.000341
$\%I$	95.1	94.3	93.9
Y_d	1.0029	1.0029	1.0029
Θ	84.0	84.0	84.0
M_n	.0076	.0092	.0068
DHO	1.920	1.920	1.420

Clean Air Engineering, Inc.

PARAMETER SHEET

UNIT #4 - OUTLET

RUN NO.	7	8	9
P_b	30.26	30.26	30.26
P_s	30.00	30.00	30.05
V_m	44.74**	44.29	41.88
$\overline{DH}$	1.01	1.000	.890
$\overline{T_m}$	120	111	105
V_{mstd}	41.73	41.96	40.08
V_{lc}	132	156	112
V_{wstd}	6.22	7.35	5.28
B_{wo}	.1297	.1490	.1163
$\%O_2$	12.1	11.0	14.2
$\%CO_2$	8.0	9.0	6.0
M_d	29.76	29.88	29.53
M_s	28.24	28.11	28.19
C_p	.840	.840	.840
$\overline{T_s}$	546	537	528
$\overline{(DP)^{1/2}}$	.747	.740	.700
V_s	58.43	57.74	54.26
A_s	26	26	26
A_n	.000341	.000341	.000341
$\%I$	90.8	93.7	90.7
Y_d	1.0110	1.0110	1.0110
θ	84.0	84.0	84.0
M_n	.0207	.0049	.0121
$DH@$	1.750	1.750	1.750

** Corrected for final leak rate per EPA Method 5

Clean Air Engineering, Inc.

PARAMETER SHEET
NO_x TESTS
Kc = 774.8

RUN #	FLASK #	Vf	Ti	Pi	Tf	Pf	Df	A
1A	18	2084	94	2.34	76	29.50	1	.093
1B	19	2100	93	2.24	77	29.10	1	.134
1C	26	2129	90	2.24	75	28.80	1	.100
1D	13	2085	91	2.24	77	29.20	1	.000
1E	38	2092	103	3.04	76	28.61	1	.077
2A	4	2038	96	2.24	77	30.30	1	.072
2B	110	1996	100	2.44	75	30.30	1	.109
2C	36	2090	97	2.14	75	28.10	1	.119
2D	105	2044	96	2.14	75	28.10		.000
2E	263	2053	98	2.44	78	28.50	1	.048
3A	123	1993	99	2.24	77	32.30	1	.060
3B	102	2016	90	2.64	75	30.30	1	.086
3C	9	2111	104	2.24	74	32.30	1	.077
3D	71	2117	94	2.24	76	32.30	1	.101
3E	103	2020	10	2.24	76	28.50	1	.067

PARAMETER SHEET
NO_x TESTS
Kc = 774.8

RUN #	FLASK #	Vf	Ti	Pi	Tf	Pf	Df	A
1A	15	2075	85	3.40	76	29.62	1	.340
1B	6	2067	87	2.80	78	29.52	1	.260
1C	11	2073	91	.80	80	29.32	1	.212
1D	3	2045	84	2.70	82	30.02	1	.252
2A	76	2074	87	3.10	80	29.22	1	.338
2B	34	2093	89	1.90	79	29.32	1	.160
2C	106	2048	88	1.90	79	29.02	1	.285
2D	10	2077	94	1.90	78	30.22	1	.310
2E	111	2020	88	2.00	78	29.02	1	.311
3A	25	2110	86	1.90	78	29.22	1	.161
3B	107	2011	85	1.90	78	29.42	1	.042
3C	16	2088	88	1.90	78	29.52	1	.183
3D	35	2090	81	1.90	80	29.82	1	.134

PARAMETER SHEET
NO_x TESTS
Kc = 774.8

RUN #	FLASK #	Vf	Ti	Pi	Tf	Pf	Df	A
1A	13	2085	78	1.50	78	29.42	1	.364
1B	19	2100	82	1.50	77	29.22	1	.242
1C	110	1996	84	1.70	77	29.52	1	.112
1D	71	2117	80	2.10	78	29.42	1	.211
1E	105	2044	79	2.30	79	29.92	1	.230
2A	4	2038	79	2.00	78	30.22	1	.310
2B	38	2092	81	1.80	79	29.62	1	.270
2C	103	2020	79	1.90	78	29.62	1	.280
2D	9	2111	81	1.90	79	29.62	1	.299
2E	18	2084	82	1.90	78	29.62	1	.188
3A	36	2090	80	1.90	79	29.62	1	.208
3B	123	1993	82	1.80	78	29.72	1	.169
3C	26	2129	81	1.70	79	29.72	1	.275
3D	263	2053	82	1.90	79	30.22	1	.290

Clean Air Engineering, Inc.

EMISSIONS TEST REPORT

MCKAY BAY REFUSE TO ENERGY PLANT

OCTOBER 2 - 5, 1989

Prepared For:

CITY OF TAMPA
ENVIRONMENTAL COORDINATION
306 EAST JACKSON STREET
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Prepared By:

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TAMPA, FLORIDA 33603

NOVEMBER 6, 1989

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I. SUMMARY

From October 2 through 5, 1989, Environmental Engineering Consultants, Inc. conducted annual compliance emissions tests at the McKay Bay Refuse-to-Energy Facility in Tampa, Florida. The sources tested were four steam boilers burning municipal garbage to generate electricity.

Compliance with specified emissions limits was determined using EPA Method 5 for particulate matter, Method 6 for sulfur dioxide, Method 7A for nitrogen oxides, Method 9 for opacity, and Method 12 for lead. These methods, except for Method 9 opacity, were performed simultaneously during each test run. One opacity determination was performed on each stack during a particulate test run.

The tests were conducted by Carl Fink, Byron Burrows, Jim Root, Stuart Dawson, and Don Wilcox of Environmental Engineering Consultants, Inc. with the assistance and cooperation of the employees of Tampa Waste Management Energy Systems.

A summary of the test results is shown in Table 1 through 8. The total emissions (sum of the average emission for each unit) in comparison to allowable emissions per FDER Permit No. A029-114760 are as follows:

Emission Type	Total Emission	Allowable Emissions
Particulate	9.4 lb/hr 0.009 gr/dscf-12%	27.9 lb/hr 0.025 gr/dscf-12%
Lead	0.3 lb/hr	3.1 lb/hr
Sulfur Dioxide	111.6 lb/hr	170.0lb/hr

Emission Type	Total Emission	Allowable Emissions
Nitrogen Oxide	223.8 lb/hr	300.0 lb/hr
Opacity	None greater than 15% opacity	Not to exceed 15% from each stack

All emission rates were determined according to the procedures required by the Florida Department of Environmental Regulation and the tested facility was found to be in compliance with applicable emissions standards.

I hereby certify that these results are true and correct and were obtained by the procedures and methods described herein.

Respectfully Submitted;

ENVIRONMENTAL ENGINEERING CONSULTANTS, INC.

