LEE COUNTY, FLORIDA
SOLID WASTE ENERGY RECOVERY FACILITY

SUPPLEMENTAL APPLICATION FOR POWER PLANT SITE CERTIFICATION

VOLUME III – AIR QUALITY

SUBMITTED BY:
THE LEE COUNTY BOARD OF COUNTY COMMISSIONERS

NOVEMBER 7, 2002

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TABLE OF CONTENTS – ABBREVIATED*
VOLUME III - AIR QUALITY

INTRODUCTION

1.0 EXECUTIVE SUMMARY

2.0 REGULATORY REVIEW

3.0 AIR POLLUTANT EMISSIONS

4.0 BEST AVAILABLE CONTROL TECHNOLOGY EVALUATION

5.0 EXISTING AMBIENT AIR QUALITY

6.0 AIR QUALITY IMPACT ANALYSES

7.0 ADDITIONAL IMPACT ANALYSES

8.0 REFERENCES

9.0 ATTACHMENTS

* A detailed Table of Contents for the Prevention of Significant Deterioration Air Permit Application is provided in Volume III.

LIST OF TABLES

Table		Page
2-1	Proposed Land Uses At The Site	2-3
2-2	Governmental Jurisdictions Within a Five-Mile Radius	2-5
2-3	Population: Lee County 1980-2000	2-13
2-4	2000 Census Estimates for Census Tracts in Study Area	2-17
2-5	Lee County Population Projections	2-18
2-6	Average Annual Labor Force 1990-2000	2-19
2-7	Major Private Sector Employers in 2000	2-19
2-8	Average Monthly Employment: Lee County 1990-2000	2-21
2-9	Monthly Employment: Lee County January-March 2001	2-24
2-10	Employment Estimates: Lee County 1998-2008	2-25
2-11	Annual Payroll by Industrial Sector: Lee County 1990-2000	2-26
2-12	Annual (Monthly) Payroll by Industrial Sector: Lee County 1990-2000	2-31
2-13	Income by Household: Lee County 2000	2-37
2-14	Housing Units: 2000	2-38
2-15	Age of Housing Stock as of 2000	2-39
2-16	Housing Values in 2000	2-39
2-17	Building Permits: Lee County 2000	2-40
2-18	Existing Roadways	2-41
2-19	Existing Traffic Volumes	2-41
2-20	Performance Standards	2-42
2-21	Influent Pretreatment Requirements for the Fort Myers Central Advanced Wastewater Treatment Plant	2-45
2-22	Summary of Soil Borings	2-52
2-23	Summary of Sieve Data for Soil Samples	2-54
2-24	On-site Groundwater Elevation Data	2-58
2-25	Summary of Groundwater Quality Data	2-61
2-26	Hydrological Data Representative of the Project Site	2-62
2-27	Wildlife Survey Results October 2001	2-69
2-28	Wildlife Observed or Expected to Occur on the Facility Site	2-71
2-29	Climatological Data - Normals, Means, and Extremes; Page Field Airport, Fort Myers	2-82
2-30	Annual Average Rural Mixing Heights and Stability	2-83
2-31	Frequency Distribution of Wind Speed and Stability	2-84
2-32	Frequency Distribution of Wind Speed and Wind Direction	2-85
2-33	Nearest Ambient Air Quality Monitoring Sites	2-87
2-34	Ambient Monitoring Data Used to Derive Background Concentrations	2-88
2-35	Proposed Background Concentrations for Criteria Pollutants	2-90
3-1	Reference Solid Waste Composition	3-8
3-2	Reference Solid Waste Ultimate Analysis	3-8

3-3 Pretreatment Requirements for the Fort Myers Central Advanced Wastewater Treatment Plant 3-13
5-1 Projected Solid Waste Quantities, Lee and Hendry Counties, 1995-2010 5-8
5-2 Comparison of Maximum Increases and Combined Facility Impacts to the NAAQS/FAAQS 5-11
5-3 Comparison of Maximum Increases and Combined Facility Impacts to PSD Class II Increments 5-12
5-4 Lee County Energy Recovery Facility; Facility Noise Levels 5-14
9-1 Contacts and Correspondence 9-1

LIST OF FIGURES

Figure **Following Page**

2-1 General Location Map 2-1
2-2 Site Layout 2-1
2-3a Aerial of Facility Site – February 1999 2-1
2-3b Aerial of Facility Site – May 2002 2-1
2-4 Abutting Properties 2-2
2-5 Existing and Closed Landfills 2-2
2-6 Site Civil Plot Plan 2-2
2-7 Flood Hazard Map 2-4
2-8 Governmental Jurisdictions Within a Five-Mile Radius 2-4
2-9a County Future Land Use Map 2-8
2-9b City of Fort Myers Future Land Use Map 2-8
2-10 Existing Land Uses 2-14
2-11 Census Tract Outline Map 2-16
2-12 Water and Wastewater Treatment Plant Locations 2-44
2-13a Water Table Aquifer - Wet Season 2-57
2-13b Water Table Aquifer - Dry Season 2-57
2-14 Permitted Wells Within a Five-Mile Radius 2-60
2-15 Habitat Survey Results 2-69
2-16 Wildlife Survey Results 2-69
2-17 Page Field Airport – Fort Myers, FL NWS Station # 12835 January 1990-December 1994 2-80
2-18 Page Field Airport – Fort Myers, FL NWS Station # 12835 January 1990-1994 2-80
2-19 Page Field Airport – Fort Myers, FL NWS Station # 12835 February 1990-1994 2-80
2-20 Page Field Airport – Fort Myers, FL NWS Station # 12835 March 1990-1994 2-80

2-21 Page Field Airport – Fort Myers, FL NWS Station # 12835 April 1990-1994 2-80
2-22 Page Field Airport – Fort Myers, FL NWS Station # 12835 May 1990-1994 2-80
2-23 Page Field Airport – Fort Myers, FL NWS Station # 12835 June 1990-1994 2-80
2-24 Page Field Airport – Fort Myers, FL NWS Station # 12835 July 1990-1994 2-80
2-25 Page Field Airport – Fort Myers, FL NWS Station # 12835 August 1990-1994 2-80
2-26 Page Field Airport – Fort Myers, FL NWS Station # 12835 September 1990-1994 2-80
2-27 Page Field Airport – Fort Myers, FL NWS Station # 12835 October 1990-1994 2-80
2-28 Page Field Airport – Fort Myers, FL NWS Station # 12835 November 1990-1994 2-80
2-29 Page Field Airport – Fort Myers, FL NWS Station # 12835 December 1990-1994 2-80
3-1 Typical Stoker Mass-Burn Facility 3-3
3-2a Architectural Building Elevations 3-5
3-2b General Arrangement Section A-A 3-5
3-3 Water Balance Diagram 3-11
3-4 Basin and Sub-Basin Boundaries 3-17
4-1 Estimated Work Force Requirement During Construction 4-9

MALCOLM PIRNIE

SUPPLEMENTAL APPLICATION FOR POWER PLANT SITE CERTIFICATION

VOLUME III – AIR QUALITY

LEE COUNTY ENERGY RECOVERY FACILITY
PREVENTION OF SIGNIFICANT DETERIORATION
AIR PERMIT APPLICATION FOR
MUNICIPAL WASTE COMBUSTOR UNIT 3

INTRODUCTION

This Volume III – Air Quality of the Supplemental Site Certification Application contains Lee County's Prevention of Significant Deterioration (PSD) application (PSD Application) for the addition of a third municipal waste combustor unit at the existing Lee County Energy Recovery Facility (LCERF). Malcolm Pirnie, Inc., as the Engineer-of-Record for the LCERF is responsible for this permitting effort and has retained and coordinated the services necessary to complete this project in cooperation with other professionals and Lee County, a Political Subdivision of the State of Florida.

This PSD Application is submitted in accordance with Rule 62-212.400 F.A.C. and 40 CFR 52.21. Section 9-Attachment A of the PSD Application contains the completed Florida Department of Environmental Protection Air Permit Application Forms. Additionally, as required by 40 CFR 60.59b(a), Section 9-Attachment B contains a copy of the notification of the public meeting for the Preliminary Draft Materials Separation Plan (the "Plan"), and the transcript of the public meeting regarding this Plan. Volume II, Appendix 3.1 of the Supplemental Site Certification Application contains the Plan and the responses to public comments regarding this Plan.

Lee County proposes Best Available Control Technology to be Good Combustion Practices for the control of volatile organic compounds and carbon monoxide; a Spray Dryer Absorber and Fabric Filter baghouse for control of sulfur dioxide, municipal waste combustor Acid Gases (sulfur dioxide and hydrogen chloride), and particulate matter less than 10 microns in diameter; activated carbon injection for control of mercury; and selective non-catalytic reduction for control of nitrogen oxides.

Lee County proposes emission limits lower than the New Source Performance Standards (NSPS) under 40 CFR 60, Subpart Eb, and lower than existing permit limits for municipal waste combustion Units 1 and 2 at the LCERF, for particulate matter; sulfur dioxide; volatile organic compounds; and fluorides. Emission limits for other pollutants are proposed at NSPS levels (e.g., carbon monoxide, cadmium, hydrogen chloride, lead,

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mercury, MWC organics, and nitrogen oxides). Actual emissions from municipal waste combustion Unit 3 are expected to be lower than the limits proposed by Lee County.

The PSD Application includes a Best Available Control Technology (BACT) evaluation for all applicable emissions, including technology evaluations and the means to achieve the proposed emission limits. The Nitrogen Oxides (NOx) BACT analysis is contained in Section 4.6 of this PSD Application. The NOx BACT technical review, with economic and engineering considerations led to the selection of Selective Non-Catalytic Reduction (SNCR) as the recommended BACT for NOx, as explained in detail in Section 4.6.

Best Available Control Technology-NOx BACT Additional Considerations

This PSD Application Introduction provides supplementary information for consideration that reinforces the SNCR BACT recommendation. Malcolm Pirnie, Inc. evaluated the cost impacts to the LCERF Unit 3 expansion project based on the Covanta Lee, Inc. SNCR cost estimate and the Babcock Borsig Power (BBP) SCR cost estimate. These cost estimates were used because they are considered to be the most complete, to be based on the equipment supplier's with waste-to-energy experience, and to be the most realistic cost estimates.

The information contained in the following figures and table depicts the economic impact to the LCERF capital and operational costs should selective Catalytic Reduction (SCR) be considered for municipal waste combustion Unit 3. Additionally the incremental cost of NOx removal for SCR relative to SNCR is also presented and reinforces the conclusion for selection of SNCR as NOx BACT.

Capital Cost Impacts

An evaluation of the Capital Cost impact to the LCERF Unit 3 expansion in considering SCR compared to SNCR was performed for 2002 dollars. Figure I-1 provides a graphic summary of the financial implications of SCR capital costs to the LCERF Unit 3 expansion project. The initial preliminary capital cost estimate of 74 million for the LCERF Unit 3 expansion project assumed that Unit 3 would be constructed utilizing a similar, but not identical, configuration as existing Units 1 and 2 (i.e. SNCR). It is clear from Figure I-1 that if SCR is proposed for Unit 3, it will have a significant impact to the Capital Costs, and will result in an increase of 21 percent, which is opined to be economically prohibitive.

Operating Cost Impacts

A 20-year municipal waste processing cost ("Operating Costs") impact analysis was performed for SNCR and SCR NOx removal technologies and is summarized in Figure I-2. The following assumptions were used for this analysis:

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- Unit 3 is projected to reach the design capacity of 600 tpd (nominal) in 2009 and at this point is assumed to have 90 percent availability;
- Operating Costs are based on 7 percent annual interest, 20-year scenario; and
- Operating Costs consist of vendor operating fees and debt service payments minus energy revenues.

Figure I-2 clearly shows that the impact to the LCERF Unit 3 Operating Costs is significantly higher if SCR is considered for NOx control versus SNCR. The increased Operating Cost for Unit 3 utilizing SCR, compared to Unit 3 utilizing SNCR is approximately 40 percent. Additionally, on a Net Present Value basis the utilization of SCR on Unit 3 would correspond to an expanded LCERF (i.e. Units 1, 2 & 3) 20-year Operating Cost increase of 14 percent over that of SNCR and is considered to be a significant economic impact.

Incremental Cost Analysis

In addition to evaluating and presenting the significant economic impacts on the LCERF Unit 3 Capital and Operating Costs, an Incremental Cost Analysis was also performed for comparison of SCR versus SNCR NOx control. Table I-1 provides the Incremental Cost Analysis for NOx removal (i.e. the additional capital costs for SCR divided by the additional tons of NOx removed).

As depicted in Table I-1, the incremental cost ($23,658) is extremely high on the basis of a cost per ton of NOx removed.

Other Salient Cost Considerations

Typically for a capital improvement project of this magnitude there are other costs to the County that have not been considered in the above cost analyses. These additional costs may include:

- Outside Financial Services
- Outside Legal (Bond) Counsel
- Outside Legal (Bond) Disclosure Counsel
- Owner's Agent Services

It is important to note that these costs will be relatively higher for more expensive capital improvement projects. Therefore it is not unreasonable to assume that the projected cost impacts may be higher than the estimated cost impacts presented in Figure I-1, Figure I-2 and Table I-1.

Figure I-2 Unit 3 MSW Processing - Operating Cost Impacts

(Based on 7% Interest Rate & 20 Year Life)

Operatimg Cost = O&M Fee Paid to the Operator + Debt Service Expenses - Energy Revenue, on per ton MSW basis, Estimated

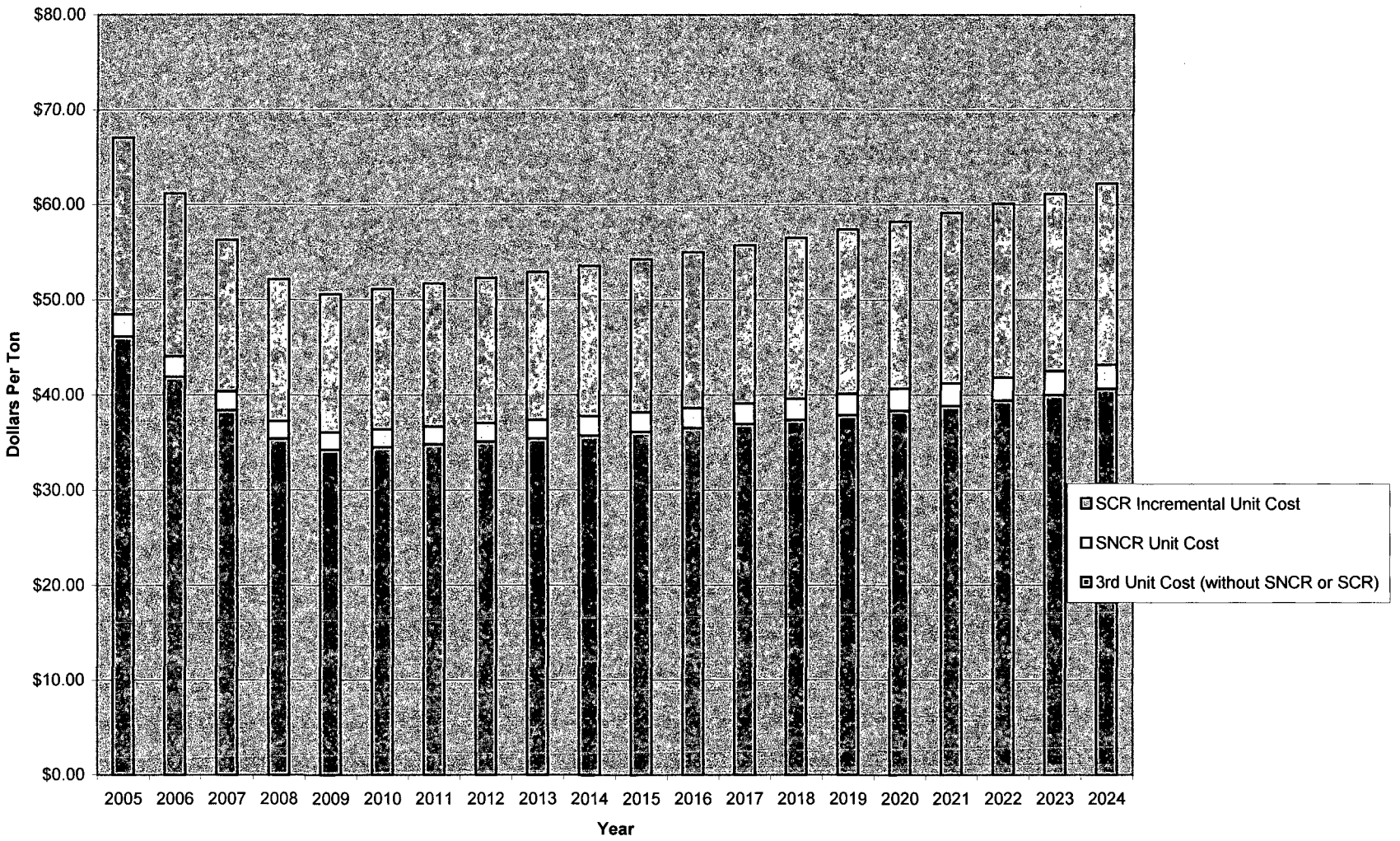

Table I-1 - Unit 3 Incremental NOx Removal Cost Analysis

Case No.	Controlled NOx ppmdv @ 7% O2	NOx Removed tons per year	Incremental NOx Removal, tpy	Annualized Cost of NOx Removal	Cost of NOx Removal dollars per ton ($/t)	Incremental Cost of NOx Removal, $/t
	Note (1)			Note (2)	Note (2)	Notes (2) (3)
SNCR	150	206	Base	$415,308	$2,016	Base
SCR (BBP)	100	301	95	$2,662,774	$8,846	$23,658

Note 1: Controlled NOx performance level is estimated for long term sustained operation
Note 2: Based on 7% annual interest rate and 20 years amortization
Note 3: This column includes incremental cost of removing NOx using SCR over the cost of removing NOx using SNCR

LEE COUNTY ENERGY RECOVERY FACILITY
LEE COUNTY SOLID WASTE DIVISION
LEE COUNTY, FLORIDA

PREVENTION OF SIGNIFICANT DETERIORATION
AIR PERMIT APPLICATION

MAJOR MODIFICATION TO ADD A THIRD
MUNICIPAL WASTE COMBUSTOR UNIT
TO THE EXISTING
LEE COUNTY ENERGY RECOVERY FACILITY

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October 31, 2002

LEE COUNTY ENERGY RECOVERY FACILITY
PREVENTION OF SIGNIFICANT DETERIORATION (PSD)
APPLICATION FOR MUNICIPAL WASTE COMBUSTOR UNIT 3

TABLE OF CONTENTS

SECTION	SECTION NAME	PAGE
1	EXECUTIVE SUMMARY	
1.1	INTRODUCTION	1-1
1.2	THE EXISTING FACILITY	1-1
1.3	THE PROPOSED FACILITY MODIFICATION	1-3
1.4	STRUCTURE OF PSD APPLICATION	1-4
1.5	SUMMARY OF IMPACTS AND CONCLUSIONS	1-4
1.6	SPECIFIC PERMIT ISSUES	1-5
2	REGULATORY REVIEW	
2.1	APPLICABLE REGULATIONS	2-1
2.2	FLORIDA STATE PROGRAM AUTHORITY	2-1
2.3	PREVENTION OF SIGNIFICANT DETERIORATION (PSD)	2-2
2.3.1	SOURCE APPLICABILITY	2-3
2.3.2	POLLUTANT APPLICABILITY	2-3
3	AIR POLLUTANT EMISSIONS	
3.1	INTRODUCTION	3-1
3.2	BASIS FOR EMISSION LIMITS	3-1
3.3	COMPOSITION OF MUNICIPAL SOLID WASTE	3-7
3.4	PARTICULATE MATTER AND PM_{10}	3-8
3.5	MWC ACID GASES	3-8
3.5.1	SULFUR DIOXIDE	3-8
3.5.2	SULFURIC ACID MIST	3-9
3.5.3	HYDROGEN CHLORIDE	3-9
3.5.4	FLUORIDES	3-10
3.6	CARBON MONOXIDE	3-11
3.6.1	ADDITIONAL CARBON MONOXIDE MALFUNCTION REGULATIONS	3-11
3.7	NITROGEN OXIDES	3-12
3.8	MWC METALS	3-13
3.8.1	MERCURY	3-14
3.8.2	LEAD	3-14
3.8.3	CADMIUM	3-15
3.8.4	ARSENIC	3-15
3.8.5	BERYLLIUM	3-16
3.9	MWC ORGANICS	3-17
3.10	VOLATILE ORGANIC COMPOUNDS	3-17
3.11	VINYL CHLORIDE	3-18
3.12	TOTAL REDUCED SULFUR	3-18

LEE COUNTY ENERGY RECOVERY FACILITY
PSD APPLICATION FOR MUNICIPAL WASTE COMBUSTOR UNIT 3

TABLE OF CONTENTS (CONTINUED)

SECTION	SECTION NAME	PAGE
3.13	REDUCED SULFUR COMPOUNDS	3-18
3.14	HYDROGEN SULFIDE	3-18
3.15	AMMONIA	3-18
3.16	TOTAL HAZARDOUS AIR POLLUTANTS	3-19
4	BEST AVAILABLE CONTROL TECHNOLOGY EVALUATION	
4.1	DESCRIPTION OF CONTROL TECHNOLOGY REVIEW	4-1
4.2	PROPOSED CONTROL TECHNOLOGIES	4-2
4.3	MATERIALS SEPARATION	4-3
4.4	BACT REVIEW FOR PARTICULATE MATTER (PM_{10}) AND MWC METALS	4-4
4.4.1	PARTICULATE FORMATION MECHANISMS	4-4
4.4.2	SOURCE SEPARATION IMPACT ON PARTICULATE EMISSIONS	4-5
4.4.3	AVAILABLE CONTROL TECHNOLOGIES	4-5
4.4.4	SELECTION OF BACT	4-6
4.5	BACT REVIEW FOR SULFUR DIOXIDE, MWC ACID GASES, AND SULFURIC ACID MIST	4-6
4.5.1	FORMATION MECHANISMS	4-6
4.5.2	SOURCE SEPARATION IMPACT ON MWC ACID GAS EMISSIONS	4-7
4.5.3	AVAILABLE CONTROL TECHNOLOGIES	4-9
4.5.4	RANKING OF ALTERNATIVE CONTROL TECHNOLOGIES	4-18
4.5.5	ENVIRONMENTAL IMPACT	4-18
4.5.6	ECONOMIC IMPACT	4-20
4.5.7	ENERGY IMPACT	4-22
4.5.8	SELECTION OF BACT	4-22
4.6	BACT REVIEW FOR NITROGEN OXIDES	4-23
4.6.1	FORMATION MECHANISMS	4-23
4.6.2	SOURCE SEPARATION IMPACT ON NITROGEN OXIDES EMISSIONS	4-24
4.6.3	AVAILABLE CONTROL TECHNOLOGIES	4-25
4.6.4	RANKING OF ALTERNATIVE CONTROL TECHNOLOGIES	4-39
4.6.5	ENVIRONMENTAL IMPACT	4-39
4.6.6	ECONOMIC IMPACT	4-39
4.6.7	ENERGY IMPACT	4-45
4.6.8	SELECTION OF BACT	4-45
4.7	BACT REVIEW FOR CARBON MONOXIDE	4-45
4.7.1	FORMATION MECHANISMS	4-45

LEE COUNTY ENERGY RECOVERY FACILITY
PSD APPLICATION FOR MUNICIPAL WASTE COMBUSTOR UNIT 3

TABLE OF CONTENTS (CONTINUED)

SECTION	SECTION NAME	PAGE
4.7.2	SOURCE SEPARATION IMPACT ON CARBON MONOXIDE	4-47
4.7.3	AVAILABLE CONTROL TECHNOLOGIES	4-48
4.7.4	RANKING OF ALTERNATIVE CONTROL TECHNOLOGIES	4-49
4.7.5	ENVIRONMENTAL IMPACT	4-50
4.7.6	ECONOMIC IMPACT	4-50
4.7.7	ENERGY IMPACT	4-50
4.7.8	SELECTION OF BACT	4-50
4.8	BACT REVIEW FOR MWC ORGANICS	4-51
4.8.1	FORMATION MECHANISMS	4-51
4.8.2	SOURCE SEPARATION IMPACT ON MWC ORGANICS	4-51
4.8.3	AVAILABLE CONTROL TECHNOLOGIES	4-52
4.8.4	RANKING OF ALTERNATIVE CONTROL TECHNOLOGIES	4-53
4.8.5	ENVIRONMENTAL IMPACT	4-54
4.8.6	ECONOMIC IMPACT	4-54
4.8.7	ENERGY IMPACT	4-54
4.8.8	SELECTION OF BACT	4-54
4.9	BACT REVIEW FOR MERCURY EMISSIONS	4-54
4.9.1	FORMATION MECHANISMS	4-55
4.9.2	SOURCE SEPARATION IMPACT ON MERCURY EMISSIONS	4-55
4.9.3	AVAILABLE CONTROL TECHNOLOGIES	4-56
4.9.4	RANKING OF ALTERNATIVE CONTROL TECHNOLOGIES	4-58
4.9.5	SELECTION OF BACT	4-58
4.10	SUMMARY OF PSD APPLICABLE POLLUTANTS AND PROPOSED BACT	4-58
5	EXISTING AMBIENT AIR QUALITY	
5.1	AMBIENT AIR QUALITY STANDARDS	5-1
5.2	AMBIENT MONITORING DATA	5-1
5.3	BASELINE AIR QUALITY	5-4
5.4	ATTAINMENT STATUS	5-8
6	AIR QUALITY IMPACT ANALYSES	
6.1	MODEL SELECTION AND OPTIONS	6-1
6.2	METEOROLOGICAL DATA	6-2
6.3	RECEPTOR DATA	6-3
6.4	SOURCE DATA	6-3
6.5	SCREENING MODELING ANALYSIS	6-11
6.6	REFINED MODELING ANALYSIS	6-13

LEE COUNTY ENERGY RECOVERY FACILITY
PSD APPLICATION FOR MUNICIPAL WASTE COMBUSTOR UNIT 3

TABLE OF CONTENTS (CONCLUDED)

SECTION	SECTION NAME	PAGE
6.7	SIGNIFICANT IMPACT LEVELS	6-24
6.8	DE MINIMIS MONITORING LEVELS	6-24
6.9	PSD CLASS II INCREMENTS	6-24
6.10	AMBIENT AIR QUALITY STANDARDS	6-29
6.11	AMBIENT REFERENCE CONCENTRATIONS	6-31
7	ADDITIONAL IMPACT ANALYSES	
7.1	LOCAL VISIBILITY IMPACTS	7-1
7.2	MINOR SOURCE GROWTH	7-3
7.3	SOILS AND VEGETATION	7-5
7.4	STARTUP, SHUTDOWN AND MALFUNCTION CONDITIONS	7-8
7.5	RISK ASSESSMENT ANALYSES	7-12
7.6	PSD CLASS I ANALYSIS	7-17
7.6.1	PSD CLASS I INCREMENT ANALYSIS	7-19
7.6.2	PSD CLASS I AIR QUALITY RELATED VALUES	7-19
7.6.2.1	ACID DEPOSITION ANALYSES	7-21
7.6.2.2	REGIONAL HAZE ANALYSIS	7-21
8	REFERENCES	8-1
9	ATTACHMENTS	
A	FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION AIR PERMIT APPLICATION FORMS	
B	TRANSCRIPT OF PUBLIC MEETING REGARDING PRELIMINARY DRAFT MATERIALS SEPARATION PLAN	
C	LIST OF PERSONS CONTACTED DURING PREPARATION OF BEST AVAILABLE CONTROL TECHNOLOGY	
D	LIST OF FACILITIES INCORPORATING SELECTIVE CATALYTIC REDUCTION	
E	SELECTIVE CATALYTIC REDUCTION SYSTEM BUDGETARY ESTIMATES RECEIVED DURING PREPARATION OF BEST AVAILABLE CONTROL TECHNOLOGY ANALYSIS AND SUPPORTING CORRESPONDENCE	
F	COST REMOVAL VALUES FOR NITROGEN OXIDES	
G	VERIFICATION OF FACILITY RISK MANAGEMENT PLAN SUBMISSION AND COMPLETENESS	

LEE COUNTY ENERGY RECOVERY FACILITY
PSD APPLICATION FOR MUNICIPAL WASTE COMBUSTOR UNIT 3

LIST OF TABLES

TABLE NO.	TABLE NAME	PAGE
TABLE 2-1	PSD POLLUTANT APPLICABILITY FOR THE ADDITION OF MWC UNIT 3 TO THE LCERF	2-4
TABLE 3-1	PROPOSED EMISSION FACTORS FOR LCERF'S MWC UNIT 3	3-5
TABLE 4-1	CONTROL EFFICIENCIES OF SULFUR DIOXIDE AND ACID GAS CONTROL TECHNOLOGIES	4-19
TABLE 4-2	ALTERNATIVE CONTROL METHODS FOR NITROGEN OXIDES	4-26
TABLE 4-3	SAMPLE LIST OF EUROPEAN MUNICIPAL WASTE COMBUSTION FACILITIES UTILIZING SCR AND THEIR AIR POLLUTION CONTROL EQUIPMENT CONFIGURATION	4-32
TABLE 4-4	EUROPEAN MUNICIPAL WASTE COMBUSTION FACILITY EMISSIONS INFORMATION RECEIVED DURING THE BACT PREPARATION PROCESS	4-33
TABLE 4-5	COMPARISON OF COST ITEMS IN SCR BUDGETARY ESTIMATES RECEIVED DURING BACT PREPARATION	4-42
TABLE 4-6	POLLUTANTS APPLICABLE TO PSD REVIEW AND PROPOSED BACT	4-59
TABLE 5-1	NATIONAL AND FLORIDA STATE AMBIENT AIR QUALITY STANDARDS	5-2
TABLE 5-2	NEAREST AMBIENT AIR QUALITY MONITORING SITES	5-3
TABLE 5-3	NEARBY AMBIENT AIR QUALITY DATA	5-5
TABLE 5-4	COMPARISON OF BASELINE CONCENTRATIONS TO AMBIENT AIR QUALITY STANDARDS	5-7
TABLE 6-1	STACK CHARACTERISTICS	6-5
TABLE 6-2	STACK GAS CONDITIONS FOR PROPOSED MWC UNIT 3	6-8
TABLE 6-3	ISCST3 SCREENING RESULTS FOR PROPOSED MWC UNIT ONLY	6-12
TABLE 6-4	STACK GAS CONDITIONS FOR LEE COUNTY FACILITY	6-14
TABLE 6-5	ISCST3 REFINED RESULTS FOR LEE COUNTY FACILITY	6-15
TABLE 6-6	MAXIMUM CRITERIA POLLUTANT IMPACTS FOR THE LEE COUNTY FACILITY EXPANSION	6-16
TABLE 6-7	COMPARISON OF MAXIMUM INCREASES AND FACILITY IMPACTS TO SIGNIFICANT IMPACT LEVELS	6-27

LEE COUNTY ENERGY RECOVERY FACILITY
PSD APPLICATION FOR MUNICIPAL WASTE COMBUSTOR UNIT 3

LIST OF TABLES (CONCLUDED)

TABLE NO.	TABLE NAME	PAGE
TABLE 6-8	COMPARISON OF MAXIMUM INCREASES AND FACILITY IMPACTS TO DE MINIMIS MONITORING LEVELS	6-28
TABLE 6-9	COMPARISON OF MAXIMUM INCREASES AND FACILITY IMPACTS TO PSD CLASS II INCREMENTS	6-30
TABLE 6-10	COMPARISON OF MAXIMUM INCREASES AND FACILITY IMPACTS TO AMBIENT AIR QUALITY STANDARDS	6-32
TABLE 6-11	COMPARISON OF MAXIMUM INCREASES AND FACILITY IMPACTS TO AMBIENT REFERENCE CONCENTRATIONS	6-33
TABLE 7-1	MODELING RESULTS FOR LEE COUNTY ENERGY RECOVERY FACILITY RISK ASSESSMENT FOR COMBINED (PROPOSED AND EXISTING) MWC UNITS	7-15
TABLE 7-2	COMPARISON OF MAXIMUM CLASS I IMPACTS TO USEPA PROPOSED SIGNIFICANT IMPACT LEVELS AND CLASS I INCREMENTS	7-20
TABLE 7-3	MODELING INPUTS FOR CALPUFF DEPOSITION ANALYSES	7-22
TABLE 7-4	MAXIMUM MODEL-PREDICTED NITROGEN AND SULFUR DEPOSITION RATES	7-23
TABLE 7-5	MODEL-PREDICTED CHANGE IN LIGHT EXTINCTION IN EVERGLADES NATIONAL PARK	7-25

LEE COUNTY ENERGY RECOVERY FACILITY
PSD APPLICATION FOR MUNICIPAL WASTE COMBUSTOR UNIT 3

LIST OF FIGURES

FIGURE NO.	FIGURE NAME	PAGE
FIGURE 1-1	GENERAL LOCATION OF THE LEE COUNTY ENERGY RECOVERY FACILITY	1-2
FIGURE 6-1	MWC UNIT 3 OPERATING WINDOW	6-7
FIGURE 6-2	CROSS-SECTIONAL VIEW OF LEE COUNTY ENERGY RECOVERY FACILITY	6-9
FIGURE 6-3	PLAN VIEW OF LEE COUNTY ENERGY RECOVERY FACILITY	6-10
FIGURE 6-4	MAXIMUM INCREASES IN FACILITY 1-HOUR CO IMPACTS (ug/m^3)	6-18
FIGURE 6-5	MAXIMUM INCREASES IN FACILITY 8-HOUR CO IMPACTS (ug/m^3)	6-19
FIGURE 6-6	MAXIMUM INCREASES IN FACILITY ANNUAL NO_X IMPACTS (ug/m^3)	6-20
FIGURE 6-7	MAXIMUM INCREASES IN FACILITY 3-HOUR SO_2 IMPACTS (ug/m^3)	6-21
FIGURE 6-8	MAXIMUM INCREASES IN FACILITY 24-HOUR SO_2 IMPACTS (ug/m^3)	6-22
FIGURE 6-9	MAXIMUM INCREASES IN FACILITY ANNUAL SO_2 IMPACTS (ug/m^3)	6-23
FIGURE 6-10	MAXIMUM INCREASES IN FACILITY 24-HOUR PM_{10} IMPACTS (ug/m^3)	6-25
FIGURE 6-11	MAXIMUM INCREASES IN FACILITY ANNUAL PM_{10} IMPACTS (ug/m^3)	6-26
FIGURE 7-1	MAXIMUM IMPACT LOCATIONS FOR RISK ASSESSMENTS	7-16

ACRONYMS AND ABBREVIATIONS

AAQS	Ambient Air Quality Standard
acf	Actual Cubic Feet
acfm	Actual Cubic Feet Per Minute
ACI	Activated Carbon Injection
APC	Air Pollution Control (Equipment)
AQCR	Air Quality Control Region
AQRV	Air Quality Related Values
ARC	Ambient Reference Concentration
As	Arsenic
ASME	American Society of Mechanical Engineers
avg	Average
BACT	Best Available Control Technology
Be	Beryllium
BPIP	USEPA Building Profile Input Program
BTU	British Thermal Unit
C	Degrees Celsius (Temperature Scale)
C&D	Construction and Demolition Waste
CAA	Clean Air Act
CARB	California Air Resources Board
CEM	Continuous Emissions Monitoring
cfm	Cubic Feet Per Minute
CFR	Code of Federal Regulations
CO	Carbon Monoxide
CO_2	Carbon Dioxide
Covanta	Covanta Lee, Inc.
dscf	Dry Standard Cubic Feet
dscfm	Dry Standard Cubic Feet Per Minute
dscm	Dry Standard Cubic Meter
ESP	Electrostatic Precipitator
°F	Degrees Fahrenheit (Temperature Scale)
FAA	Federal Aviation Administration
FAAQS	Florida Ambient Air Quality Standards
F.A.C.	Florida Administrative Code (Regulations)
FDEP	Florida Department of Environmental Protection
FF	Fabric Filter (Baghouse)
FGD	Flue Gas Desulfurization
FR	Federal Register
GCP	Good Combustion Practices
GEP	Good Engineering Practice (Stack Height)
gr/cf	Grams Per Cubic Foot
gr/dscf	Grams Per Dry Standard Cubic Foot
g/s	Grams Per Second
ha	Hectare

ACRONYMS AND ABBREVIATIONS (CONTINUED)

HAPs	Hazardous Air Pollutants
HDPE	High Density Polyethylene
HF	Hydrogen Fluoride
Hg	Mercury
HHV	Higher Heating Value
HHW	Household Hazardous Waste
hrs/yr	Hours Per Year
ISC	Industrial Source Complex Model
ISCST	Industrial Source Complex Short-Term Model
km	Kilometer
LAER	Lowest Achievable Emission Rate
lb/hr	Pounds Per Hour
LCERF	Lee County Energy Recovery Facility
m^3	Cubic Meters
mg	Milligram
MACT	Maximum Achievable Control Technology
MMBTU	Million British Thermal Units
MSW	Municipal Solid Waste
MW	Megawatts
MWC	Municipal Waste Combustor
NAAQS	National Ambient Air Quality Standards
NCDC	National Climatic Data Center
NEMA	National Electrical Manufacturers Association
NESHAPs	National Emission Standards for Hazardous Air Pollutants
ng	Nanogram
ng/Nm^3	Nanograms Per Normal Cubic Meter
NMHC	Non-Methane Hydrocarbons
NO	Nitrogen Oxide
NO_2	Nitrogen Dioxide
NOx	Nitrogen Oxides
NPS	(U.S.) National Park Service
NSPS	New Source Performance Standards
NSR	Non-Attainment New Source Review
NWS	National Weather Service
O_2	Oxygen
O_3	Ozone
OAQPS	(USEPA) Office of Air Quality Planning and Standards
Pb	Lead
PCDD	Polychlorinated dibenzo-p-dioxin
PCDF	Polychlorinated dibenzofurans
PM	Particulate Matter
$PM_{2.5}$	Particulate Matter with an Aerodynamic Diameter Less Than 2.5 Microns

ACRONYMS AND ABBREVIATIONS (CONCLUDED)

PM_{10}	Particulate Matter with an Aerodynamic Diameter Less Than 10 Microns
ppb	Parts Per Billion
ppm	Parts Per Million
ppmdv	Parts Per Million By Volume (Dry Basis)
ppmv	Parts Per Million By Volume
PPSA	(Florida Electrical) Power Plant Siting Act
PSD	Prevention of Significant Deterioration
PVC	Polyvinyl Chloride
REMAP	Reference Methods, Accuracy And Precision
SAM	Sulfuric Acid Mist
SCR	Selective Catalytic Reduction
SDA	Spray Dry Absorption (a.k.a. Semi-Dry Scrubber)
SIL	Significant Impact Level
SIP	State Implementation Plan
SNCR	Selective Non-Catalytic Reduction
SO_2	Sulfur Dioxide
S/S/M	Start-Up, Shutdown, and Malfunction
TCDD	Tetrachlorodibenzo-p-dioxin
TCDF	Tetrachlorodibenzofurans
TLV	Threshold Limiting Value
tpd	Tons Per Day
tpy	Tons Per Year
TSP	Total Suspended Particulates
ug	Microgram
um	Micrometer (micron)
Unit 1	Existing MWC Unit Number 1 at the LCERF (not modified)
Unit 2	Existing MWC Unit Number 2 at the LCERF (not modified)
Unit 3	Proposed New MWC Unit Number 3 at the LCERF
UPL	Upper Predicted Limits
U.S.	United States of America
USEPA	U.S. Environmental Protection Agency
UTM	Universal Transverse Mercator (Coordinate System)
VOC	Volatile Organic Compounds

LEE COUNTY ENERGY RECOVERY FACILITY
PREVENTION OF SIGNIFICANT DETERIORATION
APPLICATION FOR MUNICIPAL WASTE COMBUSTOR UNIT 3

SECTION 1
EXECUTIVE SUMMARY

October 31, 2002

SECTION 1
EXECUTIVE SUMMARY

1.1 INTRODUCTION

Lee County and Hendry County have entered into an interlocal agreement that requires them to jointly provide an integrated solid waste management system to satisfy the needs of their residents. The system includes three major components: (1) an aggressive materials separation program; (2) a waste-to-energy facility that is located in Lee County and known as the Lee County Energy Recovery Facility (LCERF); and (3) a landfill located in Hendry County. Lee County now wishes to expand the LCERF so that the two counties can continue to satisfy the public demand for efficient, environmentally sound, and cost-effective solid waste disposal services.

This document contains Lee County's Prevention of Significant Deterioration (PSD) application for approval of the expansion project. Specifically as required by Rule 62-212.400, Florida Administrative Code (F.A.C.) and 40 CFR 52.21, this is Lee County's application for a PSD permit for a major modification of an existing major source, the LCERF.

1.2 THE EXISTING FACILITY

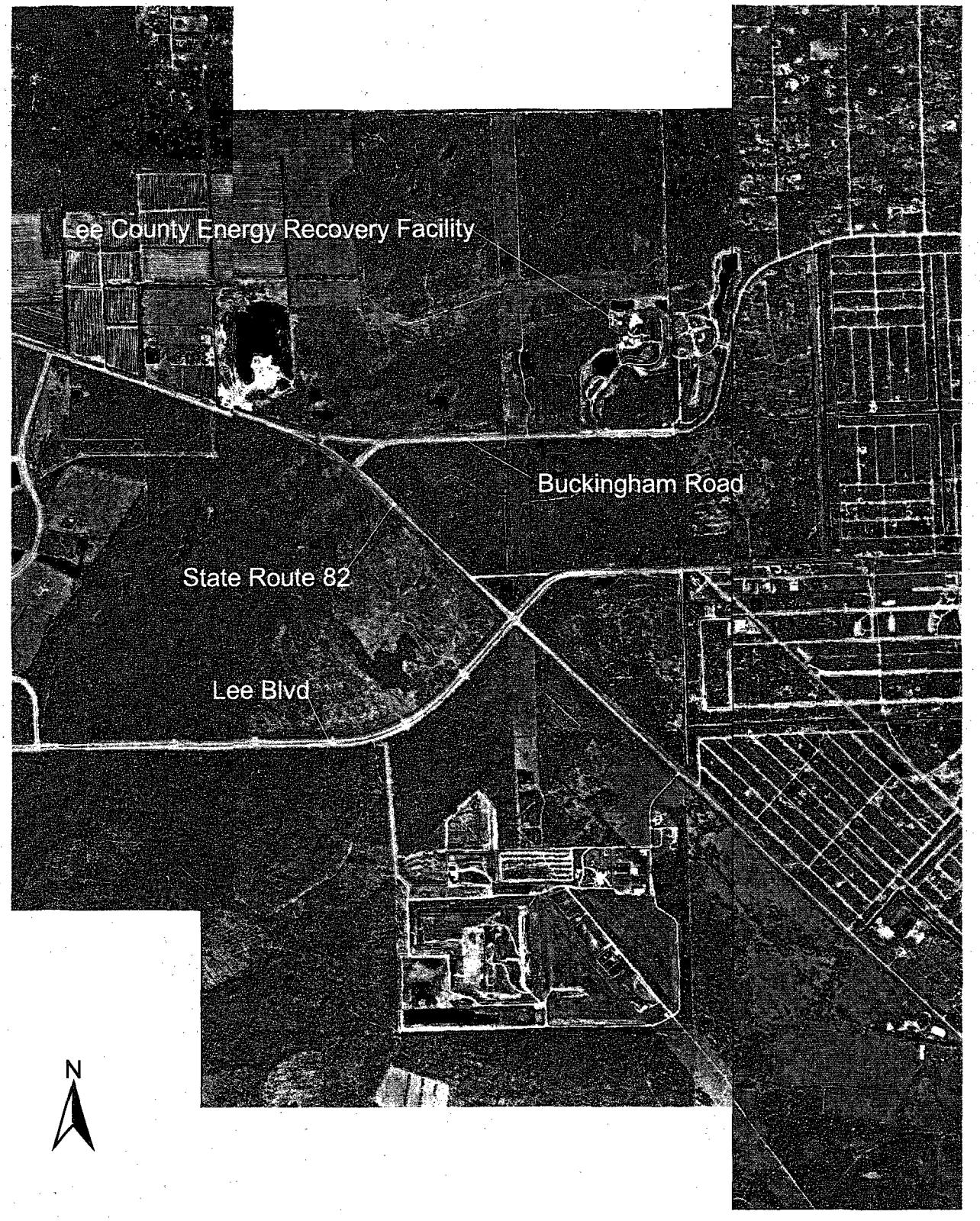
The LCERF is located at 10500 Buckingham Road, southeast of the City of Fort Myers, on a 155-acre site in an unincorporated portion of Lee County. The general location of the LCERF is shown in Figure 1-1. The specific coordinates for the LCERF are: Universal Transverse Mercator (UTM) Coordinates Zone 17, 424.21 km East and 2945.70 km North; Latitude 26° 37' 54" North, Longitude: 81° 45' 41" West.