Carl F. Fink
Test Supervisor
Senior Environmental Engineer

TABLE 1

TEST SUMMATION

PLANT: McKay Bay RTE

SOURCE: Unit #1

DATE: 10-5-89

RUN NO.	SAMPLE VOL. (DSCF)	FLOWRATE (ACFM)	FLOWRATE (DSCFM)	MOISTURE (%)	STACK TEMP. (deg F)	ISOKINETICS (%)	CARBON DIOXIDE (%)	PARTICULATE CONCENTRATION (gr/DSCF-12%)	PARTIC. EMISSIONS (lb/hr)
1	38.1207	78625	33696	15.41	575	101.9	8.7	0.0075	1.57
2	38.5911	78944	34087	15.83	562	101.9	8.6	0.0066	1.38
3	41.3671	87478	37734	15.12	571	98.7	8.4	0.0085	1.92
Average		81683	35172	15.45	569	100.8	8.6	0.0075	1.62

TABLE 2

TEST SUMMATION

PLANT: McKay Bay RTE

SOURCE: Unit #2

DATE: 10-4-89

RUN NO.	SAMPLE VOL. (DSCF)	FLOWRATE (ACFM)	FLOWRATE (DSCFM)	MOISTURE (%)	STACK TEMP. (deg F)	ISOKINETICS (%)	CARBON DIOXIDE (%)	PARTICULATE CONCENTRATION (gr/DSCF-12%)	PARTIC. EMISSIONS (lb/hr)
1	42.6913	90150	39426	16.15	547	97.5	8.4	0.0046	1.54
2	43.9900	91155	40584	14.66	545	97.6	6.6	0.0045	1.57
3	44.0435	91101	41001	14.15	540	96.7	8.5	0.0025	0.89
Average		90802	40337	14.99	544	97.3	7.8	0.0039	1.33

TABLE 3

TEST SUMMATION

PLANT: McKay Bay RTE

SOURCE: Unit #3

DATE: 10-3-89

RUN NO.	SAMPLE VOL. (DSCF)	FLOWRATE (ACFM)	FLOWRATE (DSCFM)	MOISTURE (%)	STACK TEMP. (deg F)	ISOKINETICS (%)	CARBON DIOXIDE (%)	PARTICULATE CONCENTRATION (gr/DSCF-12%)	PARTIC. EMISSIONS (lb/hr)
1	39.4019	80987	33645	15.09	612	105.5	9.0	0.0092	2.67
2	37.5453	82920	33393	17.58	612	101.2	9.0	0.0164	4.68
3	36.1848	83149	33524	17.30	613	97.2	8.8	0.0143	4.12
Average		82352	33521	16.66	612	101.3	8.9	0.0133	3.82

TABLE 4

TEST SUMMATION

PLANT: McKay Bay RTE

SOURCE: Unit #4

DATE: 10-2-89

RUN NO.	SAMPLE VOL. (DSCF)	FLOWRATE (ACFM)	FLOWRATE (DSCFM)	MOISTURE (%)	STACK TEMP. (deg F)	ISOKINETICS (%)	CARBON DIOXIDE (%)	PARTICULATE CONCENTRATION (gr/DSCF-12%)	PARTIC. EMISSIONS (lb/hr)
1	46.2705	102360	37393	17.65	718	111.4	8.2	0.0044	0.97
2	48.2553	95872	42439	15.48	539	102.4	8.2	0.0107	2.65
3	46.8094	94445	41965	15.31	536	100.4	8.1	0.0173	4.20
Average		97559	40599	16.15	598	104.8	8.2	0.0108	2.61

TABLE 5

TEST SUMMATION

PLANT: McKay Bay RTE

PARAMETER: Lead

SOURCE/DATE	RUN NUMBER	LEAD EMISSIONS (lb/hr)
Unit #1 10-5-89	1	0.05
	2	0.01
	3	0.03
	Average	0.03
Unit #2 10-4-89	1	0.04
	2	0.03
	3	0.02
	Average	0.03
Unit #3 10-3-89	1	0.07
	2	0.15
	3	0.27
	Average	0.16
Unit #4 10-2-89	1	0.03
	2	0.09
	3	0.17
	Average	0.09
Total Lead Emissions - All Units:		0.31

TABLE 6

TEST SUMMATION

PLANT: McKay Bay Refuse-to-Energy Facility

PARAMETER: Sulfur Dioxide (SO_2)

SOURCE/DATE	RUN NUMBER	SULFUR DIOXIDE CONCENTRATION (mg/dscm)	SULFUR DIOXIDE EMISSIONS (lb/hr)
UNIT #1	1	200.3	25.3
10-5-89	2	126.5	16.2
	3	129.6	18.3
	AVERAGE		19.9
UNIT #2	1	201.8	29.8
10-4-89	2	232.9	35.4
	3	449.9	69.1
	AVERAGE		44.8
UNIT #3	1	209.3	26.4
10-3-89	2	197.2	24.7
	3	262.9	33.0
	AVERAGE		28.0
UNIT #4	1	51.1	7.2
10-2-89	2	178.0	28.3
	3	135.2	21.2
	AVERAGE		18.9

Total Sulfur Dioxide Emissions - All Boilers: 111.6 lb/hr

TABLE 7

TEST SUMMATION

PLANT: McKay Bay Refuse-to-Energy Facility

PARAMETER: Nitrogen Oxides

Source/Date	Run Number	Nitrogen Oxides Concentration (mg/dscm)	Nitrogen Oxides Emissions (lb/hr)
Unit #1	1	363.6	45.9
10-5-89	2	311.0	39.7
	3	383.2	54.2
		-----	----
	Average	352.6	46.6
Unit #2	1	415.4	61.4
10-4-89	2	494.9	75.2
	3	420.3	64.6
		-----	----
	Average	443.6	67.0
Unit #3	1	425.0	53.6
10-3-89	2	414.0	51.8
	3	536.2	67.3
		-----	----
	Average	458.4	57.6
Unit #4	1	396.6	50.0
10-2-89	2	528.6	66.1
	3	496.7	62.4
		-----	----
	Average	474.0	59.5

Total Nitrogen Oxides Emissions - All Units: 223.8

TABLE 8

TEST SUMMATION

PLANT: McKay Bay RTE

PARAMETER: Opacity

SOURCE/DATE	AVERAGE OPACITY (%)	MAXIMUM 6 MIN. AVG. OPACITY (%)
West Stack Unit 1/Unit 2 10-4-89	1	4
East Stack Unit 3/Unit 4 10-2-89	1	3

APPENDIX A

DATA SUMMARIES AND CALCULATIONS

SOURCE TESTING NOMENCLATURE AND DIMENSIONS

An: Cross sectional area of nozzle, $ft.^2$

As: Cross sectional area of stack, $ft.^2$

Bws: Water vapor in the gas stream, proportion by volume

Ca: Concentration of particulate matter in stack gas at actual conditions, gr/acf

Cs: Concentration of particulate matter in stack gas at standard conditions, gr/dscf

Cs50: Concentration corrected to 50% excess air

Cs12: Concentration corrected to 12% carbon dioxide

Cp: Pitot tube coefficient

Dn: Diameter of nozzle, inches

E: Source emission rate, lbs/hr

EA: Excess air

Ef: Ratio of pounds of particulate matter per unit of heat combustion (oxygen based), lb/MMBTU

Fd: Ratio of standard volume of gas produced per unit of heat combustion (oxygen based), dscf/MBTU

I: Percent of isokinetic sampling

Md: Molecular weight of stack gas, dry basis, lb/lb-mole

Ms: Molecular weight of stack gas, wet basis, lb/lb-mole

Mn: Total particulate collected, less acetone blank correction; grams

Pb: Barometric pressure at test site, in. Hg

Ps: Absolute stack gas pressure, in.Hg.

Qa: Volumetric flowrate, actual conditions, ACFM

Qs: Volumetric flowrate, dry at standard conditions, DSCFM

Time: Duration of test, minutes

SOURCE TESTING NOMENCLATURE AND DIMENSIONS

CONTINUED

Tm:	Absolute average dry gas meter temperature, ^{o}R
Ts:	Absolute average stack gas temperature, ^{o}R
Vlc:	Total volume of liquid collected in impingers and silica gel, ml
Vm:	Volume of gas sampled under actual conditions, DCF
Vms:	Volume of gas sampled corrected to standard conditions, DSCF
Vs:	Stack gas velocity, ft/sec
Vw:	Volume of water in sample corrected to standard conditions, SCF
Y:	Dry gas meter calibration factor
dP:	Velocity head, in H20
dH:	Average pressure differential across orifice meter, in. H_2O

SUMMARY OF TEST DATA

Plant: McKay Bay RTE

Source: Unit #1

Date: 10-5-89

Emission: Particulate/Lead

	RUN 1	RUN 2	RUN 3
Test Interval:	0815-0933	1126-1300	1208-1324
Test Time, min.:	70	70	70
Stack Area, sq. ft.:	26	26	26
Nozzle Diameter, in.:	0.275	0.275	0.275
Barometric Pressure, in. Hg.:	30.03	30.04	30.04
Absolute Stack Pressure, in. Hg.:	29.74	29.72	29.72
Volume Liquid Collected, ml.:	147.4	154.1	156.5
Stack Moisture Content, %:	15.41	15.63	15.12
Stack Gas Temperature, deg F:	575	562	571
Sample Volume, DSCF:	38.1207	38.5911	41.3671
Gas Velocity, FPS:	50.401	50.605	56.076
Gas Flowrate, ACFM:	78625	78944	87478
Gas Flowrate, DSCFM:	33696	34087	37734
Percent Isokinetic, %:	101.9	101.9	98.7
Particulate Matter Collected, g:	0.0134	0.0118	0.0159
Particulate Concentration, grains/DSCF:	0.0054	0.0047	0.0059
Particulate Concentration,grains/DSCF-12%:	0.0075	0.0066	0.0085
Particulate Emissions, lb/hr:	1.57	1.38	1.92
Lead Collected, mg :	0.450	0.075	0.225
Lead Emissions, lb/hr :	0.053	0.009	0.027

SUMMARY OF TEST DATA

Plant: McKay Bay RTE

Date: 10-4-89

Source: Unit #2

Emission: Particulate/Lead

	RUN 1	RUN 2	RUN 3
Test Interval:	0830-0948	1040-1158	1235-1352
Test Time, min.:	70	70	70
Stack Area, sq. ft.:	26	26	26
Nozzle Diameter, in.:	0.275	0.275	0.275
Barometric Pressure, in. Hg.:	30.03	30.03	30.01
Absolute Stack Pressure, in. Hg.:	29.77	29.74	29.72
Volume Liquid Collected, ml.:	174.6	160.4	154.1
Stack Moisture Content, %:	16.15	14.66	14.15
Stack Gas Temperature, deg F:	547	545	540
Sample Volume, DSCF:	42.6913	43.9900	44.0435
Gas Velocity, FPS:	57.789	58.433	58.398
Gas Flowrate, ACFM:	90150	91155	91101
Gas Flowrate, DSCFM:	39426	40584	41001
Percent Isokinetic, %:	97.5	97.6	96.7
Particulate Matter Collected, g:	0.0126	0.0129	0.0072
Particulate Concentration, grains/DSCF:	0.0046	0.0045	0.0025
Particulate Concentration,grains/DSCF-12%:	0.0065	0.0082	0.0036
Particulate Emissions, lb/hr:	1.54	1.57	0.89
Lead Collected, mg :	0.300	0.250	0.150
Lead Emissions, lb/hr :	0.037	0.031	0.018

SUMMARY OF TEST DATA

Plant: McKay Bay RTE

Source: Unit #3

Date: 10-3-89

Emission: Particulate/Lead

	RUN 1	RUN 2	RUN 3
Test Interval:	0900-1020	1128-1243	1235-1352
Test Time, min.:	70	70	70
Stack Area, sq. ft.:	26.00	26.00	26.00
Nozzle Diameter, in.:	0.275	0.275	0.275
Barometric Pressure, in. Hg.:	30.03	30.04	30
Absolute Stack Pressure, in. Hg.:	29.74	29.71	29.68
Volume Liquid Collected, ml.:	148.7	170.0	160.7
Stack Moisture Content, %:	15.09	17.58	17.30
Stack Gas Temperature, deg F:	612	612	613
Sample Volume, DSCF:	39.4019	37.5453	36.1848
Gas Velocity, FPS:	51.915	53.154	53.301
Gas Flowrate, ACFM:	80987	82920	83149
Gas Flowrate, DSCFM:	33645	33393	33524
Percent Isokinetic, %:	105.5	101.2	97.2
Particulate Matter Collected, g:	0.0236	0.0398	0.0336
Particulate Concentration, grains/DSCF:	0.0092	0.0164	0.0143
Particulate Concentration, grains/DSCF-12%:	0.0123	0.0218	0.0195
Particulate Emissions, lb/hr:	2.67	4.68	4.12
Lead Collected, mg :	0.600	1.300	2.200
Lead Emissions, lb/hr :	0.068	0.153	0.270

SUMMARY OF TEST DATA

Plant: McKay Bay RTE

Date: 10-2-89

Source: Unit #4

Emission: Particulate/Lead

	RUN 1	RUN 2	RUN 3
Test Interval:	0900-1021	1115-1236	1340-1503
Test Time, min.:	70	70	70
Stack Area, sq. ft.:	26.00	26.00	26.00
Nozzle Diameter, in.:	0.275	0.275	0.275
Barometric Pressure, in. Hg.:	29.97	29.99	29.97
Absolute Stack Pressure, in. Hg.:	29.65	29.66	29.65
Volume Liquid Collected, ml.:	210.6	187.6	179.7
Stack Moisture Content, %:	17.65	15.48	15.31
Stack Gas Temperature, deg F:	718	539	536
Sample Volume, DSCF:	46.2705	48.2553	46.8094
Gas Velocity, FPS:	65.615	61.456	60.542
Gas Flowrate, ACFM:	102360	95872	94445
Gas Flowrate, DSCFM:	37393	42439	41965
Percent Isokinetic, %:	111.4	102.4	100.4
Particulate Matter Collected, g:	0.0091	0.0228	0.0354
Particulate Concentration, grains/DSCF:	0.0030	0.0073	0.0117
Particulate Concentration,grains/DSCF-12%:	0.0044	0.0107	0.0173
Particulate Emissions, lb/hr:	0.97	2.65	4.20
Lead Collected, mg :	0.250	0.750	1.400
Lead Emissions, lb/hr :	0.027	0.087	0.166