The LCERF has been designed, built and operated by Covanta Lee, Inc. (Covanta; formerly Ogden Martin Systems of Lee, Inc.), pursuant to a long-term contract with Lee County. Covanta began commercial operations of the LCERF on December 1, 1994.

Lee County has obtained PSD and Title V permits authorizing the construction and operation of two municipal waste combustor (MWC) units at the LCERF. [See PSD-FL-151, PSD-FL-151A; PSD-FL-151B; and 0710119-001-AV]. In addition, the County obtained approval for the construction and operation of the LCERF pursuant to the Florida Electrical Power Plant Siting Act (PPSA), Sections 403.501 - .518, Florida Statutes. [See PPSA Case Number PA 90-30]. The PPSA approval expressly authorized an "ultimate site capacity" for the LCERF that is based on the use of three MWC units.

The LCERF currently is equipped with two MWC units (hereafter Units 1 and 2), which utilize the Martin reverse-reciprocating stoker grate technology. Each MWC unit is capable of processing 660 tons per day (tpd) of municipal solid waste (MSW) with a higher heating valve (HHV) of 5,000 British thermal units (BTU) per pound on an annual basis. The maximum heat input of each MWC unit is 275 million BTU (MMBTU) per hour on an annual basis. The LCERF converts solid waste into saleable energy through

FIGURE 1-1
GENERAL LOCATION OF THE LEE COUNTY ENERGY RECOVERY FACILITY



Prepared By:
RTP Environmental Associates, Inc.

the use of two water wall boilers and a steam turbine generator, which produces up to 40 megawatts (MW) of electricity. The LCERF operates on a small portion of the power it generates and the remaining electricity is sold.

Truck transport is used to deliver municipal solid waste to the LCERF and to remove ash residue from the LCERF. The MSW is brought inside the LCERF before it is dumped from the packer trucks into the refuse pit. All MSW is stored inside the fully enclosed LCERF prior to combustion and is not visible from the outside. Air is drawn from the tipping floor and refuse pit and then used in the combustion process. As a result, the tipping floor and refuse pit are kept under negative air pressure, which helps ensure that dust and odors do not escape into the ambient environment. Overhead cranes mix the MSW and then place it in charging hoppers that feed into the two MWC units. Large, bulky items and other non-processible wastes are removed and set aside for proper disposal elsewhere.

The airborne emissions from the LCERF's stack are controlled through a combination of good combustion practices (GCP), a scrubber (a.k.a. spray dry absorber or SDA), a fabric filter (FF) baghouse, an activated carbon injection (ACI) system, and a selective non-catalytic reduction (SNCR) system. Fabric filters also are used to control the emissions from the LCERF's lime silos and ash handling building. The lime silos store pebble lime, which is used to make lime slurry for the SDA. Particulate matter emissions may occur when the lime silos are loaded from delivery trucks.

Bottom ash from the MWC units, and fly ash from the fabric filters, are combined and wetted in an ash discharger and then transported inside fully enclosed conveyors to an ash management building, where ferrous and non-ferrous metals are removed. The combined ash residue is stored inside the ash management building until it is taken to the Hendry County landfill for disposal.

1.3 THE PROPOSED FACILITY MODIFICATION

Despite the comprehensive materials separation program implemented in Lee and Hendry Counties, the amount of solid waste delivered to the LCERF has increased every year since the LCERF began operating. This increase in solid waste generation is primarily due to population growth in the area. In 1999, the amount of solid waste received by the LCERF reached the facility's guaranteed annual capacity of 372,300 tons. In 2000, the LCERF processed over 392,000 tons of solid waste, but the County had to dispose of nearly 44,000 additional tons of processible solid waste in landfills because there was not sufficient capacity in the LCERF. Current population projections for Lee and Hendry Counties suggest that the amount of MSW will continue to increase, reaching nearly 550,000 tons by 2010. Since the County's aggressive materials separation program has not eliminated the need for more MSW disposal capacity, Lee County concluded that it should expand the LCERF, rather than increase its use of landfills.

Lee County will expand the LCERF by installing a third 660-tpd MWC unit (Unit 3) and associated equipment, which will increase the LCERF's capacity to 1,980-tpd. The

expansion also will include the installation of a new boiler, air pollution control system, and steam turbine generator for Unit 3.

Since the original PPSA application for the LCERF anticipated the installation of a third MWC unit, the design of the LCERF was planned to facilitate the addition of Unit 3. There is space available for an additional flue in the LCERF's stack, and the tipping floor and refuse pit have been sized to accommodate the operation of three MWC units at 1,980 tpd. Nonetheless, there is a need for an expansion to the switchyard, the ash management building and the turbine generator building. There also will need to be certain modifications and/or additions to some of the LCERF's common equipment and systems so that Unit 3 can be integrated into the existing facility. There are no PSD significant changes planned for Units 1 and 2 at this time; therefore, Units 1 and 2 are not subject to New Source Review.

1.4 STRUCTURE OF PSD APPLICATION

Section 2 (Regulatory Review) of this document contains a review of applicable air rules and regulations for the existing LCERF and proposed Unit 3 addition. Section 3 (Air Pollutant Emissions) details air pollutant emissions from municipal waste combustion and possible control options. Section 4 (Best Available Control Technology Evaluation) evaluates emissions control technologies and determines the Best Available Control Technology options based on environmental, economic and social impacts and feasibility. Section 5 (Existing Ambient Air Quality) describes the existing ambient air quality for the area surrounding the LCERF. The air quality impacts are discussed in Section 6 (Air Quality Impact Analyses) along with the approach used in the air quality dispersion modeling and results obtained from the modeling. Section 7 (Additional Impact Analyses) presents additional analyses required under PSD regulations and for the risk assessments in the PPSA permit application. Section 8 (References) contains references used in this document and attachments to this document are found in Section 9 (Attachments).

1.5 SUMMARY OF IMPACTS AND CONCLUSIONS

Lee County proposes Best Available Control Technology to be Good Combustion Practices for the control of volatile organic compounds (VOC) and carbon monoxide (CO); a SDA and FF baghouse for control of sulfur dioxide (SO_2), MWC Acid Gases (as SO_2 and hydrogen chloride [HCl]), and particulate matter less than 10 microns in diameter (PM_{10}); activated carbon injection for control of mercury (Hg); and selective non-catalytic reduction for control of nitrogen oxides (NOx).

Lee County proposes to accept emission limits lower than the New Source Performance Standards (NSPS) under 40 CFR 60, Subpart Eb, and lower than existing permit limits for Units 1 and 2 at the LCERF, for particulate matter; sulfur dioxide; volatile organic compounds; and fluorides. Emission limits for other pollutants will be proposed at NSPS levels (e.g., carbon monoxide, cadmium, hydrogen chloride, lead, mercury, MWC

organics, and nitrogen oxides. Actual emissions from Unit 3 are expected to be lower than the limits proposed by Lee County.

Maximum increases in facility impacts due to the third MWC unit were shown to be less than the federal and state ambient air quality standards (AAQS), Class I and Class II PSD increments, de minimis monitoring levels, and Florida ambient reference concentrations (ARCs). In fact, maximum increases in facility impacts due to the third MWC unit, as well as maximum future facility impacts for all three MWC units, were shown to be less than the significant impact levels (SILs) for PSD criteria pollutants for both Class I and Class II areas. Hence, for pollutants regulated under the PSD regulations, impacts from the third MWC unit as well as the entire future facility are considered to be indistinguishable from background concentrations and are therefore considered to be negligible.

1.6 SPECIFIC PERMIT ISSUES

Lee County proposes to test for the following pollutants during the initial compliance emissions test on Unit 3 and then, upon successful demonstration that the emission levels are equal to or below their proposed emissions level, Lee County proposes to have the emissions limits deleted from the PSD air permit for Unit 3.

- Sulfuric Acid Mist
- Fluorides
- Arsenic
- Beryllium
- Volatile Organic Compounds
- Ammonia

This deletion request is based on a history of non-detectable or very low concentrations measured during prior performance tests for Units 1 and 2 at the LCERF. Unit 3 will be very similar to Units 1 and 2. Testing of a pollutant that is not measurable is expensive, without providing any benefit to human health and the environment. Lee County proposes alternative compliance measures to ensure control of emissions from the above pollutants, such as temperature of the fabric filter baghouse and control of sulfur dioxide.

As noted in condition A.41 of the current Title V permit, special conditions already are in place in the existing permit for Units 1 and 2 for start-up/shutdown/malfunction (S/S/M) operations. Similar S/S/M conditions are proposed for Unit 3. Lee County also requests relief from the carbon monoxide emission standard under the Subpart Eb NSPS during periods of malfunction for up to 15 hours per occurrence as provided in the November 16, 2001 Federal Register (see Section 3.6.1 [Additional Carbon Monoxide Malfunction Regulations]).

LEE COUNTY ENERGY RECOVERY FACILITY
PREVENTION OF SIGNIFICANT DETERIORATION
APPLICATION FOR MUNICIPAL WASTE COMBUSTOR UNIT 3

SECTION 2
REGULATORY REVIEW

October 31, 2002

SECTION 2
REGULATORY REVIEW

This section discusses the air quality regulations promulgated by the U.S. Environmental Protection Agency (USEPA) and the Florida Department of Environmental Protection (FDEP) applicable to Lee County's proposed project.

2.1 APPLICABLE REGULATIONS

Air quality regulations promulgated by the USEPA and the FDEP establish ambient air quality standards and regulate the sources of air contaminants in order to achieve and maintain the ambient standards. The proposed expansion to the Lee County Energy Recovery Facility (LCERF) has been evaluated to ensure compliance with the following rules and regulations.

- Prevention of Significant Deterioration (PSD)
- Non-Attainment New Source Review (NSR)
- Ambient Air Quality Standards (AAQS)
- New Source Performance Standards (NSPS)
- National Emission Standards for Hazardous Air Pollutants (NESHAP)
- Federal Aviation Administration (FAA) regulations governing stack height
- FDEP Rules (Chapter 62, Florida Administrative Code [F.A.C.]) governing air pollution
- Florida Electrical Power Plant Siting Act (PPSA)

In many cases, the FDEP air pollution regulations reflect the standards established by the USEPA; however, with respect to those cases where the Florida rules represent a more restrictive requirement, the Florida regulation has been applied.

This section focuses on the PSD regulations and discusses the applicability of the PSD program to Lee County's proposed project with respect to the source (Unit 3) and individual pollutants emitted by Unit 3. The remaining regulations referenced above are discussed further in the PPSA application.

2.2 FLORIDA STATE PROGRAM AUTHORITY

The State of Florida has been delegated full authority by the USEPA to administer the State Implementation Plan (SIP). Additionally, the FDEP has an approved program for issuing permits for new and modified sources, thereby satisfying the requirements of USEPA's PSD regulations (40 CFR Part 52.21). The USEPA also has delegated responsibility to the FDEP for administration of the PSD program for sources subject to the PPSA.

2.3 PREVENTION OF SIGNIFICANT DETERIORATION (PSD)

The Clean Air Act (CAA) was amended in 1977 to incorporate the PSD program. To carry out the policies of the 1977 CAA amendments, USEPA 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, as directed by the amended CAA (40 CFR 52.21). PSD regulations apply to attainment areas. PSD attainment areas are those areas that have been designated as in attainment or unclassifiable with respect to meeting federal or state ambient air quality standards for regulated (criteria) pollutants. The LCERF site is located in Lee County, which is part of the Southwest Florida Intrastate Air Quality Control Region (40 CFR 81.97). The project site is currently designated as attainment for the criteria pollutants (i.e., particulate matter with mean aerodynamic diameter less than 10 micron [um] [PM_{10}]; sulfur dioxide [SO_2]; nitrogen dioxide [NO_2]; carbon monoxide [CO]; lead [Pb] and ozone [O_3]).

For PSD purposes, the primary definition of major stationary source includes any source belonging to a list of 28 specified source categories which has the potential to emit 100 tons per year (tpy) or more of any pollutant regulated under the CAA. The LCERF is classified as a major source for PSD purposes because it is one of the 28 specified sources (i.e., a municipal incinerator capable of charging more than 50 tons per day (tpd) of refuse as defined in 40 CFR 52.21 and Section 169(1) of the Clean Air Act, also known as a municipal waste combustor [MWC]) and it has the potential to emit more than 100 tpy of at least one regulated pollutant (Rule 62-210.200(159)(b)8, F.A.C., Definition of Major Source of Air Pollution).

A modification to an existing major source is subject to PSD regulation if it is located in a PSD attainment area and it is a major modification. A major modification is generally a physical change or a change in method of operation of an existing major source which would result in a contemporaneous significant increase in emissions of any regulated pollutant. A significant emissions increase is an increase greater than or equal to the emission levels listed in Table 212.400-2 (Regulated Air Pollutants - Significant Emission Rates), which is contained in Rule 62-212.400, F.A.C.

In general, a PSD application in Florida (Rule 62-212.400(5), F.A.C.) must contain the following information:

- A description of the nature, location, design capacity and typical operating schedule of the facility or modification, including specifications and drawings showing its design and plant layout.
- An estimate of the emissions associated with the project or modification.
- A Best Available Control Technology (BACT) determination.
- Information relating to the air quality impacts of the facility or modification, including meteorological and topographical data.

- Information relating to the air quality impacts of general commercial, residential, industrial and other growth which has occurred since August 7, 1977, in the area the facility or modification would affect.
- A Good Engineering Practice stack height analysis.
- An assessment of the source's impact on air quality-related values including soils, vegetation, visibility and general commercial, residential and industrial growth.

The PSD regulations establish Class I, or pristine, areas in the United States. The regulations require that any major facility proposing to locate near a Class I area have an assessment performed of the source's effect on visibility at the Class I area, on Class I increment consumption, and other air quality related values (AQRVs). The Everglades National Park, a designated Class I area, is about 90 kilometers from the LCERF site. Section 7 (Additional Impact Analyses) contains the Class I impacts analyses.

2.3.1 SOURCE APPLICABILITY

Lee County's proposed project is a major modification to an existing major stationary source because the existing LCERF is a municipal waste combustion facility that is capable of burning more than 50-tpd of waste, and Unit 3 will cause at least one of the PSD regulated pollutants to be emitted at a rate that exceeds the PSD significance levels established in Rule 62-212.400, F.A.C. PSD requirements apply to new major sources or major modifications located in areas which have been designated as in attainment or unclassifiable for the ambient air quality standards for a particular pollutant. As stated further in Section 5.4 (Attainment Status), the Unit 3 project is in an area that is classified as attainment or is unclassifiable for all criteria pollutants. This project entails the addition of MWC Unit 3; Units 1 and 2 will not be modified.

2.3.2 POLLUTANT APPLICABILITY

Under the PSD program, if the potential annual emission rate exceeds the PSD emission rates designated in Rule 62-212.400, F.A.C., then a BACT analysis and air quality modeling must be conducted for each PSD pollutant emitted at greater than the significance levels. Table 2-1 compares estimated Unit 3 annual emission rates, presented in Section 3 (Air Pollutant Emissions), with the corresponding PSD significant emission rates, and identifies those pollutants for which air quality impact and BACT analyses must be performed. The detailed approaches and considerations for performing BACT analyses are presented in Section 4 (Best Available Control Technology Evaluation). As shown in Table 2-1, formal PSD analyses (including a BACT Analysis) are required for CO, NO_X, SO_2, sulfuric acid mist (SAM), PM_{10}, mercury, MWC acid gases, MWC metals and MWC organics.

The maximum annual emission rates presented in Table 2-1 were calculated assuming that Unit 3 operates 365 days per year at 110 percent load. This assumption is conservative, because Unit 3 is expected to have an annual availability factor less than 100% due to scheduled and unscheduled downtime.

TABLE 2-1
PSD POLLUTANT APPLICABILITY FOR THE ADDITION OF MWC UNIT 3 TO THE LCERF

Name of PSD Pollutant	PSD Significant Emission Rates[a] (tpy)	Proposed Unit 3 Emission Rate (tpy)	PSD Applicable
Carbon Monoxide	100	125.8	Yes
Nitrogen Oxides	40	310.1	Yes
Sulfur Dioxide	40	287.8	Yes
Sulfuric Acid Mist	7	73.51	Yes
Particulate Matter (Total)	25	22.26	No
Particulate Matter (PM_{10})	15	22.26	Yes
Ozone (VOCs)	40	21.62	No
Lead	0.6	0.216	No
Beryllium	4E-4	1.73E-4	No
Mercury	0.1	0.187	Yes
Fluorides	3	2.986[b]	No
MWC Acid Gases (as SO_2 & HCl)	40	492.7	Yes
MWC Metals (as PM)	15	22.26	Yes
Total Reduced Sulfur (Including H_2S)	10	Negligible	No
Reduced Sulfur Compounds (Including H_2S)	10	Negligible	No
Hydrogen Sulfide	10	Negligible	No
Vinyl Chloride	1	Negligible	No
MWC Organics (Total Dioxins and Furans)[c]	3.5E-6	1.41E-5	Yes

[a] Source: Rule 61-212.400, F.A.C. Table 212.400-2 (Regulated Air Pollutants – Significant Emission Rates) and 40 CFR 52.21 (Prevention of Significant Deterioration of Air Quality).
[b] Calculated from the HF emission rate of 3.145 tons per year based on the Fluorine/HF ratio of 18.9984/20.01.
[c] Measured as total tetra- through octa- chlorinated dibenzo-p-dioxins and dibenzo furans.

LEE COUNTY ENERGY RECOVERY FACILITY
PREVENTION OF SIGNIFICANT DETERIORATION
APPLICATION FOR MUNICIPAL WASTE COMBUSTOR UNIT 3

SECTION 3
AIR POLLUTANT EMISSIONS

October 31, 2002

SECTION 3
AIR POLLUTANT EMISSIONS

3.1 INTRODUCTION

The combustion of municipal solid waste (MSW) in energy recovery facilities results in the emission of some air pollutants as a consequence of several mechanisms and processes. Emissions generated in the combustion of MSW depend upon the composition of the waste stream or reflect the character of the combustion process. The quantity of each compound released also depends on whether or not it is controlled through the use of air pollution control techniques or technology.

The discussion of emission factors and rates presented in this section focuses primarily on those pollutants of public health and regulatory concern. Emissions estimates in this section are based on available operational data from Units 1 and 2 over the past seven years in addition to other available data from the U.S. Environmental Protection Agency (USEPA) and other municipal waste combustion facilities.

3.2 BASIS FOR EMISSION LIMITS

Lee County has reviewed the current plant operational data as well as test data from other facilities. The purpose of this effort is to determine appropriate permit limits for the proposed Unit 3 at the Lee County Energy Recovery Facility (LCERF). The starting point for the permit limits begins with the 1995 New Source Performance Standards (NSPS). USEPA based the performance limits in the NSPS on the most recent available data. This included 12 units with spray dry absorbers (SDA), fabric filters (FF) and selective non-catalytic reduction (SNCR) systems operating in 1994, as well as earlier data. Overall, USEPA used performance test data from over 60 municipal waste combustor plants (60 FR 65391, 19 December 1995 and 60 FR 65396, 19 December 1995). As required by Congress, the NSPS "MACT Floor" is set at the level achieved by the best performing plant. Although USEPA did not include European test data, it did indicate that the European data would not have changed the limits (59 FR 48254, 20 September 1994, Section VII - *Comparison of the Proposal and European Emission Limits*).

Due to the United States Supreme Court "Carbone" ruling on May 16, 1994 (1994 WL 183594), little development of new municipal waste combustors (MWC) has occurred in the United States after 1994. Hence, the conclusions reached by USEPA at that time should still be valid. There has been some additional experience gained in the operation of facilities equipped with modern pollution control trains, including SDA, FF, SNCR and activated carbon injection (ACI) systems. Enhanced combustion controls have also improved overall MWC performance, and USEPA's good combustion practices (GCP) have proven to be effective. The only potential modifications to the design of a new facility could be the use of a selective catalytic reduction (SCR) system for NOx control. These systems began being applied to MWCs in Europe and Asia in the late 1980s and

were reviewed by USEPA in setting the NSPS. They will be reviewed further, based on current costs, in the BACT review for this project.

Therefore, based on the Best Available Control Technology (BACT) considerations, Unit 3 will be designed and operated in accordance with the NSPS standards. Regardless of the permit limits, there will be no change in the basic design or operation of the proposed facility, unless SCR is added for NO_x control. The operation of the MWC, as well as the pollution control system, is continuously monitored and strictly regulated. The steam load is tied to the most recent dioxin stack tests demonstrating compliance with the applicable limit. The MWC load cannot exceed more than 110% of the rate achieved during the last approved stack test. Additionally, the inlet temperature to the bag house is monitored to ensure that condensed metals are collected and dioxins are not formed on the particulate in the bag house. The maximum temperature cannot be more than 17C (30.6°F) above the temperature measured during the last approved dioxin stack tests. The three GCP parameters (MWC load, baghouse inlet temperature and CO emissions) effectively establish operating conditions between stack testing events which will maintain compliance with the applicable standard.

In addition, there are continuous emission monitors (CEMs) for sulfur dioxide (SO_2), at the inlet of the SDA and at the stack. SO_2 is one of the more difficult acid gas species to remove. Control of SO_2 to the NSPS limits indicates sufficient control of MWC acid gases. The combustion related conditions are monitored continuously through carbon monoxide (CO) and nitrogen oxides (NOx) continuous emission monitors. These monitors along with the automatic combustion control system ensure proper combustion control. There is also an opacity monitor that ensures proper performance of the bag house. These instruments are monitored by control room personnel to ensure the proper operation of the MWC. There is a monitoring requirement for the carbon feed rate to ensure adequate control for mercury. The accuracy of the continuous emissions monitors (CEMs) are verified by quarterly performance specification tests. Those regulated pollutants not monitored by CEMs are typically subject to periodic stack tests. The overall effect of the design, control, and monitoring systems is to ensure that the operation of the MWC is subject to continuous oversight and hence fully protective of the public and the environment.

As noted above, regardless of the emission limit set in the permits, there will be no difference in the design or operation of the facility, unless SCR is required. Permit limits more stringent than NSPS merely increase the risk of spurious "exceedances" of an overly-restrictive standard.

It should be noted that the metals emissions are not guaranteed by the vendor and are the responsibility of Lee County. The County has maintained an aggressive materials separation program as outlined in the Materials Separation Plan for this project. There is a limited ability to predict what the variability of the waste stream will be over the life of Unit 3 and life of the permit and there is no reliable means to quantify the effect of the Materials Separation Plan on stack emissions. The permit limits must be set to accommodate the full range of variability that may occur in the waste stream over this

time and should be independent of the municipal solid waste and the Materials Separation Plan. In order to provide reasonable assurance that a lower limit could be met for the NSPS metals (cadmium, lead, mercury), additional control equipment would be required. Costs for such additional control would be prohibitive, on a cost per ton removed basis.

Due to the limited amount of test data available for the stack test pollutants (21 data points per unit), there is some difficulty in determining what, if any, reductions in the federally enforceable emission limits can be achieved in practice. Since the permit limits are deterministic, pass/fail limits that can never be exceeded, it is appropriate that they accommodate the full range of normal operation.

Although Lee County believes that the NSPS limits are stringent and protective standards, additional analyses have been performed in response to Florida Department of Environmental Protection's (FDEP) requests. These analyses included both stack test data and continuous emissions monitoring data. These data were analyzed to determine appropriate permit limits for the proposed new unit. USEPA's research for the NSPS was also considered.

After compiling and analyzing the data, the Lee County Solid Waste Division worked to define permit limits that were acceptable to the vendor (operator) as well as the County. Lead and cadmium pose particular problems because emissions of these pollutants are determined by the waste stream, which is variable by nature. Further, the NSPS limits for these pollutants already are set very low. There already is a 50% reduction in the emission limit for cadmium and a greater than 50% reduction in the lead limit from the existing units, which are regulated under the Emission Guidelines, and the NSPS for the new unit. Therefore, the County and vendor are unable to accept any reduction in the NSPS limits for these two pollutants, given the potential variability in the waste stream and the already low level required by the NSPS.

Based on the County's extensive analysis of available data from Units 1 and 2 and other factors, Lee County is willing to accept permit limits for the third MWC unit that are lower than the NSPS values (or the existing permit level where no NSPS is specified) for four parameters: VOCs; fluorides; SO_2; and particulate matter. The attached table identifies the County's proposed emission factors for all pollutants. There are no NSPS limits for fluorides or VOCs because these are indirectly considered through control mechanisms for MWC acid gases and MWC organics. However, there are current permit limits for fluoride and VOCs in the Title V permit for the existing MWC units. The County is proposing an approximate 30% reduction in the limit for fluorides; an approximate 20% reduction in the VOC level; a 10% reduction in the PM level; and a 3% reduction in the SO_2 limit for the proposed new unit.

Considerable effort and expense was expended by the County, its consultants and the vendor in developing these proposed emission limits. This included a review of the Reference Methods, Accuracy And Precision (REMAP) studies performed by American Society of Mechanical Engineers (ASME) concerning USEPA Methods 5, 23, 26 and 29, as well as a review of data from other Florida MSW combustion facilities. The County

believes that the proposed levels represent stringent yet achievable standards based on the performance of the existing units, and the extensive database compiled by USEPA in developing the NSPS. The database of facility and emission control technologies that were utilized by USEPA to develop the NSPS is still current. There has been no advancement in BACT that would allow the vendor and County to propose lower limits.

While the County's effort was rigorous and extensive, this by itself is not adequate to determine an achievable emission limit. As noted above, professional judgment accrued through experience is necessary to determine whether an emission limit is achievable and is therefore appropriate for being enforceable. Achievable in the federal context of emission standards requires that the limit must be continuously achievable for known or expected variations in a process.

It should also be noted that the limit selected will have little effect on the design or operation of the facility. The facility will be designed to meet BACT requirements and the Maximum Achievable Control Technology requirements. Further, CEM data and test reports document that long term emissions are considerably less than the short term emissions factors that are monitored and regulated by continuous emission systems or short term stack tests.

Table 3-1 summarizes proposed emissions levels for LCERF's Unit 3.

The rest of Section 3 discusses the proposed permit limits by pollutant. As part of this application for a PSD permit for Unit 3, Lee County has proposed enforceable permit limits ("Primary Emission Limits") for 13 of the pollutants that will be emitted from the LCERF. Four of the proposed Primary Emission Limits are lower than the NSPS and/or the limits for LCERF's Units 1 and 2.

Lee County also is proposing "Secondary Emission Limits" for lead and cadmium. The Secondary Emission Limit for lead would be 113.5 ug/dscm, which is far less than the NSPS limit for lead (200 ug/dscm). The Secondary Emission Limit for cadmium would be 1.24E-02 mg/dscm, which also is significantly less than the applicable NSPS limit (2.00E-02 mg/dscm).

These Secondary Emission Limits would be adopted and used by the FDEP as a means of compelling the County to minimize the LCERF's emissions of these two pollutants. If there were an exceedance of a Secondary Emission Limit, the County would be required to undertake the activities described in the County's Action Plan, as described below. However, an exceedance of a Secondary Emission Limit would not be used by the FDEP or a third party as the basis for a traditional enforcement action pursuant to the Clean Air Act (CAA) or the FDEP's air quality standards.

TABLE 3-1
PROPOSED EMISSION FACTORS FOR
LCERF'S MWC UNIT 3

Pollutant Name	Emission Factor[a]
Ammonia	50 ppmdv
Arsenic (Ar)	10.74 ug/dscm
Beryllium (Be)	0.16 ug/dscm
Carbon Monoxide (CO)	100 ppmdv
Cadmium (Cd)	20 ug/dscm
Hydrogen Chloride (HCl)	25 ppmdv or 95% Control[b]
Fluoride	3.5 ppmdv
Lead (Pb)	200 ug/dscm
Mercury (Hg)	70 ug/dscm or 85% Control[b]
Municipal Waste Combustor Organics (Total PCDD/PCDF)	13 ng/dscm
Nitrogen Oxides (NO_x)	180 ppmdv 1st year; 150 ppmdv thereafter
Particulate Matter (PM)	0.009 grains/dscf
Sulfur Dioxide (SO_2)	29 ppmdv or 80% Control[b]
Sulfuric Acid Mist (SAM)	16.68 ppmdv
Volatile Organic Compounds (VOC)	30 ppmdv

Note: ppmdv = parts per million by volume (dry basis)
ug = micrograms
ng = nanograms
dscm = dry standard cubic meter
dscf = dry standard cubic foot

[a] All emission factors are corrected to 7% oxygen.
[b] Whichever is less restrictive.

Action Plan

Lee County shall conduct periodic stack tests for lead and cadmium in accordance with the schedule and methods required in this permit. The average of three test runs, conducted under representative conditions (i.e., not adversely affected by equipment malfunction or other unusual conditions) shall be compared to the Secondary Emission Limits. If the test data indicate that a Secondary Emission Limit was exceeded during the stack test, the County shall take the following steps:

I. Within 60 days of receiving the final results of the original stack test, the County shall re-test for the pollutant that exceeded the Secondary Emission Limit.

a) If the re-test results are at or below the Secondary Emission Limit, the results of the re-test shall be provided to the FDEP. The County shall not be required to take any further action.

b) If the re-test results are above the Secondary Emission Limit, the County shall conduct a formal review of both stack tests and shall attempt to identify the cause of the exceedances. The County's review process may include:

1. A review of the quality control data for the stack tests.
2. A review of the operational conditions at the facility during the tests.
3. A review of events and conditions that may have adversely affected the test results.
4. A review of the scale records prior to and during the tests.
5. Interviews with facility personnel (e.g., crane operators and tipping floor spotters) regarding relevant activities occurring prior to and during the tests.
6. A review of the County's records concerning franchise haulers and customers to identify potential sources of problematic wastes and investigate disposal practices of those identified.
7. A review of the records from the FDEP and local agencies (e.g., notices of violation) for potential sources of problematic wastes.

c) The County shall prepare and submit a report (the "Report") to the FDEP within 90 days of the second stack test. The Report shall describe the County's efforts to identify the cause of the exceedances, the County's findings, and the measures that should be undertaken to reduce the potential for future exceedances of the Secondary Emission Limit.

II. The County shall implement the recommendations contained in the Report. The recommended action may include one or more of the following:

a) Implementation of an education campaign targeted at the waste generators that are identified in the Report as potential sources of problematic wastes.

b) Modification of the spotters' procedures and activities on the tipping floor.
c) Modification of the crane operators' procedures and practices.
d) Modification of the other operational procedures followed at the facility.

III. If the County implements the recommendations in the Report, but nonetheless continues to experience exceedances of the Secondary Emission Limits for the same pollutant in subsequent stack tests, then the County may request the FDEP to adjust the Secondary Emission Limit for that pollutant. In such circumstances, the County's request shall contain the following information:

a) The new proposed Secondary Emission Limit, including the methodology utilized to select the proposed limit.
b) A summary of the actions taken to date by the County and the facility operator to reduce the emissions of the specific pollutant that is exceeding the current Secondary Emission Limit.
c) An explanation of why the Department should accept the proposed new Secondary Emission Limit.

3.3 COMPOSITION OF MUNICIPAL SOLID WASTE

MSW is a heterogeneous mixture of materials, and the physics and chemistry of its combustion are very complex. Some emissions are products of combustion, such as NOx and CO, while other compounds present in the flue gas reflect the amount of the compound present in the waste itself.

In Lee County, certain wastes are separated from the MSW at various points prior to combustion at the LCERF, thus limiting certain compounds in the fuel (waste) and limiting certain pollutant emissions. Lee County has residential and commercial materials separation programs to separate ferrous metals, aluminum, plastic and other materials prior to combustion. Horticulture (yard) wastes are removed from the waste stream at the point of generation and converted into mulch for County residents. Household hazardous wastes (HHW) collection centers are used to separate HHW materials from the MSW. Most importantly, Lee County attempts to remove certain items from the waste stream before they enter the LCERF, including residential biomedical waste, white goods, used motor oil, fluorescent bulbs, thermostats and thermometers.

While Lee County supports materials separation, there is no known relationship between materials separation programs and quantifiable changes in stack emissions. Therefore, while materials separation is considered in the BACT analysis, materials separation should not be considered as BACT.

A more detailed description of Lee County's Solid Waste Management programs is provided in the PPSA application.

3.4 PARTICULATE MATTER AND PM_{10}

When solid waste is burned, particulate matter (PM) may originate from three sources: inorganic substances; organometallic substances; and unburned waste. Inorganic materials are not combusted, and consequently, the majority of these materials exit the system as bottom ash. A small portion of the inorganic material may become entrained in the flue gas, carried to the air pollution control (APC) equipment, and then collected and removed. Organometallic compounds appear as inorganic oxides or metal salts in the flue gas, resulting from high temperature combustion. Unburned solid waste entrained in the flue gas is a result of non-combustible materials and agglomeration of small particles. Trace metals present in the solid waste also become entrained in the flue gas. Some trace metals also may be adsorbed onto entrained solids.

The size and quantity of particulate matter emitted during the MSW combustion process depends on such factors as residence time within the combustion chamber, combustion temperature, oxidizing/reducing conditions during the combustion process, and the chemistry of the particulate matter and solid waste. A longer residence time of MSW on the grate allows more complete combustion of organic particles and a commensurate decrease in particle size. Longer flue gas residence times also increase the likelihood that larger particles will drop out of the flue gas in the combustion chamber and boiler passages. High temperatures and oxidizing conditions also promote more complete combustion.

Particulate matter will be controlled by a SDA, which will reduce the temperature of the flue gas stream and promote condensation of vapor phase flue gas components and allow the FF system to effectively remove the resulting solid phase particulates. The County's proposed control technology also includes a FF system, which will remove fly ash (including trace metals) and other types of particulate matter from the flue gas.

The maximum PM concentration at the baghouse outlet is proposed to be limited to 0.009 grains per dry standard cubic foot (gr/dscf) at 7% O_2. This emission level is equivalent to a maximum emission rate of 5.08 pounds per hour (lb/hour) and 22.26 tons per year (tpy).

In this document, as a conservative assumption, the assessment of the potential ambient impacts from the LCERF's emissions of particulate matter assumes that the particulate matter emissions from the proposed project will consist entirely of PM_{10} (Covanta Projects, Inc., 2002). These ambient impacts will be discussed later in Section 6 (Air Quality Impact Analyses).

3.5 MWC ACID GASES

3.5.1 SULFUR DIOXIDE

Sulfur dioxide is formed in the furnace from the oxidation of sulfur in the solid waste during the combustion process. The sulfur content of the waste and the chemical form (organic or inorganic) of the sulfur determine the rate and quantity of sulfur dioxide

formation. Organic sulfur will oxidize during combustion to produce gaseous sulfur dioxide and sulfur trioxide. A fraction of the inorganic sulfur (e.g., sulfates, sulfides, and sulfites) will oxidize into a gaseous form at the design temperatures in the LCERF's Unit 3 and the remainder of the inorganic sulfur will remain in the bottom ash.

A SDA followed by a FF will be used to reduce sulfur dioxide emissions. The flue gas containing sulfur dioxide will enter the SDA where it will come into contact with a finely atomized alkaline slurry. The resultant reactions are:

$$Ca(OH)_2 + SO_2 + H_2O \rightarrow CaSO_3 \cdot 1/2\ H_2O + 3/2H_2O$$
$$CaSO_3 \cdot 1/2H_2 + 1/2O_2 + 3/2\ H_2O \rightarrow CaSO_4 \cdot 2H_2O$$

Unit 3 will be designed to achieve lower outlet emissions for sulfur dioxide than is required by the NSPS. The NSPS standard is 30 ppmdv at 7% O_2 or 80% removal (by weight) of uncontrolled emissions, whichever is least stringent. Unit 3 will achieve 29 ppmdv at 7% O_2 or 80% removal. Maximum uncontrolled emissions of sulfur dioxide for Unit 3 are expected to be 500 ppmdv, corrected to 7% O_2. Eighty percent removal of this concentration will result in stack emissions of 100 ppmdv, corrected to 7% O_2 for Unit 3. Thus, the maximum allowable concentration of sulfur dioxide from Unit 3 will be 100 ppmdv corrected to 7% O_2. This level is equivalent to 65.72 lb/hour or 287.8 tpy based on worst-case operating conditions. Actual emissions from Unit 3 will typically be considerably less than this value.

3.5.2 SULFURIC ACID MIST

When released into the ambient environment, sulfur dioxide may react with water vapor to form sulfuric acid. Sulfuric acid may further react to form sulfate salts, a particulate aerosol. The SDA/FF system will control Sulfuric Acid Mist (SAM) emissions from Unit 3 to maximum levels of 16.68 ppmdv, corrected to 7% O_2. This level equates to 16.78 lb/hour and 73.51 tpy.

If the County successfully demonstrates that the SAM levels are 16.68 ppmdv or below during the initial compliance emissions test, the County proposes to have the SAM permit limit removed from the Prevention of Significant Deterioration (PSD) permit.

This deletion request is based on a history of low concentration measurements during prior performance tests. Testing for SAM at such low levels is an unnecessary expense and does not provide any benefit to human health and the environment. Because SAM is a function of sulfur dioxide concentration, flue gas temperature and flue gas moisture content, continuous control of sulfur dioxide is a viable surrogate for control of SAM.

3.5.3 HYDROGEN CHLORIDE

Hydrogen chloride is formed during the combustion of MSW. The amount of hydrogen chloride formed during the combustion process is related to the amount of chlorine containing products present during the combustion process. Examples of such

compounds are salts (sodium chloride and calcium chloride) and polyvinyl chloride (PVC).

A SDA followed by a FF will be used to reduce hydrogen chloride emissions from Unit 3. The flue gas containing hydrogen chloride will enter the SDA where it will come in contact with a finely atomized alkaline slurry. The resultant reaction is:

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

The USEPA NSPS at 40 CFR 60, Subpart Eb, establish a limit for hydrogen chloride of 25 ppmdv, corrected to 7% O_2, or 95% removal (by weight) of uncontrolled hydrogen chloride emissions, whichever is least stringent. Maximum uncontrolled hydrogen chloride emissions for Unit 3 are expected to be 2500 ppmdv, corrected to 7% O_2. Unit 3 will remove a minimum of 95% of this level and thus will emit a maximum of 125 ppmdv, corrected to 7% O_2 which is equivalent to 46.76 lbs/hour or 204.8 tpy. Actual hydrogen chloride emissions from Unit 3 are expected to be less than these values.

3.5.4 FLUORIDES

Fluorides can be formed during the combustion of MSW. The source for fluoride is thermally driven chemical reactions between the combustion air and the fluorine in the solid waste. A majority of the fluorine found in municipal solid waste is chemically bound to other compounds. A portion of these substances is released during combustion and becomes entrained in the flue gas. Consequently, the type of fluorine compounds formed in the MWC units will be strongly dependent on the presence of gaseous compounds, combustion temperatures, and oxidizing/reducing conditions in the combustor. Similarly, the uncontrolled emission rate for fluorides is related to fuel concentrations of fluoride and the combustion technology.

Fluorides will be controlled by the SDA/FF system and the maximum allowable concentration of fluorides from Unit 3 is 3.5 ppmdv, corrected to 7% O_2. This level is lower than the existing fluoride permit limit of 5 ppmdv (corrected to 7% O_2) for Units 1 and 2. Unit 3 will emit a maximum of 0.718 lb/hour or 3.145 tpy of fluorides measured as hydrogen fluorides (or 2.986 tpy of fluorides). Actual fluorides emissions from Unit 3 are expected to be less than this value.

Upon successful demonstration that the fluoride levels are less than 3.5 ppmdv level during the initial compliance emissions test, the County proposes to have the fluoride permit limit removed from the PSD permit.

This deletion request is based on a history of low concentration measurements during prior performance tests. Testing for fluoride at such low levels is an unnecessary expense and does not provide any benefit to human health and the environment. Because fluoride is highly soluble in water and is controlled by the semi-dry scrubber system, continuous control of SO_2 is a viable surrogate for control of fluorides.

3.6 CARBON MONOXIDE

Carbon monoxide (CO) is formed by the incomplete oxidation of carbon compounds in fuel. Some carbon monoxide is formed in all combustion processes in which carbon-containing fuel is burned. However, the amount of carbon monoxide formed is dependent upon the combustion efficiency of the fuel-burning process. Incomplete oxidation can be caused by a number of factors, including:

- Fuel-rich conditions (not enough oxygen).
- Poor fuel-air mixing (oxygen does not intimately contact fuel).
- Low combustion temperature.
- Short combustion zone residence time.

Accordingly, carbon monoxide formation is minimized by designing the combustor to provide an adequate supply of combustion air and maximizing combustion efficiency. The USEPA utilizes carbon monoxide as part of the strategy to ensure that good combustion is occurring. Good combustion practices (GCP) were developed by the EPA to minimize both formation and emission of dioxins/furans and other trace organics. There are three components to GCP: a CO emission limit, a load limit, and a temperature limit at the inlet of the PM control device (USEPA, 1995d).

Elevated emissions of carbon monoxide from a MWC may result from the failure of the combustion system to complete the burnout of the combustible gases emitted from the burning refuse on the grate. The proper utilization of underfire and overfire air provides adequate oxygen levels and gas turbulence to minimize emissions of carbon monoxide.

Section 3.6.1 below discusses in detail the carbon monoxide emissions during start-up, shutdown and malfunction of Unit 3 and the NSPS requirements for carbon monoxide during these periods as they were amended by the November 16, 2001 NSPS amendments.

Unit 3 will utilize an automatic combustion control system to minimize carbon monoxide emissions. This will enable Unit 3 to maintain a proposed maximum emission limit of 100 ppmdv corrected to 7% O_2 (based on a 4-hour block average), which is also the NSPS limit. This emission rate is equivalent to 28.73 lb/hour and 125.8 tpy.

3.6.1 ADDITIONAL CARBON MONOXIDE MALFUNCTION REGULATIONS

On November 16, 2001, the USEPA proposed and promulgated through a direct final rule, amendments to the Subpart Eb NSPS concerning compliance with the CO emissions standards during periods of start-ups, shutdowns and malfunctions (S/S/M) (66 Fed. Reg. 57824-57828, November 16, 2001). Prior to the USEPA's action, the CO emissions standards in the NSPS were not enforced during periods of S/S/M, but only for a maximum duration of three hours. The November 2001 amendment extends this malfunction time period for CO emissions, if the malfunction is caused by a loss of boiler water level control or combustion air control.

During periods of boiler S/S/M, it is difficult to maintain the proper balance between the waste feed and combustion air flow to provide for sufficient control of complete combustion. Incomplete combustion will increase the amount of CO formation, and supplemental combustion with auxiliary fuel burners is typically used to provide additional oxidation of CO to carbon dioxide (CO_2).