CALCULATIONS

PLANT: McKay Bay RTE

SOURCE: Unit #1

DATE: 10-5-89

RUN NO.	1		2		3	
Cp=	0.84		0.84		0.84	
Y=	0.983		0.983		0.983	
Dn=	0.275	inches	0.275	inches	0.275	inches
An=	4.125E-04	sq. ft.	4.125E-04	sq. ft.	4.125E-04	sq. ft.
Pb =	30.03	in Hg	30.04	in Hg	30.04	in Hg
Ps =	29.74	in Hg	29.72	in Hg	29.72	in Hg
As =	26	sq. ft.	26	sq. ft.	26	sq. ft.
Time=	70	min	70	min	70	min
Vm =	39.468	DCF	40.68	DCF	43.782	DCF
dH=	1.15	in. H2O	1.21	in. H2O	1.44	in. H2O
Tm=	541	deg R	551	deg R	553	deg R
Ts=	1035	deg R	1022	deg R	1031	deg R
Vlc=	147.4	ml.	154.1	ml.	156.5	ml.
SQRTdP=	0.6295		0.6353		0.7015	
CO2=	8.7	%	8.6	%	8.4	%
O2=	10.7	%	10.8	%	11	%
CO+N2=	80.6	%	80.6	%	80.6	%
Mn=	0.0134	grams	0.0118	grams	0.0159	grams
Lead=	0.450	mg	0.075	mg	0.225	mg
Vms=	38.1207	DSCF	38.5911	DSCF	41.3671	DSCF
Vw=	6.9425	SCF	7.2581	SCF	7.3712	SCF
Bws=	0.1541		0.1583		0.1512	
Md=	29.820		29.808		29.784	
Ms=	27.999		27.939		28.002	
Vs=	50.4008	FPS	50.6052	FPS	56.0758	FPS
Qs=	33696	DSCFM	34087	DSCFM	37734	DSCFM
Qa=	78625	ACFM	78944	ACFM	87478	ACFM
I=	101.9	%	101.9	%	98.7	%
Cs=	0.0054	gr/DSCF	0.0047	gr/DSCF	0.0059	gr/DSCF
Cs12=	0.0075	gr/DSCF	0.0066	gr/DSCF	0.0085	gr/DSCF
E=	1.57	lb/hr	1.38	lb/hr	1.92	lb/hr
Epb=	0.05262	lb/hr	0.00876	lb/hr	0.02715	lb/hr

```
Vm(std)=17.64*Vm*Y*(Pb+dH/13.6)
Vw=.0471*Vlc
Bws=Vw/Vw+Vm(std)
Md=0.44(%CO2)+0.32(%O2)+0.28(%CO+%N2)
Ms=Md(1-Bws)+18*Bws
Vs=85.49*Cp*SQRTdPavg*SQRT(Ts/Ps*Ms)
Qs=1058*(1-Bws)*Vs*As*(Ps/Ts)
Qa=60*As*Vs
I=100*Vm(std)*As/Theta*Qs*An
Cs=15.43*Mn/Vm(std)
Cs12=Cs*12/CO2
E=Cs*Qs/116.67
Epb=1.323E-4*Lead*Qs/Vms
```

CALCULATIONS

PLANT: McKay Bay RTE

SOURCE: Unit #3

DATE: 10-3-89

RUN NO.	1		2		3	
Cp=	0.84		0.84		0.84	
Y=	0.983		0.983		0.983	
Dn=	0.275	inches	0.275	inches	0.275	inches
An=	4.125E-04	sq. ft.	4.125E-04	sq. ft.	4.125E-04	sq. ft.
Pb =	30.03	in Hg	30.04	in Hg	30	in Hg
Ps =	29.74	in Hg	29.71	in Hg	29.68	in Hg
As =	26	sq. ft.	26	sq. ft.	26	sq. ft.
Time=	70	min	70	min	70	min
Vm =	39.25	DCF	39.82	DCF	38.62	DCF
dH=	1.15	in. H2O	1.19	in. H2O	1.13	in. H2O
Tm=	520	deg R	554	deg R	557	deg R
Ts=	1072	deg R	1072	deg R	1073	deg R
Vlc=	148.7	ml.	170	ml.	160.7	ml.
SQRTdP=	0.6379		0.6493		0.6505	
CO2=	9	%	9	%	8.8	%
O2=	10.3	%	10.4	%	10.6	%
CO+N2=	80.7	%	80.6	%	80.6	%
Mn=	0.0236	grams	0.0398	grams	0.0336	grams
Lead=	0.6	mg	1.3	mg	2.2	mg
Vms=	39.4019	DSCF	37.5453	DSCF	36.1848	DSCF
Vw=	7.0038	SCF	8.0070	SCF	7.5690	SCF
Bws=	0.1509		0.1758		0.1730	
Md=	29.852		29.856		29.832	
Ms=	28.0632		27.7720		27.7852	
Vs=	51.9147	FPS	53.1538	FPS	53.3009	FPS
Qs=	33645	DSCFM	33393	DSCFM	33524	DSCFM
Qa=	80987	ACFM	82920	ACFM	83149	ACFM
I=	105.5	%	101.2	%	97.2	%
Cs=	0.0092	gr/DSCF	0.0164	gr/DSCF	0.0143	gr/DSCF
Cs12=	0.0123	gr/DSCF	0.0218	gr/DSCF	0.0195	gr/DSCF
E=	2.67	lb/hr	4.68	lb/hr	4.12	lb/hr
Epb=	0.06778	lb/hr	0.15297	lb/hr	0.26966	lb/hr

Vm(std)=17.64*Vm*Y*(Pb+dH/13.6)
Vw=.0471*Vlc
Bws=Vw/Vw+Vm(std)
Md=0.44(%CO2)+0.32(%O2)+0.28(%CO+%N2)
Ms=Md(1-Bws)+18*Bws
Vs=85.49*Cp*SQRTdPavg*SQRT(Ts/Ps*Ms)
Qs=1058*(1-Bws)*Vs*As*(Ps/Ts)
Qa=60*As*Vs
I=100*Vm(std)*As/Theta*Qs*An
Cs=15.43*Mn/Vm(std)
Cs12=Cs*12/CO2
E=Cs*Qs/116.67
Epb=1.323E-4*Lead*Qs/Vms