Loss of boiler water level control, from a rupture of a boiler tube for example, exposes the metal tubes to increases in temperatures. Boiler tube metal must be kept at or below about 800°F (427C) to prevent damage or burn-out. Proper boiler water level assists in regulating tube metal temperatures, and failure of the water level control will allow temperatures to rise above this 800°F (427C) mark and increase damage to the remaining boiler tubes. Temperatures above this level and failure to maintain correct temperature profiles can lead to boiler damage from heat stress. Increases in CO formation normally are overcome by using auxiliary fuel burners to provide additional combustion. However, the use of the fuel burners during the failure of boiler water level will increase the temperature of the boiler water tubes and increase the potential for MWC unit failure. Indeed, the use of auxiliary fuel burners during periods of boiler tube malfunction are prohibited by the National Fire Protection Association.

A second type of malfunction covered under the amended NSPS is loss of combustion air control due to such events as loss of control or malfunction of combustion air fan, loss of control or malfunction of induced draft fan, or a failure or malfunction of the grate system. Loss of combustion air control prevents control of the MWC unit to provide for complete combustion and results in increased CO formation as well as significantly increases the risk for explosion. The increased CO formation can be remedied by using auxiliary fuel burners to provide for additional oxidation of CO into CO_2. However, the use of auxiliary fuel burners can worsen the problem by decreasing the amount of air available for combustion.

The amended NSPS requires MWCs to develop and implement operation and maintenance programs and allows CO emissions to increase during these periods of S/S/M and limits the event to 15 hours per occurrence. The LCERF has an operation and maintenance program in place to ensure that the MWC unit is operated properly and is compliant under the amended NSPS.

3.7 NITROGEN OXIDES

Nitrogen oxides are produced in all combustion processes. There are two mechanisms by which nitrogen oxides are formed during combustion.

- Thermal nitrogen oxides are formed by high temperature oxidation of nitrogen in the combustion air.
- Fuel nitrogen oxides are formed by the oxidation of nitrogen in the fuel.

The primary components of nitrogen oxides (NOx) are nitric oxide (NO) and nitrogen dioxide (NO_2). The combination of these compounds is referred to as nitrogen oxides. Conversion of nitrogen in the waste occurs at lower temperatures (less than 1,090C [2,000°F]), while oxidation of atmospheric nitrogen occurs at higher temperatures. Because of the temperatures at which MWC furnaces operate, 70 to 80 percent of nitrogen oxides formed in MWCs is associated with nitrogen in the waste (USEPA, 1996). Accordingly, technologies that affect the formation of nitrogen oxides from fuel nitrogen would have a relatively significant effect on the overall nitrogen oxides emissions level. Factors that affect fuel nitrogen oxides formation include the amount and distribution of excess combustion air, the nitrogen content of the refuse fuel, and to some extent, changes in combustion temperature.

Research has shown that the formation of thermal nitrogen oxides is affected strongly by combustion temperature (MacKinnon, 1974). Since thermal nitrogen oxides formation is dependant on high temperatures, nitrogen oxides formation may occur in "hot spots" in the combustion zone where local temperatures reach levels much higher than the average combustion temperature. Thermal nitrogen oxides formation is also affected by the availability of oxygen in high temperature regions of the combustion zone. Consequently, thermal nitrogen oxides formation can be minimized by limiting the amount of excess air provided to the high temperature zones of the combustion chamber and by the location and manner in which air is later introduced to complete combustion.

Unit 3 will utilize an automatic combustion control system and SNCR to reduce nitrogen oxides levels and maintain a maximum emission limit of 150 ppmdv, corrected to 7% O_2 (180 ppmdv at 7% O_2 for the first year of operation), in conformance with the federal NSPS for the municipal waste combustion industry. This 150 ppmdv level equates to 70.79 lb/hour and 310.1 tpy.

3.8 MWC METALS

Combustion of solid waste may result in the emission of trace concentrations of certain metals. These metals are present in both the combustible and non-combustible parts of the waste. During combustion, the non-volatile metals are distributed in two general areas: bottom ash and fly ash. Volatile metal emissions also occur as vapor phase emissions. The distribution of trace metals is determined by their physical properties and the operating temperatures of the various components of the combustion unit and the air pollution control system. Trace metals will be removed at the LCERF by the SDA and FF system. The SDA will reduce the flue gas temperature to approximately 300°F (149C). At that temperature, most volatilized metals will condense on available particulate matter and be collected by the FF.

The USEPA NSPS specifies separate emission levels for mercury, lead, and cadmium. The Florida Mercury Rule (Rule 62-296.416, F.A.C.) provides specific limits for mercury emissions. Other metals are regulated by the particulate control standard established by the NSPS. The emission rates for mercury, lead, cadmium, arsenic and beryllium are discussed below.

The flue gas stream may contain trace amounts of nickel, antimony, copper, chromium, selenium, tin, zinc, and other metals. These trace metals will be controlled with the particulate matter.

3.8.1 MERCURY

Mercury is a trace metal found in many different waste materials. Within the temperature range of the combustion process for solid waste, mercury is found as a metallic vapor. The melting point and boiling point of mercury are -38.87C (-37.97°F) and 356.9C (674.42°F), respectively (Perry, et al., 1984).

Significant research efforts have been undertaken in order to determine the origin and nature of mercury emissions from MWCs. The origin of mercury in solid waste was investigated by Franklin Associates, "Characterization of Products Containing Mercury in Municipal Solid Waste in the United States, 1970 to 2000" (1991). According to the report, numerous field test programs established the variability of mercury emissions. The field test programs indicated that up to 89% of the mercury in solid waste at that time (1991) was from batteries and, therefore, new mercury-free or low mercury content batteries should significantly reduce the uncontrolled mercury emissions from MWCs. This conclusion was correct, as shown by the subsequent reduction of mercury levels in uncontrolled stack gases as mercury was removed from consumer batteries. Notwithstanding the reductions that have occurred, additional amounts of mercury are still introduced into the waste stream with mercury containing devices and some pesticide treatments.

With activated carbon injection, mercury is adsorbed onto the carbon particle, which is then captured in the PM control device. Test programs using activated carbon injection on MWCs in the United States have shown mercury removal efficiencies can vary from 50 to over 95 percent, depending on several factors, including the carbon feed rate (USEPA, 1996).

The activated carbon injection (ACI) system proposed by the County will provide a stable and reliable control of mercury emissions. The ACI system will reduce the concentration of mercury from Unit 3 to 70 ug/dscm as required under the Florida Mercury Rule or provide 85% removal of uncontrolled mercury emissions as required under the USEPA NSPS, whichever is less stringent. Maximum uncontrolled mercury emissions are expected to be 1,150 ug/dscm, corrected to 7% O_2. The powdered activated carbon injection system will provide 85% removal of uncontrolled mercury emissions or a level of 172.5 ug/dscm, corrected to 7% O_2. The maximum emission rate will be 0.043 lb/hour or 0.187 tpy.

3.8.2 LEAD

Lead is a trace metal found in solid waste. Lead emissions are directly proportional to the lead content of the solid waste, as long as the waste component is combustible. The

melting point and boiling point of lead are 327.5C (621.5°F) and 1,620C (2,948°F), respectively (Perry, et al., 1984). Some of the lead will volatilize and condense to become a component in the fly ash. Lead will either become part of the bottom ash or adhere to the fly ash which will be collected in the FF.

Unit 3 will maintain the USEPA NSPS limit of 200 ug/dscm at 7% O_2. This is equivalent to an emission factor of 0.0494 lb/hour or 0.216 tpy.

3.8.3 CADMIUM

Cadmium is present in both combustible and non-combustible components of municipal solid waste and is collected in the FF. The melting point and boiling point of cadmium are 320.9C (609.6°F) and 767C (1,412.6°F), respectively (Perry, et al., 1984). As with the other metals, cadmium emissions will be efficiently controlled by proper operation of the SDA/FF system. The County's proposed project will comply with the USEPA NSPS emissions level of 20 ug/dscm at 7% O_2. This is equivalent to a maximum emission factor of 0.00494 lb/hour or 0.0216 tpy.

3.8.4 ARSENIC

Arsenic is a metallic compound found in trace quantities in solid waste. Emissions of arsenic are a function of the arsenic content of the MSW.

The arsenic content of municipal solid waste is generally in the combustible fraction and, as such, is considered to be fully released and volatilized by the combustion process. Arsenic, therefore, primarily exits the furnace with the flue gas stream with a small fraction found in bottom ash. Studies involving combustion of both coal and refuse have shown that arsenic is enriched in fine particulate matter, as compared to coarser particulate matter or bottom ash. It is theorized that arsenic, and other metals as well, are volatilized in the high temperature combustion zone of the MWC. Upon cooling, these compounds are then adsorbed or condensed onto fine particulate matter. The amount of enrichment varies with particle size, amount of particulate, and flue gas temperature (California Air Resources Board [CARB], 1984). Therefore, high removal efficiencies for arsenic and other metals can be achieved by effectively controlling fine particulate matter emissions.

By operating the particulate matter control equipment at temperatures below 500°F (260C) and efficiently collecting particulate matter, the County will achieve high removal efficiencies for arsenic in flue gas (CARB, 1984). The LCERF will utilize a SDA followed by a FF to control arsenic. As stated above, the SDA/FF will condition the flue gas and cool it to approximately 300°F (149C).

Operation of the SDA/FF will reduce arsenic emissions to a maximum level of 10.74 ug/dscm, corrected to 7% O_2. This arsenic emission level equates to 0.00265 lb/hour or 0.0116 tpy.

Once Unit 3 demonstrates compliance with this arsenic emission level during its initial emissions test, Lee County proposes to have this arsenic level removed from its permit.

This deletion request is based on a history of low concentration measurements during prior performance tests. Testing for arsenic at such low levels is an unnecessary expense and does not provide any benefit to human health and the environment. Because arsenic is a function of the quantity of arsenic in the waste fuel and will be controlled using the particulate control equipment (SDA and FF), continuous monitoring of opacity, combined with annual particulate tests are viable surrogates for verifying control of arsenic.

3.8.5 BERYLLIUM

Beryllium is a metallic compound found in trace quantities in MSW. As a product of combustion, beryllium emissions are a function of the beryllium content of the MSW. Beryllium is a light metal and has a high melting point, which allows it to be used in nuclear work, ceramic applications and other uses with high temperature requirements. Beryllium is not used in appreciable quantities for consumer products which are generally found in municipal solid waste. Beryllium occurs naturally in soils in small quantities (about 2-6 ppm) (Merck and Company, Inc., 1996). The primary beryllium contribution to solid waste comes largely from newsprint, paper-board, and other paper byproducts. Yard wastes, food wastes, polyurethane foam, and polyethylene containers may also contribute to combustible constituents of beryllium. As stated above in Section 3.3 (Composition of Municipal Solid Waste), the LCERF Materials Separation Plan assists in the removal of recyclable paper products and yard wastes to the extent possible, thereby reducing the amount of beryllium introduced to the LCERF.

The maximum allowable concentration of beryllium from Unit 3 is 0.16 ug/dscm, corrected to 7% O_2. This level equates to 3.95 E-5 lb/hour or 1.730 E-4 tpy. Upon demonstration that Unit 3 is below this level during the initial emissions test, the applicant proposes to have this beryllium limit removed from the permit. Beryllium emission estimates are included primarily to demonstrate non-applicability to PSD review for Unit 3.

This deletion request is based on non-detect measurements of prior performance tests. The USEPA has determined that the beryllium National Emission Standards for Hazardous Air Pollutants (NESHAP) does not apply to MWCs. Testing of a pollutant that is not measurable is expensive without providing any benefit to human health and the environment. Continuous monitoring of opacity and annual particulate tests are viable surrogates for monitoring control of beryllium because beryllium is a function of the quantity of beryllium in the waste fuel and will be controlled using the particulate control equipment.

3.9 MWC ORGANICS

MWC Organics are defined by the USEPA in 40 CFR 60.51b as organic compounds emitted in the exhaust gases from municipal waste combustor units and includes tetra- through octa- chlorinated dibenzo-p-dioxins and dibenzofurans. Various organic compounds have been measured in emissions from solid waste combustion facilities. The principal compounds of concern are dioxins/furans.

Dioxin and tetrachlorodibenzo-p-dioxin (TCDD) are popular synonyms for the chemical 2,3,7,8-tetrachlorodibenzo-p-dioxin (2,3,7,8-TCDD). This chemical is one of 22 TCDD isomers, each of which is distinguished by the location of the four chlorine atoms contained within its structure. Each species of TCDD has its own chemical and physical properties.

The term polychlorinated dibenzo-p-dioxin (PCDD) refers to 75 isomers that differ in the number and position of chlorine atoms attached to the dibenzo-p-dioxin molecule and the number system for distinguishing possible chlorine site.

In a similar manner, 2,3,7,8-tetrachlorodibenzofurans (2,3,7,8-TCDF) is one of 22 tetrachlorodibenzofurans. The term polychlorinated dibenzofurans (PCDF) refers to 135 chemically, physically, and toxicologically distinct isomers (Fred C. Hart Associates, Inc., 1984).

Lee County's proposed project will employ good combustion practices in combination with a SDA and FF to minimize PCDD and PCDF formation and emissions. GCP according to the USEPA includes monitoring of steam load, carbon monoxide concentration and flue gas temperature into the fabric filter.

Further, the use of the ACI and FF systems will promote removal of dioxins/furans in flue gas. The maximum PCDD and PCDF emissions (tetra- through octa- chlorinated dibenzo-p-dioxins and dibenzofurans) from Unit 3 will be at or below 13 ng/dscm at 7% O_2 (total). This is equivalent to an emission factor of 3.21 E-6 lbs/hour or 1.41 E-5 tpy (total).

3.10 VOLATILE ORGANIC COMPOUNDS

Volatile organic compounds (VOCs) and other non-methane hydrocarbons (NMHC) are formed during the combustion of MSW and are present in the flue gas. The principal mechanism to control these organic compounds is GCP. GCP include proper design and operation of the MWC unit to maximize the thermal destruction of VOCs and NMHC.

The maximum allowable VOC concentration from Unit 3 is 30 ppmdv, corrected to 7% O_2. This emission level equates to 4.936 lb/hour (as methane) or 21.62 tpy. The permit limit for the existing MWC Units 1 and 2 is 37 ppmdv corrected to 7% O_2. Upon successful demonstration that the VOC levels from Unit 3 are below 30 ppmdv level

during the initial compliance emissions test, the County proposes to have the VOC permit limit removed from the air permit.

This deletion request is based on a history of non-detectable or low concentrations measured during prior performance tests. Testing of a pollutant at these low concentrations is an unnecessary expense and does not provide any significant benefit to human health and the environment. Because VOC emissions are a function of the combustion process, continuous monitoring of carbon monoxide is a viable surrogate for monitoring control of VOCs.

3.11 VINYL CHLORIDE

Vinyl chloride emissions from Unit 3 are expected to be non-existent or negligible because of the oxidizing atmosphere in the furnace.

3.12 TOTAL REDUCED SULFUR

Total Reduced Sulfur emissions from Unit 3 are expected to be non-existent or negligible because of the oxidizing atmosphere in the furnace.

3.13 REDUCED SULFUR COMPOUNDS

Emissions of Reduced Sulfur Compounds from Unit 3 are expected to be non-existent or negligible because of the oxidizing atmosphere in the furnace.

3.14 HYDROGEN SULFIDE

Emissions of hydrogen sulfide from Unit 3 are expected to be non-existent or negligible because of the oxidizing atmosphere in the furnace.

3.15 AMMONIA

The County will utilize a SNCR system to control nitrogen oxides emissions. As discussed later in Section 4 (Best Available Control Technology Evaluation), SNCR utilizes ammonia as a reagent to promote the reduction of nitrogen dioxide into nitrogen molecules in the post combustion flue gas stream. The SNCR system will be designed and operated in a manner to minimize ammonia slip, which will not exceed 50 ppmdv, corrected to 7% O_2.

This maximum ammonia emission level of 50 ppmdv equates to a level of 8.72 lb/hour or 38.19 tpy. Upon successful demonstration that the ammonia levels from Unit 3 are below this 50 ppmdv level during the initial compliance emissions test, the County proposes to have the ammonia permit limit removed from the air permit.

3.16 TOTAL HAZARDOUS AIR POLLUTANTS

Emissions of total hazardous air pollutants (HAPs), as defined by Rule 62-210.200(130), F.A.C., will consist of arsenic, beryllium, cadmium, dioxins, hydrogen chloride, hydrogen fluoride, lead and mercury. Total HAPs from Unit 3 will 47.58 lb/hour or 208.4 tpy.

LEE COUNTY ENERGY RECOVERY FACILITY
PREVENTION OF SIGNIFICANT DETERIORATION
APPLICATION FOR MUNICIPAL WASTE COMBUSTOR UNIT 3

SECTION 4
BEST AVAILABLE CONTROL TECHNOLOGY EVALUATION

October 31, 2002

SECTION 4
BEST AVAILABLE CONTROL TECHNOLOGY EVALUATION

4.1 DESCRIPTION OF CONTROL TECHNOLOGY REVIEW

The proposed modification to the Lee County Energy Recovery Facility (LCERF) is a major modification to an existing major stationary source in an attainment area and is subject to Prevention of Significant Deterioration (PSD) review because this modification will result in an increase in pollutant emissions in excess of PSD significant emission rates. Specific pollutants with proposed emissions greater than PSD significant emission rates (see Table 2-1) are particulate matter [particulates with a mean aerodynamic diameter less than ten microns (PM_{10})], sulfur dioxide (SO_2), carbon monoxide (CO), nitrogen oxides (NOx), mercury (Hg), sulfuric acid mist (SAM), municipal waste combustor (MWC) metals (as PM), MWC acid gases (as SO_2 and hydrogen chloride [HCl]), and MWC Organics (as total dioxins and furans). A Best Available Control Technology (BACT) evaluation must be conducted for the pollutants which are subject to PSD review.

On December 20, 1989, the U.S. Environmental Protection Agency (USEPA) proposed standards and guidelines for MWCs in 40 CFR Part 60 Subparts Ea and Ca, respectively. Subparts Ea and Ca were promulgated on February 11, 1991 and were developed under the authority of paragraph (b) of Section 111 of the Clean Air Act (CAA) of 1977. These promulgated standards and guidelines were developed from a series of background information documents issued from 1987 through 1989 (60 FR 65388). On November 15, 1990, amendments to the CAA were enacted and Section 129 (Solid Waste Combustion) was added to the CAA. Section 129 specified that revised standards and guidelines must be developed for MWCs. The USEPA subsequently reviewed the Subpart Ea standards and Subpart Ca guidelines and concluded that they were not fully consistent with new requirements established in Section 129 of the CAA. Therefore, USEPA proposed to revise the standards and guidelines in a September 20, 1994 proposal that was promulgated December 19, 1995 as the final rule (Section Eb and Cb).

In preparing the final rule, USEPA did collect additional data. They reaffirmed conclusions drawn from background information documents issued from 1987 to 1989. USEPA did solicit public comments on the 1994 proposed rulemaking that was compiled into a background information document "Municipal Waste Combustion: Background Information Document for Promulgated Standards and Guidelines – Public Comments and Responses" (USEPA, 1995d). No new U.S. MWC has been permitted since the promulgation of the final standards and guidelines for MWCs. Thus, the information presented in this BACT for Lee County reflect information and conclusions contained in documents issued by USEPA in the late 1980s that were reaffirmed when USEPA established final standards and guidelines for MWCS in 1995. USEPA's conclusions have not changed because there has been a lack of any new activity in the municipal waste combustion industry.

In accordance with current USEPA policy, a BACT analysis involves, on a pollutant specific basis, the identification of all applicable emission control alternatives for the pollutants subject to PSD review and any others requested by the governing regulatory agency. The control alternatives are then evaluated using a "top down" approach where they are ranked in descending order of effectiveness. A "top down" analysis first examines the most stringent or "top" control method to determine if technical considerations or potential energy, environmental, or economic impacts justify a conclusion that the control method is not BACT. If the most stringent or "top" control alternative is determined not to be BACT using this methodology, then the next most stringent alternative is considered until BACT is determined. Equipment with equivalent control capabilities does not require an evaluation. For those pollutants which have applicable air pollutant emission standards, such as New Source Performance Standards (NSPS), BACT needs to be at least as stringent as the applicable standard.

The criteria used to evaluate BACT alternatives are as follows:

- Technical Feasibility
- Energy Impacts
- Environmental Impacts
- Economic Impacts

The technical feasibility of a control alternative relates to whether the technology can reasonably be expected to remove a specific pollutant from the source exhaust gas stream given the physical and chemical characteristics of the source and its exhaust. Energy impact evaluation relates to the determination of whether the energy needed to apply a control technology is excessive relative to other available technologies. Environmental impact evaluation relates to the identification of both beneficial and non-beneficial environmental impacts resulting from application of a given control technology. Economic impact evaluation relates to the determination of the cost-effectiveness of applying a given control technology. For purposes of the BACT analysis, cost effectiveness estimates are developed as a "cost per ton of pollutant removed" for evaluating the reasonableness of various emission control technology costs. This is done by dividing the total annual cost of each control alternative by the amount of emissions (in tons) reasonably expected to be controlled by each control alternative. Economic impacts can also be determined as an "incremental cost-effectiveness" when evaluating the added benefit of marginally different control options.

4.2 PROPOSED CONTROL TECHNOLOGIES

The applicant, Lee County, proposes to control air pollutant emissions through a combination of good combustion practices (GCP) and add-on exhaust gas controls. PM_{10} as well as MWC Metals (as PM_{10}) will be controlled with a high efficiency fabric filter (FF) baghouse. Acid gases such as SO_2, MWC acid gases (SO_2 and HCl), and SAM will be controlled with a spray dry absorber (SDA) in combination with the FF. GCP will be utilized to maximize burnout of products of incomplete combustion such as CO, volatile organic compounds (VOCs), and trace organics. The applicant also proposes to install an

activated carbon injection system in combination with flue gas cooling in the spray dry absorber (SDA) and particulate control in the FF for control of Hg. These types of control have been proven to be effective in controlling the range of pollutants expected to be emitted from a municipal waste combustor. Thus, these proposed control options will be considered the "base" control options for the pollutant specific BACT analyses.

4.3 MATERIALS SEPARATION

Lee County has in place an aggressive county-wide materials separation plan to minimize waste generation. Residents of Lee County are required to pay for curbside collections of separated glass bottles, plastic containers (numbers 1 through 7), steel cans, aluminum cans and foil, corrugated cardboard, kraft paper bags, telephone books, magazines, newspapers and dry-cell batteries for recycling. Residents also separate household waste such as electronic equipment, motor oils, pesticides, waste fuels (gasoline/fuel oil), paints, solvents, drain cleaners, pool chemicals, anti-freeze and auto batteries. Lee County has a voluntary commercial materials separation program that provides for the collection of source separated recyclable materials from businesses and institutions. The County requires its franchise collection haulers to provide, at a minimum, recycling collection services for all businesses and institutions, and prohibits the imposition of any collection and transfer fees for recyclables. The Lee County Materials Separation Plan is more fully described in Volume II.

Source separation of combustible and non-combustible materials can result in lower emissions of various pollutants such as mercury and lead from household and industrial/commercial batteries. The Lee County Materials Separation Plan includes ferrous and non-ferrous metal collection from residential collection, private recycling facilities, "buy-back" programs for scrap steel, copper, and aluminum and post-combustion ferrous and non-ferrous metals separation and recovery at the LCERF. Segregated loads of commercial construction and demolition (C&D) waste debris are generally not accepted at the LCERF. Segregated C&D waste is directed to separate private landfills and recycling facilities. White goods (large appliances such as stoves and refrigerators) are collected separately by franchise haulers and delivered to private recycling facilities.

Lee County maintains waste tire storage and processing areas at the LCERF. Waste tires are shredded by a private tire processor and used as fuel for the LCERF combustors and for drainage media at the County's landfill.

Lee County also sponsors several additional waste programs to be utilized on a voluntary basis. Residents and business can dispose used motor oils at designated county "oil-change" business locations. The County also provides a residential used-sharps program for convenient disposal of used syringes. Biomedical waste disposal containers for used syringes can be obtained free at participating pharmacies and fire stations. Drop-off locations for the biomedical waste are available at fire stations throughout Lee County. Other commercially generated waste, such as fluorescent bulbs, thermostats and

thermometers are to be disposed properly by the generator according to prevailing local, state and federal rules and regulations.

While certain materials separation efforts are considered in this document because of their potential to reduce air emissions, the amount of emissions reductions cannot be quantified. For this reason, materials separation activities are discussed in this BACT analysis; however, materials separation should not be imposed as BACT.

4.4 BACT REVIEW FOR PARTICULATE MATTER (PM_{10}) and MWC METALS

For the purposes of this BACT review, particulate matter refers to PM_{10} and MWC Metals. In the proposed facility system, there are several operations that generate particulate emissions that are controlled by air pollution control (APC) equipment. The primary source of particulate matter at the proposed Unit 3 is the combustion unit. Minor particulate matter sources are the tipping floor area, various conveyors that will be part of the facility modification, ash handling areas and the storage and handling of lime used in the SDA.

The combustion air intake for Unit 3 will collect particulate matter and odors from the tipping floor area as is done with the existing two units. Since tipping area particulate emissions are controlled in the combustion unit and collected by the SDA/FF, these are evaluated as part of the combustion unit particulate emissions. Fugitive particulate created by the delivery and use of lime will be controlled by a separate control device mounted on the storage silo. This is further discussed in Section 6.4 (Source Data) of this document.

It is anticipated that the ash handling system will not be a significant source of fugitive particulate from the proposed Unit 3. The existing ash handling systems for Units 1 and 2 are designed to be wet systems for ash quenching and dust suppression. The bottom ash from the combustor and fly ash from the APC system are mixed together in an ash discharger where the resultant wet ash is approximately 10 to 20 weight percent water which minimizes nuisance dust generation. The ash is stored in a separate building prior to disposal. Ash handling and disposal is further discussed in Section 6.4 (Source Data) of this document. This BACT section will focus entirely on particulate emissions resulting from the combustion unit.

4.4.1 PARTICULATE FORMATION MECHANISMS

The particulates generated in the pit area or tipping hall will be entrained in the air used by the combustion unit. The primary dust generating mechanisms are the movement of trucks and other equipment in the tipping area, the discharge of refuse into the pit area, the mixing and movement of refuse by the overhead cranes, the loading of refuse into hoppers, and other minor activities. The air intakes for the combustion unit are located in the tipping hall area to provide control of odors and particulate matter. Within the tipping floor area, the negative pressure created by the induced draft fans directs movement of air

to the screened vents, therefore preventing odors and dust from escaping to the environment.

The movement of refuse through the combustors, in addition to the refuse combustion, causes the suspension of substantial amounts of particulates. The high combustion temperatures also cause the vaporization of a portion of the MWC metals contained in the waste, which condense onto entrained particles as flue gas temperatures decrease along the exhaust gas flow pathway. Some of the larger particulates fall out in the boiler section, but the majority move downstream to the SDA unit. Particulates collected in the bottom ash from the boiler section are mixed in the ash discharger with fly ash particulate matter collected by the SDA system. All collected flyash is conveyed by enclosed screw conveyors.

Once the combustion exhaust gases enter the SDA, the flue gas cleaning system introduces a lime-slurry spray into the exhaust gas stream and thereby increases the particulate loading in the flue gas. As the lime-slurry dries and the water evaporates, the exhaust gases cool and the dry lime particles disperse from the resultant intense turbulence within the reaction chamber. This intense turbulence causes intimate contact between the fine lime particulate and acid gases and other constituents in the exhaust stream. Condensation onto particles and agglomeration of finer particles occurs. Some large particles in the exhaust gases are collected in the hopper of the SDA vessel. The remaining particles are carried to the FF control system where the combination of reacted and unreacted lime helps form a filter "cake" on the baghouse fabric that assists in particulate removal and ultimately, highly efficient exhaust gas cleaning.

4.4.2 SOURCE SEPARATION IMPACT ON PARTICULATE EMISSIONS

While certain materials separation efforts are considered in this document because of their potential to reduce air emissions, the amount of emissions reductions cannot be quantified. For this reason, materials separation activities are discussed in this BACT analysis; however, materials separation should not be imposed as BACT. There is no evidence to demonstrate that source separation of certain components by itself provides for consistent and measurable reductions of particulate emissions. Because it is not possible to quantify the effect of source separation, source separation does not qualify as a technology or clean fuel process.

4.4.3 AVAILABLE CONTROL TECHNOLOGIES

Particulate matter control devices have been employed in numerous industries and include FFs, electrostatic precipitators (ESP), cyclones, wet scrubbers, and others. From a top-down perspective the most effective types of particulate matter control equipment being successfully applied to municipal waste combustors are FF and ESP systems. USEPA, in its review of control technologies in support of the NSPS for municipal waste combustors, considers FF and ESP systems to be equivalent in providing control of particulate matter (USEPA, 1989e; and USEPA, 1995d). This equipment has been successfully applied to numerous municipal waste combustor installations in the U.S. It

is a generally accepted conclusion that either an ESP or a FF system can effectively reduce the particulate loading in an exhaust gas stream from a municipal waste combustor and either technology represents the most restrictive emission control technology available for particulate emissions. Unit 3 will incorporate a FF system designed to limit particulate emissions to 0.009 grains per dry standard cubic foot (gr/dscf) of exhaust gas, corrected to 7% oxygen.

Developments in FF technology have produced a variety of filter materials including coated or non-coated fiberglass, felts, and synthetic membranes to deal with differences in ash characteristics and resistivity, inlet flue gas temperature, filter cake cohesiveness, and other problems encountered with specific FF design parameters. Lee County will utilize a bag material that will meet the proposed PM_{10} emission limit of 0.009 grains per dry standard cubic foot (gr/dscf) at 7% O_2.

4.4.4 SELECTION OF BACT

Lee County is proposing to install a FF system to control particulate matter emissions which represents the "top" technology available. No further evaluation of control options is considered necessary. Therefore, a FF designed to achieve a particulate matter emission rate of 0.009 gr/dscf at 7% O_2 is selected as BACT for Unit 3.

In addition, a second lime silo will be added to the facility for additional lime storage needed for the Unit 3 SDA system. The lime silo will be equipped with a FF unit to control particulate emissions during filling operations of the silo. The FF for the lime silo will be designed to achieve an outlet grain loading of 0.03 gr/dscf, which is considered BACT for small, low flow FF units.

4.5 BACT REVIEW FOR SULFUR DIOXIDE, MWC ACID GASES, AND SULFURIC ACID MIST

For purposes of this BACT review, acid gases include SO_2, MWC acid gases, such as HCl and hydrogen fluorides (HF), and SAM. SO_2 and acid gases are generated in the combustion unit. The sources of these pollutants are the thermally driven chemical reactions between the sulfur, chlorine, and other elements and compounds in the municipal solid waste (MSW) and combustion air. Gas scrubbing systems are the most effective methods currently available for application to resource recovery systems to control SO_2 and acid gases. Wet, semi-dry, and dry scrubbing systems are available and have been applied to MSW combustion facilities. The following discussion addresses the formation of SO_2, as an equivalent acid gas, in the combustor and the specific energy, economic, and environmental impacts of available control technologies.

4.5.1 FORMATION MECHANISMS

The majority of the sulfur and chlorine found in refuse is chemically bound to other compounds. A portion of these substances are released during combustion and escape the furnace in various forms. Consequently, the type of sulfur, chlorine and fluorine

compounds released from the combustion units will be strongly dependent on the presence of gaseous compounds, combustion temperatures, and oxidizing/reducing conditions in the combustor. Similarly, uncontrolled emission rates of these compounds will be related to fuel concentrations of sulfur, chlorine, and fluorine, and to the combustion technology.

Various sulfur compounds are produced from direct combustion processes. SO_2 is the predominant form of sulfur compound released from the municipal solid waste combustion process. Some of the SO_2, when released into the ambient environment, reacts with atmospheric water vapor to form sulfuric acid. Similarly, emitted chlorine react with water vapor to form hydrochloric acid. The presence of these acid gases in the atmosphere results in reduced visibility, material corrosion, sensitive organ irritation in humans and animals, and can add to acid rain/fog problems. Sulfuric acid and emitted sulfuric acid mist may further react in the atmosphere to form sulfate salts, a particulate aerosol.

4.5.2 SOURCE SEPARATION IMPACT ON MWC ACID GAS EMISSIONS

Source Separation Impact on SO_2 and Sulfur Compound Emissions

Municipal waste combustion facility emissions of SO_2 and sulfur compounds appear to be related to both the sulfur content of the MSW and to the combustion environment. The major contributors of sulfur to the municipal solid waste stream (and their approximate sulfur content by weight) were estimated in the California Air Resources Board (CARB) document (1984) to be plastics (0.3%), textiles (0.2%), food wastes (0.25%), and yard wastes (0.35%). As can be seen by these approximate figures, the sulfur content of municipal solid waste is quite small, typically averaging less than 0.25% of the total weight (CARB, 1984). Other sources of sulfur in MSW and their approximate sulfur contents (by weight) are corrugated cardboard (0.05%), mixed paper (0.04%), newsprint (0.03%), and rubber (0.2%) (CARB, 1984). A search for more recent data regarding the chemical constituency of different components of the general municipal solid waste stream did not identify useful information. This was confirmed in discussions with Mr. Winston Porter, formerly of the USEPA (Marks, M., 2002).

With the exception of food wastes and textiles, the Lee County Materials Separation Plan provides curbside collection for a significant portion of these materials. Lee County provides weekly collection of yard and horticultural wastes from all single family residential dwellings. Commercially generated yard and horticultural wastes are generally transported to county and private facilities for recycling. Corrugated cardboard, mixed paper and newsprint are included in the residential and commercial materials separation programs. Used automotive tires are separately collected and shredded for the County by a private tire processor. Shredded tires are burned at the LCERF to recover energy and steel. Shredded tires are also used as drainage media at the County's landfill.

While certain materials separation efforts are considered in this document because of their potential to reduce air emissions, the amount of emissions reductions cannot be quantified. For this reason, materials separation activities are discussed in this BACT analysis; however, materials separation should not be imposed as BACT. There is no evidence to demonstrate that source separation of certain components by itself provides for consistent and measurable reductions of SO_2 and sulfur compounds. Because it is not possible to quantify the effect of source separation, source separation does not qualify as a technology or clean fuel process.

Source Separation Impact of HCl Emissions

HCl emissions, to a limited extent, can be related to the amount of MSW components containing chlorine. The CARB reports that plastics [mostly polyvinyl chloride (PVC) and polyurethane plastics] and miscellaneous organic wastes are the major sources of chlorine in MSW. Table salt is also regarded as a major chlorine source (CARB, 1984). Other chlorine contributors in the MSW stream are chlorine-bleached paper, yard waste, and high density polyethylene (HDPE) plastics. Based on Berkeley, California data reported by CARB, the approximate chlorine content, by weight, for these MSW components are: plastics, 6.5%; organic wastes, 1.8%; yard waste, 0.3%; rubber and textiles, 0.14%; mixed paper, 0.12%; and cardboard and newsprint, 0.05% (CARB, 1984). While separation of organic wastes, mostly food wastes, is not feasible due to their putrescible nature, recycling of other identified materials is technically and economically feasible. Recycling of plastics and paper and composting yard wastes would appear to be effective options for limiting chlorine from those contributors to the proposed Unit 3. However, tests of separated wastes have shown that removal of these wastes via materials separation programs exerts little change in facility HCl emissions. Apparently, significant chlorine exists even in source separated waste to produce significant emissions of HCl.

The Lee County Materials Separation Plan provides curbside collection of source-separated materials including plastic containers, yardwaste, mixed paper, cardboard and newsprint, as part of the residential materials separation program. These materials are also recycled at commercial businesses and institutions. Unfortunately, the plastics which are readily recycled (i.e., polyethylene) tend to contain only trace amounts of chlorine. Typical chlorine contents for various plastic materials are polyethylene (trace), polystyrene (trace), polyurethane (2.4%), and PVC (45%) (CARB, 1984). It is likely that much of the PVC plastics are used mostly for various building materials and represent only a small fraction of plastics in the normal MSW stream. Construction/demolition waste debris is not generally accepted at the Lee County ERF and is typically disposed separately from MSW at privately owned facilities identified in the Materials Separation Plan.

While certain materials separation efforts are considered in this document because of their potential to reduce air emissions, the amount of emissions reductions cannot be quantified. For this reason, materials separation activities are discussed in this BACT analysis; however, materials separation should not be imposed as BACT. There is no

evidence to demonstrate that source separation of certain components by itself provides for consistent and measurable reductions of HCl. Because it is not possible to quantify the effect of source separation, source separation does not qualify as a technology or clean fuel process.

4.5.3 AVAILABLE CONTROL TECHNOLOGIES

A number of control technologies specifically designed to reduce SO_2 and acid gas emissions have been tested and/or are operating on combustion sources in the U.S. and abroad. The most successful methods (i.e., those consistently achieving the highest control efficiencies) employ either a wet scrubbing system or an alkaline sorbent injection system of a dry or a semi-dry nature or a combination of these. Another control system that has been tested and/or employed in various forms utilizes a catalytic method of SO_2 control. These technologies are described in the following review of control alternatives for the proposed Unit 3.

Wet Scrubbing Systems

The promulgation of the CAA in 1970 and subsequent inclusion of NSPS for coal-fired utility boilers caused many new coal-fired utility boiler projects to include flue gas desulfurization (FGD) units, typically wet scrubbers, in the plant designs. The typical "first generation" wet scrubber was a wet lime or limestone spray tower which normally achieved SO_2 removal efficiencies in the 70 - 90% range. Scrubber designs included packed towers or medium high pressure drop venturi scrubbers, and many were designed for particulate removal in the same vessel. A number of design and operating problems have been associated with these "first generation" designs such as:

- Corrosion caused by improper materials selection and design;
- Equipment failure caused by improper equipment selection or design;
- Scaling and plugging caused by improper operation and control and by improper equipment design or control system design;
- Scrubber waste processing and disposal problems caused by improper equipment design, mostly related to the cementing properties and poor dewatering characteristics of calcium sulfite sludges.

As these "first generation" problems were identified, they were corrected by retrofit and improved new system designs.

The various operating problems were encountered because often the scrubber was designed for both particulate and acid gas removal. Wet scrubbing for acid gases differs markedly from wet scrubbing for particulate matter in several ways: (1) emphasis is on gas/liquid contact and not impingement of particles, (2) chemical additives to the scrubber liquid require careful attention to the system chemistry and accelerate the potential for corrosion and fouling of scrubber internals, and (3) the volume of waste is substantially increased. As a result, significantly more attention is paid to process

conditions and effluent/exhaust chemical composition with wet scrubbing for gases (USEPA, 1987d).

Many types of wet scrubbers are used for removing acid gases including spray towers, centrifugal scrubbers and low pressure drop venturi scrubbers. Scrubbers with internals, such as packed-beds and trays, are typically not incorporated with waste combustion due to the potential for plugging and corrosion (USEPA, 1987d).

Currently, wet scrubbers are operating on numerous sources in the U.S., predominantly high sulfur fuel (coal and oil) fired power plants, municipal sludge combustors, and hazardous waste combustors. Wet, calcium-based FGD systems have been the preferred acid gas control option for large utility power plants. However, wet scrubbers have not gained popularity in the U.S. waste-to-energy industry. Municipal waste combustion plants in the U.S. have predominantly utilized dry or semi-dry FGD systems in combination with a FF baghouse to minimize water use and for enhanced fine particulate control. USEPA, in evaluating data and conducting analyses in support of the established MWC emission guidelines, NSPS and maximum achievable control technology (MACT) gave little consideration to wet scrubbers as a viable acid gas control option for MWCs (USEPA, 1989b).

The bulk of recent wet scrubber experience with municipal waste combustion systems and thus, municipal waste combustion flue gas cleaning systems, comes primarily from Europe. Modern flue gas cleaning systems reflect a better quality of design based upon the experience gained from the first scrubber installations. Some specific examples of earlier designs and the modifications made include:

- The use of packed bed designs in earlier systems (e.g., turbulent contact absorbers) in lieu of the preferred open spray tower.
- Earlier designs incorporated the use of venturi scrubbers for removal of particulate, HCl and SO_2 in the same unit. The preferred method is to remove particulate separately, thus avoiding the high pressure drop of the venturi and the problems associated with scaling and mud formation. This is accomplished by placing the scrubber downstream of a particulate collection device such as an ESP.
- Location of induced draft fans downstream of wet scrubbers where the flue gas is at saturation, and thus more corrosive, was also modified in later designs (Jordan, 1987).

The original TA LUFT Legislation promulgated in West Germany in 1974 prompted the installation of wet scrubbers on a number of refuse burning facilities in West Germany. The original wet scrubber systems installed at the Kiel and Krefeld facilities were tested and reviewed to gain performance data for these systems.

The Kiel plant was the first refuse burning facility in West Germany to have used ESPs in combination with a single stage wet scrubber. The facility is equipped with two VKW furnaces and can burn up to 240 metric tons per day (265 tpd) of sewage sludge and

refuse. Flue gases exiting the furnaces are routed to ESPs for removal of particulate matter and then enter a single stage wet scrubber for control of HCl, hydrogen fluoride (HF) and SO_2. The wet scrubbers use calcium hydroxide, $Ca(OH)_2$, as the alkaline reagent. Air pollution tests conducted at the Kiel plant in 1976 showed HCl and HF removal efficiencies of greater than 95%. In addition, emissions of sulfur oxides (SO_2 and SO_3) were reduced by approximately 50% (CARB, 1984). The Kiel plant demonstrated high on-line reliability for continuous operation (Beaumont Environmental, Inc. (BEI), 1986).

The lower SO_2 removal efficiency relative to the higher HF and HCl removal efficiencies shown at the Kiel facility identified a problem with single-stage scrubbing utilizing a calcium based sorbent for acid gas control. The performance of wet scrubbers is dependent on many factors, and at the time, the data base was too limited on municipal waste combustion applications for detailed evaluations of the effects. Theoretically, the reaction of strong acid gases (HCl, HF) proceeds rapidly with alkaline solutions and even mildly acidic solutions. Hence, HCl and HF removal should be high (greater than 90%) in most cases, assuming proper operation. The reaction of SO_2 proceeds more slowly and over a limited pH range, the limiting factors are the rate of SO_2 absorption and, for calcium systems, the dissolution rate of solid caustic particles. Thus, SO_2 removal may vary greatly over a limited range of operation, depending on pH control, inlet SO_2 concentration, and many other factors (USEPA, 1987e). This determination of different reaction rates prompted European facilities to begin utilizing two stage wet scrubbers to separately remove first HCl and HF in the first stage and SO_2 in the second stage.

Two stage wet scrubbing also provided for better recycled products from generated wastes. Control of HCl in the combustor flue gas with a single-stage scrubber results in a significant portion of calcium chloride ($CaCl_2$) in waste scrubber solids as well as a buildup of chlorides in the scrubber liquor such that waste handling and liquor recycle are more difficult. Solids were also more difficult to settle and dewater with $CaCl_2$, making generation of a useful waste material such as gypsum ($CaSO_4$) impractical. Utilization of a two-stage scrubber allows removal of HF and HCl, typically with water, in the first stage with the second stage, or main absorber, utilizing reagent scrubbing for SO_2 control. This arrangement has demonstrated better control of all acid gases while providing the potential for more saleable by-product wastes (USEPA, 1987e).

The Krefeld plant, built soon after the Kiel plant, is designed to burn up to 1600 metric tpd of sewage sludge and refuse. Similar in design to the Kiel facility, the Krefeld plant at that time utilized ESPs and wet scrubbers for emissions control. However, the Krefeld plant incorporated two-stage wet scrubbers. Each stage uses a different alkaline reagent in the scrubber solution. The first stage uses calcium hydroxide to reduce emissions of gaseous HCl and HF. Emissions of sulfur oxides are reduced in the second stage through use of either a sodium or calcium based reagent (CARB, 1984). Results from tests conducted on the Krefeld facility showed an optimum 99+% HCl removal, 97+% HF removal and 96+% SO_2 reduction when firing refuse only (BEI, 1986).