CALCULATIONS

PLANT: McKay Bay RTE

SOURCE: Unit #2

DATE: 10-4-89

RUN NO.	1		2		3	
Cp=	0.84		0.84		0.84	
Y=	0.983		0.983		0.983	
Dn=	0.275	inches	0.275	inches	0.275	inches
An=	4.125E-04	sq. ft.	4.125E-04	sq. ft.	4.125E-04	sq. ft.
Pb =	30.03	in Hg	30.03	in Hg	30.01	in Hg
Ps =	29.77	in Hg	29.74	in Hg	29.72	in Hg
As =	26	sq. ft.	26	sq. ft.	26	sq. ft.
Time=	70	min	70	min	70	min
Vm =	44.228	DCF	46.77	DCF	47.01	DCF
dH=	1.51	in. H2O	1.59	in. H2O	1.66	in. H2O
Tm=	541	deg R	556	deg R	558	deg R
Ts=	1007	deg R	1005	deg R	1000	deg R
Vlc=	174.6	ml.	160.4	ml.	154.1	ml.
SQRTdP=	0.7308		0.7389		0.7436	
CO2=	8.4	%	6.6	%	8.5	%
O2=	11.1	%	12.9	%	10.9	%
CO+N2=	80.5	%	80.5	%	80.6	%
Mn=	0.0126	grams	0.0129	grams	0.0072	grams
Lead=	0.300	mg	0.250	mg	0.150	mg
Vms=	42.6913	DSCF	43.9900	DSCF	44.0435	DSCF
Vw=	8.2237	SCF	7.5548	SCF	7.2581	SCF
Bws=	0.1615		0.1466		0.1415	
Md=	29.788		29.572		29.796	
Ms=	27.8840		27.8759		28.1271	
Vs=	57.7886	FPS	58.4326	FPS	58.3979	FPS
Qs=	39426	DSCFM	40584	DSCFM	41001	DSCFM
Qa=	90150	ACFM	91155	ACFM	91101	ACFM
I=	97.5	%	97.6	%	96.7	%
Cs=	0.0046	gr/DSCF	0.0045	gr/DSCF	0.0025	gr/DSCF
Cs12=	0.0065	gr/DSCF	0.0082	gr/DSCF	0.0036	gr/DSCF
E=	1.54	lb/hr	1.57	lb/hr	0.89	lb/hr
Epb=	0.03665	lb/hr	0.03051	lb/hr	0.01847	lb/hr

Vm(std)=17.64*Vm*Y*(Pb+dH/13.6)
Vw=.0471*Vlc
Bws=Vw/Vw+Vm(std)
Md=0.44(%CO2)+0.32(%O2)+0.28(%CO+%N2)
Ms=Md(1-Bws)+18*Bws
Vs=85.49*Cp*SQRTdPavg*SQRT(Ts/Ps*Ms)
Qs=1058*(1-Bws)*Vs*As*(Ps/Ts)
Qa=60*As*Vs
I=100*Vm(std)*As/Theta*Qs*An
Cs=15.43*Mn/Vm(std)
Cs12=Cs*12/CO2
E=Cs*Qs/116.67
Epb=1.323E-4*Lead*Qs/Vms

CALCULATIONS

PLANT: McKay Bay RTE

SOURCE: Unit #4

DATE: 10-2-89

RUN NO.	1	2	3
Cp=	0.84	0.84	0.84
Y=	0.983	0.983	0.983
Dn=	0.275 inches	0.275 inches	0.275 inches
An=	4.125E-04 sq. ft.	4.125E-04 sq. ft.	4.125E-04 sq. ft.
Pb =	29.97 in Hg	29.99 in Hg	29.97 in Hg
Ps =	29.65 in Hg	29.66 in Hg	29.65 in Hg
As =	26 sq. ft.	26 sq. ft.	26 sq. ft.
Time=	70 min	70 min	70 min
Vm =	48.638 DCF	51.2 DCF	49.43 DCF
dH=	1.87 in. H2O	1.97 in. H2O	1.84 in. H2O
Tm=	549 deg R	554 deg R	551 deg R
Ts=	1178 deg R	999 deg R	996 deg R
Vlc=	210.6 ml.	187.6 ml.	179.7 ml.
SQRTdP=	0.7625	0.7797	0.7689
CO2=	8.2 %	8.2 %	8.1 %
O2=	11.2 %	11.4 %	11.4 %
CO+N2=	80.6 %	80.4 %	80.5 %
Mn=	0.0091 grams	0.0228 grams	0.0354 grams
Lead=	0.25 mg	0.75 mg	1.4 mg
Vms=	46.2705 DSCF	48.2553 DSCF	46.8094 DSCF
Vw=	9.9193 SCF	8.8360 SCF	8.4639 SCF
Bws=	0.1765	0.1548	0.1531
Md=	29.76	29.768	29.752
Ms=	27.6840	27.9467	27.9524
Vs=	65.6154 FPS	61.4564 FPS	60.5415 FPS
Qs=	37393 DSCFM	42439 DSCFM	41965 DSCFM
Qa=	102360 ACFM	95872 ACFM	94445 ACFM
I=	111.4 %	102.4 %	100.4 %
Cs=	0.0030 gr/DSCF	0.0073 gr/DSCF	0.0117 gr/DSCF
Cs12=	0.0044 gr/DSCF	0.0107 gr/DSCF	0.0173 gr/DSCF
E=	0.97 lb/hr	2.65 lb/hr	4.20 lb/hr
Epb=	0.02673 lb/hr	0.08727 lb/hr	0.16605 lb/hr

Vm(std)=17.64*Vm*Y*(Pb+dH/13.6)
Vw=.0471*Vlc
Bws=Vw/Vw+Vm(std)
Md=0.44(%CO2)+0.32(%O2)+0.28(%CO+%N2)
Ms=Md(1-Bws)+18*Bws
Vs=85.49*Cp*SQRTdPavg*SQRT(Ts/Ps*Ms)
Qs=1058*(1-Bws)*Vs*As*(Ps/Ts)
Qa=60*As*Vs
I=100*Vm(std)*As/Theta*Qs*An
Cs=15.43*Mn/Vm(std)
Cs12=Cs*12/CO2
E=Cs*Qs/116.67
Epb=1.323E-4*Lead*Qs/Vms

EPA METHOD 6 SO2 CALCULATIONS

PLANT: McKAY BAY REFUSE-TO-ENERGY

DATE: OCTOBER 2-5,1989

UNIT #1

RUN NO.	1		2		3	
Vm=	20.290	liters	20.375	liters	20.290	liters
Pb=	30.03	"Hg	30.04	"Hg	30.04	"Hg
Tm=	539.5	deg R	547.5	deg R	549.5	deg R
Qs=	33696	DSCFM	34087	DSCFM	37734	DSCFM
Y=	0.990		0.990		0.990	
Vms=	0.01972	DSCM	0.01952	DSCM	0.01937	DSCM
SO2=	3.95	mg	2.47	mg	2.51	mg
C=	200.27	mg/dscm	126.52	mg/dscm	129.58	mg/dscm
E=	25.28	lb/hr	16.15	lb/hr	18.31	lb/hr

UNIT #2

RUN NO.	1		2		3	
Vm=	20.325	liters	20.395	liters	20.285	liters
Pb=	30.03	"Hg	30.03	"Hg	30.01	"Hg
Tm=	537.8	deg R	550	deg R	555.5	deg R
Qs=	39426	DSCFM	40584	DSCFM	41001	DSCFM
Y=	0.990		0.990		0.990	
Vms=	0.01981	DSCM	0.01944	DSCM	0.01913	DSCM
SO2=	4.00	mg	4.53	mg	8.61	mg
C=	201.82	mg/dscm	232.94	mg/dscm	449.90	mg/dscm
E=	29.80	lb/hr	35.41	lb/hr	69.10	lb/hr