Wet scrubbers have demonstrated potential for high efficiency SO_2 and acid gas control. However, it has been shown that wet scrubbers alone are only moderately effective in controlling heavy metals and organic emissions. In order to get effective metal and organic emissions control, additional reagent injection and subsequent particulate collection are employed. Generally, ESP's are used in conjunction with wet scrubbers for added particulate removal. Typically, some flue gas re-heating is necessary to reduce acid condensation within downstream equipment and to increase plume rise. FFs are not typically used with wet scrubbers due to the detrimental effect of saturated moisture on the filter bags (Davis, W.T., 2000).

Regarding the ability of wet scrubbers to remove additional pollutants, several test programs at municipal waste combustion facilities with wet scrubbers have focused on variations in dioxin/furan toxicity at different points in the process. The results indicated that although there may be a reduction in the mass rate of organics, the overall toxicity of the emission increases. This phenomenon is theorized as being attributable to stripping of chloride ions from high PCDD/PCDF isomers such as octa and hepta to the higher toxicity isomers, tetra and penta PCDD/PCDF (Franklin Associates, 1991).

Wet scrubbers are generally not effective in controlling submicron aerosol mists which would include SAM or volatilized mercury vapor. The fate of captured mercury is unknown regarding the continuous recycling of wet scrubber reagent and the disposal of sludge with captured mercury in the liquid phase. Most recent European facilities that employ wet scrubbers also include a reagent injection system for mercury control (Franklin Associates, 1991).

With introduction of very stringent emissions limitations in Germany, Austria and the Netherlands in the early 1990's, high efficiency multi-stage flue gas cleaning processes were designed and applied to new MWCs or retrofitted to existing MWCs. These typically comprised selective separation stages for each individual pollutant. The captured pollutants and their resultant waste streams were converted to recyclable products, for example, SO_2 to $CaSO_4$ or gypsum. In addition, it became desirable to control well below regulatory requirements to "near zero" emissions. This application of multiple control steps was often done without consideration for cost or the impact on energy production/plant efficiency. In some cases in the mid-1990's, plants were built with five to seven individual cleaning steps in the attempt to produce saleable products from the waste stream. Companies in the environmental control industry found that this approach was not transferable to many other countries due to differences in waste management practices and economics. Furthermore, it became evident that revenue generated from recycled products did not justify the added investment of separate control stages (Schüttenhelm, et al., 2000).

In Germany as well as other countries, a trend to simpler, integrated flue gas cleaning processes has been observed in the last three to four years. This trend has been prompted by more general acceptance of MWCs as well as a ban on landfilling MSW, coupled with a considerable change in the overall economic climate. Development of more thermally efficient MWC systems that include less expensive, and hence, more cost effective

control technologies has been the result. Thus, new plants are featuring integrated flue gas cleaning processes producing mixed wastes for disposal, rather than individual separation processes producing recyclable wastes (Schüttenhelm, et al., 2000).

Semi-Dry Sorbent Systems (SDA)

SDA scrubber systems effectively control SO_2 and other acid gases and have been applied to the majority of resource recovery facilities in the U.S. in the last 10 years. In addition, SDA's have been the technology of choice for retrofit to existing municipal waste combustors to meet the emission guidelines acid gas removal requirements.

Spray drying is designed to control acid gases, but also provides control of organics and volatile metal emissions from municipal waste combustion facilities. In the spray drying process, lime slurry is injected into the spray dryer chamber typically through either a rotary atomizer or two-fluid nozzles. Rotary atomizers use centrifugal energy to atomize the slurry. The slurry is fed to the center of a rapidly rotating disk or wheel where it flows outward to the edge of the disk. The slurry is atomized as it leaves the surface of the rapidly rotating disk. Two-fluid nozzles use kinetic energy to atomize the slurry. High velocity air is injected into a stream of slurry, breaking the slurry into droplets, which are ejected at near sonic velocities into the spray drying chamber. Both of these atomization methods have been used in spray dryers on municipal waste combustion facilities. Spray dryers with two-fluid nozzles are typically larger in height than diameter while those with rotary atomizers have a larger diameter than height. Slurry droplets of comparable size can be obtained with both two-fluid nozzles and rotary atomizers, minimizing differences in performance due to atomizer type.

The atomized slurry droplets contact the hot flue gas in the SDA chamber. The water in the lime slurry evaporates to cool the flue gas, and the lime reacts with the acid gases in the flue gas to form calcium salts. The SDA chamber is designed to provide sufficient contact and residence time to produce a dry product leaving the SDA chamber. The residence time in the chamber is typically 10 to 15 seconds. The particulate exiting the SDA contains fly ash plus calcium salts, water, and unreacted lime. The simultaneous evaporation and reaction in the spray drying process increases the moisture and particulate content of the flue gas.

Key design and operating parameters that can significantly affect SDA performance are SDA outlet temperature, lime-to-acid stoichiometric ratio, and slurry droplet size. The SDA outlet temperature is controlled by the amount of water in the slurry. More effective acid gas removal occurs at lower temperatures, but the temperature must be kept high enough to ensure the slurry and reaction products are adequately dried prior to collection in the particulate control device and that the flue gas temperature stays above the acid dew point. Therefore, a minimum SDA outlet temperature of approximately 240°F (116C) or higher is typically required to control agglomeration of PM and sorbent by calcium chloride and to guarantee that wet material is not collected by the particulate control device (Davis, W.T., 2000).

The stoichiometric ratio is defined as the molar ratio of calcium in the lime slurry fed to the SDA to the theoretical amount of calcium required to completely react with the HCl and SO_2 in the flue gas at the inlet to the SDA. At a ratio of 1.0, the moles of calcium are equal to the moles of incoming HCl and SO_2. However, because of mass transfer limitations, incomplete mixing, differing rates of reaction (SO_2 reacts more slowly than HCl), and the presence of other acid gases that react with calcium (e.g., HF, sulfur trioxide), the amount of lime fed to the spray dryer is generally more than the theoretical amount. Although not usually measured during a compliance test, droplet size would be expected to affect SDA performance. Smaller droplet size increases the surface area for reaction between lime and acid gases and increases the rate of water evaporation.

The FF is generally preferred over the electrostatic precipitation (ESP) in combination with SDA because of its inherent high efficiency and especially because of its greater secondary reaction capability. This secondary reaction capability relates to the creation of a porous filter cake on the FF bags which contains both spent and unspent reagent. This filter cake is credited with controlling pressure drops, dampening surges or pollutant spikes, providing a site for increased reagent utilization, and increasing equipment reliability (BEI, 1986).

A performance summary of SDA/FF on several facilities (USEPA, 1989a and USEPA, 1995d) presented the following results which support the use of a SDA/FF as a means of controlling several pollutants in addition to MWC acid gases:

- Acid gases - Factors affecting acid gas removal by SDA/FF systems include stoichiometric ratio, SDA outlet temperature (FF inlet), and inlet SO_2 concentration to the SDA. A stoichiometric ratio in excess of three is generally necessary to obtain consistently high acid gas removal efficiencies of 90% SO_2 and 98% HCl. Suppliers have claimed that SDA/FF systems are capable of achieving 90+% SO_2 and 95+% HCl removal efficiencies. (Eight years of data from the existing Lee County facilities have demonstrated the ability to consistently achieve this performance level).
- Particulate Matter - Analysis of particulate matter emissions from the facilities averaged less than 0.01 gr/dscf at 12% CO_2.
- Metals - Based on measured removal efficiencies of metals by SDA/FF systems; arsenic, cadmium, chromium, and lead can be removed at 99% efficiency. Nickel removal is generally high (98%), but varies. The level of Mercury removal by SDA/FF systems is uncertain, given test data showing removal efficiencies ranging from zero to 95%.
- Dioxins and Furans - SDA/FF systems operating at FF inlet temperatures of 325°F (163C) or less can consistently achieve average outlet dioxin and furan concentrations of between 1 and 30 ng/dscm at 7% O_2.

In developing and promulgating the MWC NSPS, the USEPA concluded that SDA/FF systems are the best demonstrated control technology for reducing MWC facility emissions of acid gases, particulate matter and metals, and providing additional control of

MWC facility organic emissions. This conclusion is based on operating data from a number of operating modern MWC facilities (USEPA, 1989b and USEPA, 1995d).

Dry Injection Systems

In dry SO_2 removal processes, the dry sorbent powder reacts with SO_2 and is removed in the particulate collector. Three general approaches are available or have been tested for bringing the dry sorbent into contact with the SO_2: 1) furnace sorbent injection, 2) economizer injection of calcium hydroxide sorbent, and 3) post furnace injection of dry sorbent into combustion products. These three approaches correspond to the three temperature windows that are available for SO_2 removal by a dry sorbent: furnace injection at temperatures around 1100-1250C (2012-2282°F) using a variety of calcium-based sorbents; economizer inlet injection between 450 and 550C (840-1020°F) using hydrates; and duct injection into the gas passage leading to the particulate collector, either at temperatures approaching within 5-15C (5-27°F) of adiabatic saturation for hydrates or at 130-180C (234-324°F) for sodium sorbents (Muzio, et al., 1987).

Furnace sorbent injection is a technique for controlling acid gas emissions which has been applied to conventional municipal waste combustion facilities. Lime (CaO), hydrated lime [$Ca(OH)_2$], or limestone ($CaCO_3$) is injected into the furnace section of the MWC. If limestone is used, sufficient temperature must be available for calcination of $CaCO_3$ to CaO and CO_2. Limestone is rapidly calcined to lime in the furnace at temperatures of 1400-2000°F (760-1093C). The lime, in turn, reacts with SO_2 and HCl to form calcium sulfate ($CaSO_4$) and calcium chloride ($CaCl_2$), which can be removed by the particulate control device. In conventional municipal waste combustion facilities, sorbent can be injected into the furnace using existing overfire air jets or through separate ports located above the fuel bed.

Furnace injection provides for effective SO_2 removal because lime and SO_2 readily react at typical furnace temperatures of 1600-2200°F (871-1204C). Furnace sorbent injection also provides extended contact time between lime and acid gases, as they are in contact in the flue gas starting in the combustor, through the heat recovery sections, and ending in the particulate control device. Control efficiencies have been estimated to range up to 50% or more for SO_2 and up to 90% for HCl (USEPA, 1989a). However, HCl and lime reportedly do not react at temperatures above 1400°F (760C). Potential disadvantages of furnace sorbent injection include fouling and erosion of convective heat transfer surfaces by the injected sorbent (USEPA 1989a).

A temperature window around 550C (1022°F) exists that yields sulfur capture rates similar to furnace injection with commercial hydrates and significantly better performance with specially prepared sorbents. This reactivity peak, found under the Electric Power Research Institute (EPRI) sorbent research program, is at a temperature frequently located near the economizer inlet. Injection at these moderate temperatures may not only result in higher sorbent utilizations but also facilitate injection due to the smaller cross-section (denser, higher velocity gas) and ability to insert lances or injection grids. The process, however, is effective only with hydrates. At these temperatures, SO_2

appears to react very rapidly and directly with calcium hydroxide, according to the following formula:

$$Ca(OH)_2 + SO_2 \rightarrow CaSO_3 + H_2O$$

The formation of sulfite, however, has to compete with the reaction between the abundant CO_2 and $Ca(OH)_2$ to form $CaCO_3$. Below 550C (1022°F), both sulfite and carbonate occur, but sulfite formation dominates. Above 550C (1022°F), dehydration of the $Ca(OH)_2$ accelerates, with carbonation and dehydration occurring at the expense of sulfite formation. Since sulfite formation is very fast and the window is approximately 100C (212°F) wide, the process is compatible with the high quench rates through economizers (Muzio, et al., 1987).

Economizer injection of sorbent appears useful for SO_2 removal, especially in retrofit situations. Study in this area is ongoing, and as yet, this control method has not been proposed or demonstrated on modern municipal waste combustion facilities in the U.S. Furthermore, interaction of the hydrates with trace contaminants in MSW combustion flue gas has not been fully evaluated. Due to a lack of available operational data, this experimental control option cannot be fully evaluated at this point. Therefore, this method is not considered further in this application.

Duct sorbent injection (DSI) is designed to control acid gas emissions by injecting powdered sorbent, usually hydrated lime [$Ca(OH)_2$], into the flue gas upstream of the particulate control device. The sorbent is generally injected through a venturi or into a reactor vessel just upstream of the particulate control device. The residence time prior to the particulate control device is generally one to two seconds. The sorbent reacts rapidly with the acid gases to form salts which, in addition to the fly ash and unreacted sorbent, are removed by the ESP or FF. Lower system operating temperatures increase sorbent reactivity and increase removal of acid gases as well as condensable metals and organics. At the injection point, the flue gas temperature can range from less than 300°F to roughly 600°F (149-316C). Flue gas can be conditioned (cooled) upstream of the injection point by heat exchange, such as by an economizer or air-to-air exchanger, humidification, or addition of lower temperature air (USEPA, 1989a).

Higher removal efficiencies have been observed when the flue gas is conditioned and humidified (Muzio, et al., 1987). Generally, spray drying of sorbent is more effective at removing SO_2 and acid gases than dry sorbent injection, with increasing acid gas control as the outlet gas temperature decreases toward the saturation temperature (USEPA, 1988b). Dry sorbent injection without flue gas conditioning does not appear to significantly add to the control of metals emissions more than the control supplied by the particulate control device.

Greater acid gas control can be achieved by combining the DSI system with an FF rather than an ESP. Collected particulate builds up on the FF bags forming a filter cake. The presence of unreacted sorbent in the filter cake provides additional acid gas removal. FFs

may also provide additional control of metals through control of fine particulate (USEPA, 1989a).

An analysis of performance of DSI/FFs at several facilities, including Dutchess County, New York; Claremont, New Hampshire; Quebec City, Canada; and Wurzburg, West Germany, gave the following results (USEPA, 1989a):

- Acid Gases - analysis of acid gas data shows that the FF inlet temperature significantly affects SO_2 and HCl removal efficiency (i.e., removal efficiency across the DSI/FF systems increase as temperature decreases for the data sets involved). Up to 90% SO_2 and 95% HCl removal efficiency has been demonstrated with an FF inlet temperature of 250°F (121C) and increased stoichiometric ratio of lime to acid gas. The ability to achieve these removal levels consistently has not yet been documented.
- Particulate Matter - Outlet PM concentrations averaged 0.01 gr/dscf or lower at the tested DSI/FF systems.
- Metals - Removal efficiency for metals was available for only one facility. Removal efficiencies were estimated for other facilities based on measured outlet concentrations. Removal efficiencies for lead (Pb), cadmium (Cd), and arsenic were estimated to average 99% or better. Estimates of removal efficiencies for chromium (Cr) and nickel (Ni) ranged from 94-99%. Removal efficiencies for Hg ranged from zero control to 99% control and appeared tied to the FF inlet temperature (USEPA, 1989a).
- Dioxins and Furans - Removal of dioxins and furans also appeared dependent on the FF inlet temperature, showing decreased emissions with temperature decrease. At less than 300°F (149C), emissions were below 7.7 ng/dscm at 7% O_2 (USEPA, 1989a).

Innovative Acid Gas Control Processes

The DeSONOx process is a flue gas purification process during which nitrogen oxides (NOx) and SO_2 are simultaneously extracted. The essential feature of this process is the combination of catalysts for the selective reduction of nitrogen oxide by ammonia (NH_3) with oxidizing catalysts for the conversion of SO_2 to sulfur trioxide (SO_3). The derived SO_3 is extracted as usable, concentrated sulfuric acid.

The DeSONOx process was pilot tested on the Münster heating and power plant in Germany. Preliminary results from initial testing of the system showed up to 85% SO_2 removal (Brand, et al., 1989). Corresponding HF and HCl removal efficiencies were not reported.

It appears that this technology is now marketed by Mg Engineering - Lurgi and is employed as a specialty technology for low SO_2 concentration flue gas streams. This technology does not appear to be offered for large scale facilities. No information could be found indicating application of this technology to a large-scale waste-to-energy project. Emerichem, LLC (formerly Goalline Environmental Technologies), markets the

SCONOX® and SCOSOX® pollution control technologies. SCONOX® is a catalytic control method for nitrogen oxides and SCOSOX® is a catalytic control method for SO_2. SCOSOX® has not been applied to a large scale municipal waste combustion facility for SO_2 control and currently is not being marketed in this application. Furthermore, a representative of Emerichem, LLC stated that the company would decline from offering to provide a SCOSOX® system in this application due to the potential for catalyst fouling and deactivation from trace contaminants in the municipal waste combustion flue gas (Hober, M, 2002a).

Therefore, at present, it appears that these technologies must still be considered as experimental technologies and are yet undemonstrated for application to large-scale, municipal waste combustion facilities. In addition, test results have not shown acid gas control efficiencies as high as either the SDA or wet scrubber systems. Also, the systems do not appear to offer the secondary pollutant control of HCl, HF, trace metals, etc. that the SDA/FF offers. Hence, these innovative technologies will not be further considered for application to Unit 3.

4.5.4 RANKING OF ALTERNATIVE CONTROL TECHNOLOGIES

Several systems for controlling SO_2 and acid gas compounds in combustor flue gases have been reviewed. The overall ranking of systems would conclude that wet scrubbing and semi-dry (SDA) sorbent injection systems would rank the highest of the available systems with respect to SO_2 and acid gas removal efficiency. In general, it is expected that a modern wet scrubbing system would provide slightly better SO_2 and acid gas control than the SDA. Table 4-1 presents these approximate expected control efficiencies.

Based on the above analyses of control technologies available for controlling SO_2 and acid gases, two alternatives: wet scrubbers and semi-dry scrubbers will be further evaluated on the basis of energy, economics and environmental impacts. The applicant is proposing the use of an SDA system which will be considered the base case.

4.5.5 ENVIRONMENTAL IMPACT

Despite advancements in scrubber technology, some environmental impacts are unavoidable as a result of the use of wet scrubbers. Wet scrubbers consume more makeup water (by an approximate factor of three) than a SDA system. The wet scrubber also produces an acidic, high-chloride wastewater requiring treatment. Alternative treatments for the wastewater include:

- The use of cooling tower blowdown for prescrubber makeup
- Percolation of wastewater through a limestone bed
- Evaporation ponds
- Deep well injection
- Solids dewatering and disposal to a landfill

TABLE 4-1
CONTROL EFFICIENCIES OF SULFUR DIOXIDE AND ACID GAS CONTROL TECHNOLOGIES[a]

Pollution Control System	Achievable Removal Efficiencies	
	SO_2	Acid Gas (HCl)
Wet Scrubber	90-95 %	95-99 %
Spray Dry Absorber	85-95 %	95-99 %
Dry Injection Systems	50-90 %	90-95 %

Note: SO_2 = Sulfur Dioxide
HCl = Hydrogen Chloride

[a] Source: Air Pollution Engineering Manual (Davis, W.T., 2000)

More sophisticated (and more costly) wastewater treatment alternatives would include reverse osmosis, electrodialysis, and flash evaporation/crystallization. If organics removal is required, carbon filters, UV-ozonation, or other organic treatment methods may be considered. Because the prescrubber (cooling tower) blowdown contains dilute hydrochloric acid, there may be uses for this by-product after filtration (e.g., demineralizer regeneration). Waste solids from the SDA/FF typically do not require additional treatment or processing because potential secondary uses are limited. This material is typically used for stabilization of material to be landfilled or it is directly landfilled.

Another indirect environmental impact associated with wet scrubbers is the additional pollutant burden produced by flue gas reheat above the saturation temperature if done with gas burners. Effective wet scrubbing of flue gases requires reducing flue gas temperatures to below the saturation temperature. Excessive water carryover in the flue gas can damage or destroy the particulate control device. This problem is avoided with the SDA/FF in that the flue gas temperature is maintained above saturation. Also, while slightly higher acid gas removal efficiencies are expected with the wet scrubber, significant data exists for the removal ability of SDA/FF systems. Eight years of data from the existing LCERF Units 1 and 2 show SDA/FF systems provide high efficiency acid gas removal and comparable, if not better, secondary removal of other pollutants such as trace metals and trace organics than would be expected from a wet scrubber.

Positive environmental impacts are observed relative to MSW produced for disposal. Wet scrubbing systems produce less scrubber solid waste than that produced by an SDA/FF by an approximate ratio of 2/3. If treated, some of the wet scrubber waste solids may be saleable as by-product (e.g., gypsum); however, this potential usage is speculative at best because of the presence of other trace contaminants from the municipal solid waste. Thus, in this case, solids from either a wet scrubber or SDA/FF would most likely be disposed in a landfill.

4.5.6 ECONOMIC IMPACT

USEPA, in preparation for development of the MWC emission guidelines and NSPS published approximate capital and operating costs for a SDA/FF system in the "Municipal Waste Combustion Study", (USEPA, 1987e). USEPA failed to develop similar costs for wet scrubber systems, due to limited application of wet scrubbers to MWCs. Comparative wet scrubber capital costs are developed from supplier quotes supplied during preparation of the BACT review for the proposed Mercer County (New Jersey) Resource Recovery Facility application. These capital costs were scaled to the Unit 3 facility using the "sixth-tenths" rule and escalated to 2001 dollars. The availability of recent wet scrubber cost data from installations on MWCs is limited. Most recent European facilities, as noted previously, are opting for integrated, multi-pollutant control systems such as SDA/FFs.

When considering specific capital costs of the systems for comparative purposes, it was determined to utilize combined costs for the scrubber and particulate removal device as

neither the SDA nor the wet scrubber are as effective without added particulate removal equipment. Therefore, costs were developed for SDA/FF and wet scrubber/ESP cases. The ESP would most likely precede the wet scrubber, which significantly enhances wet scrubber acid gas removal ability while reducing the potential for plugging from collected particulate. The FF would follow the SDA to collect dry particulate matter formed in the SDA. It is expected that both systems will provide better than 95% control for HCl, HF and other acid gases. Therefore, cost comparisons will be based on removal of the more difficult pollutant, SO_2, with the SDA/FF at 80% SO_2 removal (1151 tons/year) and the wet scrubber at 90% SO_2 removal (1295 tons/year). Estimated cost removal values are:

SDA/FF	\$1,750-\$2,000 / ton SO_2 removed
Wet Scrubber/ESP	\$3,500-\$4,300 / ton SO_2 removed

These costs did not include waste treatment and disposal, integration of the systems with existing Units 1 and 2 and additional problems with water use and disposal, all of which are expected to be significantly costlier for the wet scrubber/ESP than the SDA/FF.