UNIT #3

RUN NO.	1		2		3	
Vm=	20.040	liters	20.040	liters	20.335	liters
Pb=	30.03	"Hg	30.04	"Hg	30.00	"Hg
Tm=	544.5	deg R	551.5	deg R	559.0	deg R
Qs=	33645	DSCFM	33393	DSCFM	33524	DSCFM
Y=	0.990		0.990		0.990	
Vms=	0.01930	DSCM	0.01906	DSCM	0.01905	DSCM
SO2=	4.04	mg	3.76	mg	5.01	mg
C=	209.31	mg/dscm	197.24	mg/dscm	262.88	mg/dscm
E=	26.38	lb/hr	24.67	lb/hr	33.01	lb/hr

UNIT #4

RUN NO.	1		2		3	
Vm=	20.590	liters	20.335	liters	20.720	liters
Pb=	29.97	"Hg	29.99	"Hg	29.97	"Hg
Tm=	545.5	deg R	557.5	deg R	549.0	deg R
Qs=	37393	DSCFM	42439	DSCFM	41965	DSCFM
Y=	0.990		0.990		0.990	
Vms=	0.01975	DSCM	0.01910	DSCM	0.01975	DSCM
SO2=	1.01	mg	3.40	mg	2.67	mg
C=	51.13	mg/dscm	177.98	mg/dscm	135.17	mg/dscm
E=	7.16	lb/hr	28.29	lb/hr	21.25	lb/hr

Vms=0.01764*Vm*Y*Pb/Tm   C=SO2/Vms   E=6.243E-8*C*Qs*60

METHOD 7A NOx CALCULATIONS

PLANT: McKay Bay RTE SOURCE: Unit No. 1

DATE: 10-5-89

RUN 1

SAMPLE NO. =	1		2		3		4	
FLASK VOL. =	2000	ml	2031	ml	2025	ml	2018	ml
Pi=	0.43	"Hg	0.53	"Hg	0.53	"Hg	0.53	"Hg
Pf=	30.08	"Hg	29.08	"Hg	28.78	"Hg	29.28	"Hg
Ti=	299	K	298.5	K	300	K	300.5	K
Tf=	299	K	299	K	300	K	300.5	K
Vsc=	1917.9	ml	1875.7	ml	1844.3	ml	1867.3	ml
HSF=	76	ug	67	ug	68	ug	62	ug
Qs=	33696	DSCFM	33696	DSCFM	33696	DSCFM	33696	DSCFM
C=	396	mg/dscm	357	mg/dscm	369	mg/dscm	332	mg/dscm
E=	50.0	lb/hr	45.1	lb/hr	46.5	lb/hr	41.9	lb/hr

RUN 2

SAMPLE NO. =	1		2		3		4	
FLASK VOL. =	2003	ml	1990	ml	2032	ml	2032	ml
Pi=	0.54	"Hg	0.54	"Hg	0.44	"Hg	0.54	"Hg
Pf=	28.18	"Hg	30.08	"Hg	28.88	"Hg	28.28	"Hg
Ti=	305	K	302.5	K	306	K	305	K
Tf=	301	K	301	K	301	K	301	K
Vsc=	1779.2	ml	1888.7	ml	1857.5	ml	1811.8	ml
HSF=	58	ug	56	ug	56	ug	58	ug
Qs=	34087	DSCFM	34087	DSCFM	34087	DSCFM	34087	DSCFM
C=	326	mg/dscm	297	mg/dscm	301	mg/dscm	320	mg/dscm
E=	41.6	lb/hr	37.9	lb/hr	38.5	lb/hr	40.9	lb/hr

RUN 3

SAMPLE NO. =	1		2		3		4	
FLASK VOL. =	2029	ml	2005	ml	1994	ml	1993	ml
Pi=	0.54	"Hg	0.44	"Hg	0.44	"Hg	0.44	"Hg
Pf=	28.28	"Hg	28.88	"Hg	28.78	"Hg	28.88	"Hg
Ti=	308	K	306	K	303.5	K	303.5	K
Tf=	300	K	300	K	300	K	300	K
Vsc=	1815.6	ml	1838.7	ml	1821.8	ml	1827.3	ml
HSF=	52	ug	79	ug	81	ug	68	ug
Qs=	37734	DSCFM	37734	DSCFM	37734	DSCFM	37734	DSCFM
C=	286	mg/dscm	430	mg/dscm	445	mg/dscm	372	mg/dscm
E=	40.5	lb/hr	60.7	lb/hr	62.8	lb/hr	52.6	lb/hr

Vsc = 9.7928 * (Vf-25) * [(Pf/Tf) - (Pi/Ti)]
C = (HSF) * 10,000/Vsc
E = (6.243E-8) * C * Qs * 60

METHOD 7A NOx CALCULATIONS

PLANT: McKay Bay RTE SOURCE: Unit No. 2

DATE: 10-4-89

RUN 1

SAMPLE NO. =	1		2		3		4	
FLASK VOL. =	2000	ml	2031	ml	2025	ml	2018	ml
Pi=	0.83	"Hg	0.63	"Hg	0.68	"Hg	0.78	"Hg
Pf=	28.80	"Hg	27.60	"Hg	29.20	"Hg	28.80	"Hg
Ti=	299	K	298	K	298.5	K	299	K
Tf=	295	K	295.5	K	296	K	296	K
Vsc=	1834.5	ml	1793.3	ml	1887.5	ml	1848.0	ml
HSF=	62	ug	76	ug	81	ug	87	ug
Qs=	39426	DSCFM	39426	DSCFM	39426	DSCFM	39426	DSCFM
C=	338	mg/dscm	424	mg/dscm	429	mg/dscm	471	mg/dscm
E=	49.9	lb/hr	62.6	lb/hr	63.4	lb/hr	69.5	lb/hr

RUN 2

SAMPLE NO. =	1		2		3		4	
FLASK VOL. =	2003	ml	1990	ml	2032	ml	2032	ml
Pi=	0.93	"Hg	0.68	"Hg	0.53	"Hg	0.88	"Hg
Pf=	28.40	"Hg	29.20	"Hg	28.60	"Hg	28.60	"Hg
Ti=	304	K	302	K	305	K	302	K
Tf=	296	K	296.5	K	296	K	296.5	K
Vsc=	1799.2	ml	1851.8	ml	1864.9	ml	1838.5	ml
HSF=	87	ug	90	ug	93	ug	94	ug
Qs=	40584	DSCFM	40584	DSCFM	40584	DSCFM	40584	DSCFM
C=	484	mg/dscm	486	mg/dscm	499	mg/dscm	511	mg/dscm
E=	73.5	lb/hr	73.9	lb/hr	75.8	lb/hr	77.7	lb/hr

RUN 3

SAMPLE NO. =	1		2		3		4	
FLASK VOL. =	2029	ml	2005	ml	1994	ml	2003	ml
Pi=	0.81	"Hg	0.51	"Hg	0.76	"Hg	0.86	"Hg
Pf=	27.90	"Hg	28.20	"Hg	28.20	"Hg	28.00	"Hg
Ti=	307.5	K	307	K	309.5	K	305	K
Tf=	296	K	296.5	K	296.5	K	295.5	K
Vsc=	1798.1	ml	1811.9	ml	1786.6	ml	1780.8	ml
HSF=	94	ug	86	ug	61	ug	61	ug
Qs=	41001	DSCFM	41001	DSCFM	41001	DSCFM	41001	DSCFM
C=	523	mg/dscm	475	mg/dscm	341	mg/dscm	343	mg/dscm
E=	80.3	lb/hr	72.9	lb/hr	52.4	lb/hr	52.6	lb/hr

Vsc = 9.7928 * (Vf-25) * [(Pf/Tf) - (Pi/Ti)]
C = (HSF) * 10,000/Vsc
E = (6.243E-8) * C * Qs * 60

METHOD 7A NOx CALCULATIONS

PLANT: McKay Bay RTE SOURCE: Unit No. 3

DATE: 10-3-89

RUN 1

SAMPLE NO. =	1		2		3		4	
FLASK VOL. =	2000	ml	2031	ml	2025	ml	2018	ml
Pi=	0.63	"Hg	0.53	"Hg	0.53	"Hg	0.53	"Hg
Pf=	27.63	"Hg	28.63	"Hg	28.03	"Hg	28.58	"Hg
Ti=	299	K	298.5	K	299.5	K	303	K
Tf=	297	K	296	K	296.5	K	296.5	K
Vsc=	1758.5	ml	1865.2	ml	1816.9	ml	1847.1	ml
HSF=	73	ug	81	ug	68	ug	88	ug
Qs=	33645	DSCFM	33645	DSCFM	33645	DSCFM	33645	DSCFM
C=	415	mg/dscm	434	mg/dscm	374	mg/dscm	476	mg/dscm
E=	52.3	lb/hr	54.7	lb/hr	47.2	lb/hr	60.0	lb/hr

RUN 2

SAMPLE NO. =	1		2		3		4	
FLASK VOL. =	2003	ml	1990	ml	2032	ml	2032	ml
Pi=	0.64	"Hg	0.54	"Hg	0.54	"Hg	0.54	"Hg
Pf=	27.43	"Hg	29.63	"Hg	27.73	"Hg	28.83	"Hg
Ti=	304	K	305	K	308	K	302	K
Tf=	296.5	K	296.5	K	297	K	297.5	K
Vsc=	1751.2	ml	1888.9	ml	1800.6	ml	1869.5	ml
HSF=	81	ug	73	ug	75	ug	73	ug
Qs=	33393	DSCFM	33393	DSCFM	33393	DSCFM	33393	DSCFM
C=	463	mg/dscm	386	mg/dscm	417	mg/dscm	390	mg/dscm
E=	57.9	lb/hr	48.3	lb/hr	52.1	lb/hr	48.8	lb/hr

RUN 3

SAMPLE NO. =	1		2		3		4	
FLASK VOL. =	2029	ml	2005	ml	1994	ml	2003	ml
Pi=	0.4	"Hg	0.5	"Hg	0.5	"Hg	0.6	"Hg
Pf=	27.73	"Hg	28.03	"Hg	27.63	"Hg	27.88	"Hg
Ti=	308.5	K	306.5	K	305	K	305	K
Tf=	298.5	K	298.5	K	298.5	K	299	K
Vsc=	1797.7	ml	1789.1	ml	1753.2	ml	1768.0	ml
HSF=	91	ug	89	ug	91	ug	110	ug
Qs=	33524	DSCFM	33524	DSCFM	33524	DSCFM	33524	DSCFM
C=	506	mg/dscm	497	mg/dscm	519	mg/dscm	622	mg/dscm
E=	63.6	lb/hr	62.5	lb/hr	65.2	lb/hr	78.1	lb/hr

Vsc = 9.7928 * (Vf-25) * [(Pf/Tf) - (Pi/Ti)]
C = (HSF) * 10,000/Vsc
E = (6.243E-8) * C * Qs * 60

METHOD 7A NOx CALCULATIONS

PLANT: McKay Bay RTE SOURCE: Unit No. 4

DATE: 10-2-89

RUN 1

SAMPLE NO. =	1		2		3		4	
FLASK VOL. =	2000	ml	2031	ml	2025	ml	2018	ml
Pi=	0.57	"Hg	0.47	"Hg	0.47	"Hg	0.47	"Hg
Pf=	28.03	"Hg	28.33	"Hg	28.23	"Hg	28.63	"Hg
Ti=	302	K	302	K	302.5	K	302.5	K
Tf=	295	K	295	K	295.5	K	295.5	K
Vsc=	1801.2	ml	1856.0	ml	1840.6	ml	1860.6	ml
HSF=	66	ug	68	ug	76	ug	82	ug
Qs=	33645	DSCFM	33645	DSCFM	33645	DSCFM	33645	DSCFM
C=	366	mg/dscm	366	mg/dscm	413	mg/dscm	441	mg/dscm
E=	46.2	lb/hr	46.2	lb/hr	52.0	lb/hr	55.5	lb/hr

RUN 2

SAMPLE NO. =	1		2		3		4	
FLASK VOL. =	2003	ml	1990	ml	2032	ml	2032	ml
Pi=	0.49	"Hg	0.49	"Hg	0.39	"Hg	0.39	"Hg
Pf=	27.93	"Hg	29.73	"Hg	28.03	"Hg	27.63	"Hg
Ti=	304.5	K	305	K	304.5	K	306	K
Tf=	296	K	296	K	296	K	296	K
Vsc=	1796.6	ml	1901.8	ml	1836.0	ml	1809.6	ml
HSF=	93	ug	95	ug	100	ug	100	ug
Qs=	33393	DSCFM	33393	DSCFM	33393	DSCFM	33393	DSCFM
C=	518	mg/dscm	500	mg/dscm	545	mg/dscm	553	mg/dscm
E=	64.8	lb/hr	62.5	lb/hr	68.1	lb/hr	69.1	lb/hr

RUN 3

SAMPLE NO. =	1		2		3		4	
FLASK VOL. =	2029	ml	2005	ml	1994	ml	2003	ml
Pi=	0.37	"Hg	0.37	"Hg	0.47	"Hg	0.47	"Hg
Pf=	27.93	"Hg	28.03	"Hg	27.63	"Hg	27.53	"Hg
Ti=	305	K	304.5	K	306	K	307	K
Tf=	295.5	K	296	K	296	K	296.5	K
Vsc=	1831.1	ml	1812.6	ml	1770.3	ml	1768.9	ml
HSF=	100	ug	86	ug	91	ug	80	ug
Qs=	33524	DSCFM	33524	DSCFM	33524	DSCFM	33524	DSCFM
C=	546	mg/dscm	474	mg/dscm	514	mg/dscm	452	mg/dscm
E=	68.6	lb/hr	59.6	lb/hr	64.6	lb/hr	56.8	lb/hr

Vsc = 9.7928 * (Vf-25) * [(Pf/Tf) - (Pi/Ti)]
C = (HSF) * 10,000/Vsc
E = (6.243E-8) * C * Qs * 60

WHEELABRATOR MCKAY BAY, INC.
TAMPA, FLORIDA

Client Reference No: Letter Agreement
CAE Project No: 7784-1

Table 1-1:
Summary of Test Results

Source / Constituent	Sampling Method	Average Emission	Permit Limit[1]
Unit 1 ESP Outlet			
Particulate (gr/dscf @ 12% CO_2)	EPA M5	0.0065	0.025
Particulate (lb/hr)	EPA M5	1.39	
Lead (lb/hr)	BIF Metals	0.0182	
Mercury (ug/dscm @ 7% O_2)	EPA M101A	132	
Mercury (lb/hr)	EPA M101A	0.0124	
Unit 2 ESP Outlet			
Particulate (gr/dscf @ 12% CO_2)	EPA M5	0.0055	0.025
Particulate (lb/hr)	EPA M5	1.17	
Lead (lb/hr)	BIF Metals	0.0293	
Mercury (ug/dscm @ 7% O_2)	EPA M101A	147	
Mercury (lb/hr)	EPA M101A	0.0133	
Unit 3 ESP Outlet			
Particulate (gr/dscf @ 12% CO_2)	EPA M5	0.0037	0.025
Particulate (lb/hr)	EPA M5	0.83	
Lead (lb/hr)	BIF Metals	0.0137	
Mercury (ug/dscm @ 7% O_2)	EPA M101A	111	
Mercury (lb/hr)	EPA M101A	0.0103	
Unit 4 ESP Outlet			
Particulate (gr/dscf @ 12% CO_2)	EPA M5	0.0035	0.025
Particulate (lb/hr)	EPA M5	0.71	
Lead (lb/hr)	BIF Metals	0.0182	
Mercury (ug/dscm @ 7% O_2)	EPA M101A	373	
Mercury (lb/hr)	EPA M101A	0.0322	
Combined Units 1 through 4			
Particulate (lb/hr)	EPA M5	4.1	27.9
Lead (lb/hr)	BIF Metals	0.079	3.1
Mercury (lb/hr)	EPA M101A	0.068	0.6

[1] Permit limits obtained from Wheelabrator McKay Bay, Inc. permit number: AO29-206279 issued pursuant to Section 403.087, Florida Statutes.

The test conditions and results of analysis are presented in Table 2-1 through Table 2-10 on pages 2-1 through 2-10.

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To Cynthia Hibbard	From J. Strowbridge
Co.	Co.
Dept.	Phone #
Fax #	Fax #

WHEELABRATOR MCKAY BAY, INC.
TAMPA, FLORIDA

Client Reference No: Letter Agreement
CAE Project No: 7784-1

2-7

RESULTS

Table 2-7:
Unit 1 ESP Outlet - Mercury Emissions

Run No.		1	2	3	Average
Date (1996)		October 3	October 3	October 3	
Start Time (approx.)		07:30	10:05	12:57	
Stop Time (approx.)		09:41	12:34	15:02	
Gas Conditions					
O_2	Oxygen (dry volume %)	11.2	11.3	11.5	11.3
CO_2	Carbon dioxide (dry volume %)	8.3	8.3	8.4	8.3
T_s	Temperature (°F)	501	500	498	500
B_{wo}	Moisture (volume %)	15.76	15.06	14.65	15.16
Volumetric Flow Rate					
Q_a	Actual conditions (acfm)	78,730	78,030	76,760	77,840
Q_{std}	Standard conditions (dscfm)	36,250	36,270	35,930	36,150
Mercury					
C	Concentration, standard conditions (µg/dscm)	99.6	109	65.0	91.4
C	Corrected to 7% O_2 (µg/dscm)	143	157	97.5	132
C	Corrected to 12% CO_2 (µg/dscm)	144.020	156.974	94.234	131.742
E	Emission rate (lb/hr)	0.0135	0.0148	0.00888	0.0124

WHEELABRATOR MCKAY BAY, INC.
TAMPA, FLORIDA

Client Reference No: Letter Agreement
CAE Project No: 7784-1

RESULTS

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Table 2-8:
Unit 2 ESP Outlet - Mercury Emissions

Run No.		1	2	3	Average
Date (1996)		October 3	October 3	October 3	
Start Time (approx.)		07:30	10:17	12:52	
Stop Time (approx.)		09:41	12:27	15:02	
Gas Conditions					
O_2	Oxygen (dry volume %)	11.1	11.4	11.5	11.3
CO_2	Carbon dioxide (dry volume %)	8.5	8.2	8.1	8.3
T_s	Temperature (°F)	513	519	521	518
B_{wo}	Moisture (volume %)	15.91	15.21	15.76	15.63
Volumetric Flow Rate					
Q_a	Actual conditions (acfm)	75,540	78,560	78,920	77,670
Q_{std}	Standard conditions (dscfm)	34,300	35,710	35,530	35,200
Mercury					
C	Concentration, standard conditions (μg/dscm)	103	128	71.3	101
C	Corrected to 7% O_2 (μg/dscm)	147	188	105	147
C	Corrected to 12% CO_2 (μg/dscm)	146.025	187.702	105.891	146.473
E	Emission rate (lb/hr)	0.0133	0.0172	0.00951	0.0133

RESULTS

Table 2-9: Unit 3 ESP Outlet - Mercury Emissions

Run No.	1	2	3	Average
Date (1996)	October 1	October 1	October 1	
Start Time (approx.)	07:40	10:28	13:19	
Stop Time (approx.)	09:55	12:50	15:29	
Gas Conditions				
O_2 Oxygen (dry volume %)	11.8	11.9	12.0	11.9
CO_2 Carbon dioxide (dry volume %)	8.0	7.9	7.9	7.9
T_s Temperature (°F)	533	530	534	532
B_{wo} Moisture (volume %)	15.58	14.88	14.92	15.12
Volumetric Flow Rate				
Q_a Actual conditions (acfm)	86,210	86,740	85,700	86,220
Q_{std} Standard conditions (dscfm)	38,500	39,120	38,480	38,700
Mercury				
C Concentration, standard conditions (μg/dscm)	65.1	44.4	105	71.4
C Corrected to 7% O_2 (μg/dscm)	99.5	68.6	164	111
C Corrected to 12% CO_2 (μg/dscm)	97.690	67.425	159.096	108.070
E Emission rate (lb/hr)	0.00939	0.00850	0.0151	0.0103

WHEELABRATOR MCKAY BAY, INC.
TAMPA, FLORIDA

Client Reference No: Letter Agreement
CAE Project No: 7784-1

RESULTS

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Table 2-10:
Unit 4 ESP Outlet - Mercury Emissions

Run No.		1	2	3	Average
Date (1996)		October 1	October 1	October 1	
Start Time (approx.)		07:40	10:24	13:02	
Stop Time (approx.)		09:51	12:36	15:13	
Gas Conditions					
O_2	Oxygen (dry volume %)	12.0	12.0	12.0	12.0
CO_2	Carbon dioxide (dry volume %)	7.8	7.6	7.6	7.7
T_s	Temperature (°F)	474	472	480	476
B_{wo}	Moisture (volume %)	15.12	15.44	16.03	15.53
Volumetric Flow Rate					
Q_a	Actual conditions (acfm)	75,350	74,930	79,040	76,440
Q_{std}	Standard conditions (dscfm)	36,010	35,760	37,120	36,300
Mercury					
C	Concentration, standard conditions (µg/dscm)	80.0	555	81.9	239
C	Corrected to 7% O_2 (µg/dscm)	126	866	128	373
C	Corrected to 12% CO_2 (µg/dscm)	123,109	875,666	129,311	376,028
E	Emission rate (lb/hr)	0.0108	0.0743	0.0114	0.0322