In general, and with all costs considered, the wet scrubber/ESP option is significantly more costly than the SPA/FF option, given the small increase (if any) in SO_2 and acid gas control assumed from a wet scrubber as opposed to the SDA/FF. This should also be considered relative to the demonstrated performance of the SDA/FFs currently operating on Units 1 and 2 at the LCERF. Emissions data from 1994-2001 have demonstrated removal efficiencies for SO_2 typically in excess of 90% and removal efficiencies for HCl and HF typically in excess of 95%.

When considering the incremental cost of applying a wet scrubber/ESP over a SDA/FF for assumed increased SO_2 control (additional removal of 144 tons of SO_2), the cost per ton of SO_2 removed increases to the approximate range of \$31,000.00 to \$38,500.00. This assumes the SDA/FF achieves 80% SO_2 control and wet scrubber/ESP achieves 90% control. As discussed above, actual performance of the SDA/FF has demonstrated higher removal efficiencies that would significantly increase this incremental cost.

Thus, the increase in cost of applying a wet scrubber/ESP system would appear excessive for a technology that offers potential for only a marginal increase in SO_2 control, at best. Furthermore, wet scrubber/ESP systems have not demonstrated the ability for multi-pollutant removal on MWCs that SDA/FFs have.

The SDA/FF system proposed for Unit 3 will be designed and is guaranteed by the supplier to comply with a HCl emission limit of 25 ppmdv at 7% O_2 or 95% control, whichever is least stringent, a HF emission limit of 3.5 ppmdv at 7% O_2, a SO_2 emission limit of 29 ppmdv at 7% O_2 or 80% control, whichever is least stringent and a SAM emission limit 16.68 ppmdv at 7% O_2.

4.5.7 ENERGY IMPACT

Wet scrubber systems are generally more energy intensive than SDA scrubbers systems, which translates to higher energy costs. This higher energy requirement results mainly from the slurry re-circulation pumps, the flue gas reheat system, and the scrubber wastewater treatment systems. After treatment in a wet scrubber, flue gases are typically reheated above saturation to avoid fogging, icing or condensation in the downstream equipment or stack. After treatment in a SDA/FF, flue gases typically are not reheated as temperatures are maintained above saturation. SDA/FF systems also do not require separate wastewater treatment systems or scrubber waste solids treatment and de-watering as wet scrubber systems do. Other significant energy consuming components (e.g., fans, ESPs, rotary atomizers) and additives of wet scrubbers are minor and can be safely assumed to be equivalent to corresponding components in an SDA system.

Differential energy costs were not quantified for this review. Therefore, from an electrical energy standpoint, the wet scrubber systems can be considered more energy intensive than SDA/FF system. With respect to reheat energy, the SDA/FF systems do not utilize flue gas reheat and are thus more energy conservative than wet scrubber systems. These reheat costs alone can be substantial due to continuously fluctuating fuel costs.

4.5.8 SELECTION OF BACT

The preceding analysis identified wet scrubbers and semi-dry SDA scrubbers as the two "top" acid gas control technologies as providing the highest removal efficiencies relative to other technologies. Based on a review of energy, economic and environmental impacts, wet scrubbers are rejected as BACT for the Unit 3 facility. It is generally recognized that wet scrubbers may achieve slightly lower emissions of acid gases than SDA systems; however, their effectiveness in controlling trace metals and trace organic emissions as well as SDA systems is questionable. Test results have shown that wet scrubbers and SDA systems provide comparable reductions in emissions of HCl and HF and nearly equivalent reductions in SO_2 emissions (USEPA, 1988b and USEPA, 1989a). This is also confirmed in available test data from Units 1 and 2 at the LCERF. Whether wet scrubbers provide enhanced control of trace metals and trace organics is inconclusive due to the lack of data showing this relationship. The negative aspects of wet scrubbers with respect to SDA systems include:

- Potential higher ambient impacts due to lower plume buoyancy dispersion factor
- Increased requirement of makeup water over SDA systems
- Production of wastewater effluent requiring treatment prior to discharge
- Higher capital and operating costs associated with wet scrubbers
- Increased energy utilization
- Increased secondary pollutant generation
- It is a relatively undemonstrated control technology for modern municipal waste combustion facilities in the U.S.

Also, extensive test data is available demonstrating the effectiveness of SDA/FF systems for SO_2 and acid gas emissions as well as secondary pollutant (trace organics and trace metals) control. Thus, based on an analysis of energy, economic, and environmental factors and considering the negative aspects of wet scrubbers in comparison to SDA systems, BACT for the control of SO_2 and acid gases at the proposed Unit 3 is determined to be the SDA/FF option.

Additionally, in developing the NSPS for municipal waste combustion facilities, USEPA stated that the best demonstrated technology for reducing emissions of acid gases from large MWCs (i.e., greater than 250 tpd) is a SDA followed by a FF (USEPA, 1989b and USEPA, 1995d). The system proposed for Unit 3 is a SDA system, which is a post furnace injection technology followed by a FF baghouse. The SDA system introduces a finely atomized lime-based slurry into the flue gas stream causing turbulent reaction with SO_2 and acid gases as the slurry evaporates and dries, resulting in a dry product collected in the particulate control device. The SDA system will be designed to achieve SO_2 control levels of 29 ppmdv or 80% removal of uncontrolled emissions (geometric mean 24-hour block average), whichever is least stringent. The emission rates for SO_2 and acid gases are given in Section 3.

4.6 BACT REVIEW FOR NITROGEN OXIDES EMISSIONS

NOx emissions are formed by two mechanisms during the combustion process. The first mechanism is the formation of NOx by high temperature oxidation of atmospheric nitrogen, which is called thermal NOx. The second mechanism is the formation of NOx by the oxidation of fuel-bound nitrogen, also known as fuel NOx. The combination of higher temperature combustion required in municipal solid waste combustion units to destroy organics and air toxics precursors (which tends to increase thermal NOx generation and subsequent emission) and concern about the role of emitted NOx in the formation of ozone and acid rain has caused increased attention on NOx control.

4.6.1 FORMATION MECHANISMS

Nitrogen-based compounds are products of all conventional combustion processes. Nitric oxide (NO) is the predominant form of NOx produced in MWCs along with lesser amounts of nitrogen dioxide (NO_2). However, once emitted, it is assured that NO converts to NO_2 in the atmosphere. The generation of NOx from MSW combustion is primarily the result of the conversion of fuel-bound nitrogen (fuel NOx), although some nitrogen in the combustion air (thermal NOx) may also be converted to NO in the higher temperature regions (Davis, W.T., 2000). Fuel NOx is formed when MSW containing nitrogen and its compounds is burned, and the nitrogen is oxidized in the process. Thermal NOx formation is a result of the relatively high concentration of nitrogen in the ambient air combustion supply (ambient air contains approximately 79% nitrogen by volume). The introduction of ambient air (excess air) to the combustion zone, which is often at high enough temperatures to oxidize the nitrogen in the ambient air, results in thermal NOx formation.

Thus, because of the abundance of available nitrogen present in combustion makeup air, thermal NOx formation is primarily a function of temperature and excess air (oxygen availability). Fuel NOx formation is strongly affected by the local oxygen concentration present in the flame and also by the mixing rate of fuel (MSW) and combustion air. Like thermal NOx, formation of fuel NOx is dominated by the local combustion conditions (specifically how and at what temperature combustion air and MSW are mixed).

4.6.2 SOURCE SEPARATION IMPACT ON NITROGEN OXIDES EMISSIONS

Removing the materials that are relatively high in nitrogen content is one possible way of lowering the mass emission rate of NOx. However, as noted by CARB (1984), the percent reduction in NOx emissions from such efforts is probably not significant. Based on CARB's compilation of available data, nitrogen typically comprises less than 1% (by weight) of the total waste stream (CARB, 1984).

The major nitrogen contributors and their approximate relative percent by weight for typical MSW composition are textiles (5.5%), food wastes (10.4%), yard wastes (15.4%), and, to a lesser degree, plastics (7.5%). The nitrogen content of these respective materials is estimated by CARB as 2.2%, 2.8%, 2.9%, and 1.0%. (CARB, 1984) The largest reduction in fuel nitrogen contents can thus be realized by separation of food wastes and yard wastes. Due to the putrescible nature of food waste, source separation is not a viable option for this material.

The Lee County Materials Separation Plan provides for both residential and commercial recycling of yard and horticultural wastes. Of the remaining solid waste constituents which significantly contribute to the MSW fuel nitrogen content, residential recycling of PET, HDPE, and other plastic consumer products containers is also provided by the Materials Separation Plan. No separation of textiles is planned at this time. Paper products, while containing less than 0.3% by weight of nitrogen, constitute a significant portion of any municipal solid waste stream. Curbside collection of residentially separated corrugated cardboard, kraft paper bags, telephone books, magazines, newspapers and mixed papers is provided by the Materials Separation Plan. Separation and collection of these materials by commercial businesses and institutions is done on a voluntary basis.

While certain materials separation efforts are considered in this document because of their potential to reduce air emissions, the amount of emissions reductions cannot be quantified. For this reason, materials separation activities are discussed in this BACT analysis; however, materials separation should not be imposed as BACT. There is no evidence to demonstrate that source separation of certain components by itself provides for consistent and measurable reductions of NOx. Because it is not possible to quantify the effect of source separation, source separation does not qualify as a technology or clean fuel process.

4.6.3 AVAILABLE CONTROL TECHNOLOGIES

Emissions of NOx can potentially be reduced at municipal waste combustion facilities by two methods: 1) minimizing the quantity of NOx generated during combustion (combustion modification), and 2) reducing the quantity of NOx in the flue gas stream (flue gas controls).

Table 4-2 is a summary based on available data of the NOx control techniques that could potentially be used at municipal solid waste combustion facilities. The information in Table 4-2 also includes the status and the control efficiency of the three major NOx reduction methods. Combustion modifications typically include staged combustion and low excess air (LEA). Other combustion modifications tested on MWCs with mixed or inconclusive results are gas reburning and flue gas recirculation (FGR). Flue gas controls include selective catalytic reduction (SCR), selective non-catalytic reduction (SNCR), wet flue gas denitrification (FGD_n), electron beam treatment (E-Beam) and innovative methods such as SCONOX®. Of these techniques, only combustion modifications, reburning with natural gas, SNCR, and SCR have been successfully demonstrated on municipal solid waste combustion facilities or show significant potential for effective NOx control (USEPA, 1989c). Thus, detailed descriptions of NOx controls will be limited to these technologies.

Combustion Modifications

Techniques available for NOx control that fall within the combustion modification category include LEA, staged combustion, FGR and gas reburning. These technologies achieve NOx emission reductions from MSW combustors by limiting the amount of thermal and fuel NOx formed in the combustion process.

Low Excess Air (LEA) and Staged Combustion

LEA and staged combustion can be used separately or together. With LEA, less air is supplied to the combustor than normal, lowering the supply of oxygen available in the flame zone to react with nitrogen in the combustion air. With staged combustion, the amount of underfire (primary) air is reduced, generating a starved-air region. By creating a starved-air zone, strong reducing atmosphere is generated where part of the fuel-bound nitrogen is converted to ammonia (NH_3). Secondary air to complete combustion is added as overfire air. With proper control of overfire air, NH_3, NOx, and O_2 react to form N_2 and water.

LEA and staged combustion together reduce NOx emission due to a combination of several factors. First, a lack of available oxygen for NOx formation in the fuel rich combustion stage results in off-stoichiometric firing. Second, the flame temperature is generally lower in the first stage than would be expected with single stage combustion at stoichiometric conditions. Third, the peak temperature in the second stage (air rich) is lower. By creating a slow combustion air and fuel (MSW) mixing process, a greater opportunity to convert fuel bound nitrogen to molecular nitrogen occurs rather than

TABLE 4-2
ALTERNATIVE CONTROL METHODS
FOR NITROGEN OXIDES

Control Method	Control Efficiency	Status
Source Separation	Not Quantifiable	Effect on MWC emissions are not quantifiable.
Combustion Modification		
Good Combustion Practices (GCP), including Low Excess Air (LEA) and Staged Combustion	30-60%	Effective but unknown side effects on combustion process and combustion related pollutants
Flue Gas Recirculation	10-25%	Somewhat effective, but the relatively moist flue gas from after the baghouse in combination with GCP may lead to increased emissions of CO and boiler problems.
Gas Reburning	Unknown	Not yet applied to MWCs in the U.S.
Flue Gas Controls		
Selective Catalytic Reduction (SCR)	50-90%[a]	Has not been applied to MWCs in the U.S.
Selective Non-Catalytic Reduction (SNCR)	35-60%	Has been applied to MWCs in the U.S.
Wet Flue Gas Denitrification (FGD_n)	Unknown	Has not been applied to MWCs in the U.S.
Electron-Beam (E-Beam)	Unknown	Has not been applied to MWCs in the U.S.

[a] Only limited short-term data is available.

allowing it to be converted to NOx. LEA and staged combustion have been demonstrated to be an effective technique for reducing NOx emissions in the design of modern MWCs, and is inherent in the design of the Martin combustion system.

It should be noted that the lower NOx emissions can be partly attributable to a lower quantity of thermal and fuel NOx resulting from lower flue gas temperatures. These conditions are known to lower NOx emissions, but they can also be related to higher CO emissions and lower combustion efficiency. Should the technique be improperly applied, higher emissions of CO, hydrocarbons (HC), and other products of incomplete combustion (PIC) may result.

The formation of thermal NOx is minimized in the Martin combustor by controlling the flame temperatures below 2,400°F (1316C). The distribution of the combustion air is controlled with the Martin reverse reciprocating grate firing system and master combustion control system such that the available oxygen in the primary combustion zone is maintained at desired levels.

Approximately 60-70% of the combustion air is introduced in the primary combustion zone, below the grates. The remainder of the combustion air is provided by overfire air ports located above the grate to ensure complete oxidation of combustibles. The fuel-rich regions of the primary flame zone cool by radiation before the combustion process is completed with the remaining combustion air. Peak flame temperatures are reduced, thus reducing thermal NOx formation, and fuel-rich combustion regions minimize oxidation of the fuel-bound nitrogen. The lengthening of the flame path via the use of overfire air also has the favorable effect of maintaining low temperatures and thus controlling thermal NOx formation (USEPA, 1989c).

Flue Gas Recirculation (FGR)

In FGR, cooled flue gas (i.e., after the spray dryer baghouse) is mixed with combustion air, thereby reducing the oxygen content of the combustion air supply. The flame temperature is lowered and less oxygen is present in the flame zone, reducing thermal NOx generation. At the Long Beach, CA, mass burn combustor, where FGR was used to supply 10% of the underfire air, reductions in NOx emissions were observed, although available quantitative results are limited. However, due to operational problems, the FGR system at Long Beach has been removed. At the Kita facility in Tokyo, Japan, a Volund mass burn/refractory combustor, where FGR is used to supply 20% of the combustion air, NOx reductions of 10-25% were reported (CARB, 1984). Little increase in NOx reduction was observed with FGR supplying rates in excess of 20% of the combustion air.

FGR for NOx control may increase emissions of other pollutants. Should the technique be improperly applied, higher emissions of CO, HC, and other products of incomplete combustion (PICs) may result. For example, if the excess air is decreased too much, visible emissions and higher CO concentrations may result. If too much flue gas is recirculated, the flame zone can become unstable, causing poor combustion and higher

CO emissions (USEPA, 1989c). Also, corrosion and slagging in the boiler may occur. Thus, given the potential problems FGR can introduce, most modern MWCs do not incorporate FGR. Moreover, FGR has not been used in combination with other technologies, such as SNCR in the U.S. MWCs.

Gas Reburning

Gas reburning is a NOx control technique that overlaps combustion modification techniques. LEA is provided in the combustor, with recirculated flue gas introduced above the grate. Natural gas is added to this LEA zone to generate a fuel-rich zone. Air is supplied above the fuel-rich zone to complete combustion. This process is designed to reduce NOx formation without increasing CO emissions.

The goal of gas reburning is to achieve up to 75% NOx reduction when combined with LEA, staged combustion and FGR. To date, most of the available data for gas reburning are for applications on pulverized coal-fired boilers. Initial testing for municipal waste incinerators was conducted on a six tpd pilot-scale combustor. In the pilot-scale unit, NOx emissions without gas reburning ranged from 190 to 260 ppm at 7% O_2. With gas reburning, the NOx emissions were 110-125 ppm at 7% O_2, an average reduction of 50%. The maximum NOx reduction measured was 60-70%. During these tests, 15% (heat input basis) natural gas, 15% FGR (for mixing the natural gas), and 30-40% secondary excess air were used. Neither CO nor hydrocarbon emissions increased with gas reburning (Abbasi, et al., 1989).

Additional tests with natural gas reburning were conducted at the Olmsted County (Minnesota) municipal waste combustion facility by a joint program with the Gas Research Institute (Abbasi, et al., 1991). The test data showed that the natural gas injection of 12% to 15% (heat input basis) and FGR of 6% to 8% resulted in NOx reduction of 60% and CO reduction of 50%. Natural gas reburning also allowed a reduction of excess air from 80% to 40% which provided increased boiler efficiency. The test data also indicated that optimization of residence time in the combustor is important for simultaneous reduction of NOx and CO. However, long-term operational data on natural gas reburning in MWCs is not available.

In general, natural gas reburning has not been utilized as a NOx control technique in new MWCs primarily due to increased fuel costs and operational costs relative to less expensive, yet equally effective, NOx reduction techniques. Natural gas reburning has primarily been applied to fossil fuel boilers as a retrofit NOx control technique or for seasonal NOx reductions, where needed.

Flue Gas Controls

Flue gas controls can generally be placed into one of two categories: SCR and SNCR. Three additional technologies, flue gas denitrification (FGD_n), the electron-beam (E-Beam) process, and other catalytic methods such as SCONOX® have been tested or applied for NOx control on industrial facilities and are discussed below. The following

discussion explains the technological aspects of each of these control methods and their associated environmental, energy and economic impacts.

Selective Catalytic Reduction (SCR)

SCR is an add-on control technology for NOx removal. Ammonia (NH_3) is injected into the flue gas downstream of the boiler where it is mixed with the NOx contained in the flue gas and passed through a catalyst bed. In the catalyst bed, NOx is reduced to N_2 by reaction with NH_3. The overall reactions between NOx and NH_3 are:

$$4NO + 4NH_3 + O_2 \rightarrow 4N_2 + 6H_2O$$
$$2NO_2 + 4NH_3 + O_2 \rightarrow 3N_2 + 6H_2O$$

The reactions between NOx and NH_3 occur at temperatures of 375-750°F (191-399C), depending on the specific catalyst and the type and level of competing contaminants in the flue gas.

SCR has been tested and applied at coal, oil, and natural gas-fired facilities in the U.S. Reductions of NOx emissions have ranged from 50-90% and have been measured at these facilities with varying NH_3 to NOx molar ratios and varying operational temperatures. Currently there are no applications of SCR on municipal waste combustion facilities in the U.S. Therefore, no data exists regarding costing, achieved control efficiencies and longevity of systems applied to municipal waste combustors in this country. However, SCR systems have been applied and are operating on municipal waste combustion facilities in Europe and the Far East, and most recently in Canada.

Lee County attempted to obtain information from foreign facilities regarding continuous operation of the SCR units and their long-term emission reduction capabilities. An intensive search for information was initiated, with requests for information submitted to a number of catalyst manufacturers, catalyst system suppliers, individual facilities and government agencies. The focus of the information request was to obtain a list of MWCs employing SCR as well as obtain information on system operation relative to the following four questions:

- Operational history of the SCR units (installation date, life of unit, catalyst life expectancy, problems with unit, catalyst poisoning problems, etc.),
- Specific capital, installation, operating, and miscellaneous costs of SCR on waste incinerators,
- Maximum/minimum/average flue gas concentrations for 1-hour, 3-hours, 24-hours, and annual time periods for nitrogen oxides, sulfur dioxide, volatile organic compounds, and carbon monoxide; and
- Estimated system upset or downtime from SCR malfunction.

It was considered necessary to have this information in order to perform proper feasibility analyses as required by USEPA. A copy of the contact list of this data search is provided in Attachment C to this document. The only information received from this data search

was single performance test data for several European facilities and SCR system suppliers as well as one Japanese SCR system supplier with most of the test data collected at startup of the unit. Mitsubishi Heavy Industries, Ltd. (MHI) provided a letter to Covanta Projects, Inc. that included initial performance test data from two facilities collected in 1987. More recent data or a description of system performance since 1987 was not provided. No responses were received that adequately addressed the four questions noted above. This limited data set shows achievable NOx reductions ranging from 62.5% to 85% during specific tests with no indication of system ability to continuously achieve high reductions in the long-term.

Early testing of SCR on refuse-fired boilers in Japan revealed difficulties, primarily due to catalyst fouling by particulates and condensable. In applications where the catalyst was upstream of the particulate removal device, the relatively high particulate grain and/or condensable loading of the flue gas fouled the catalyst, rendering the bed ineffective in NO_2 removal. Particulates eroded the catalyst and substrate material, and poisoned or blinded the catalyst (ENSR, 1991).

According to USEPA, earlier SCR problems such as catalyst poisoning by SO_2, plugging, ammonium bisulfate deposition, production of SO_3 and erosion of the catalyst had generally been overcome on other types of combustion units (ENSR, 1991). However, in scenarios where conventional SCR catalysts (which use a base metal with titanium oxide) were placed at the economizer outlet (to take advantage of the optimum temperature range of 530°F-800°F [277-427 C]), attack of catalyst by hydrochloric acid (HCl) was a persistent problem. Research efforts continue on developing high temperature catalysts resistant to HCl attack, metals poisoning, and high particulate loadings. MHI, which has supplied the catalyst for several Japanese facilities, considers placement of a SCR catalyst upstream of the particulate removal device in municipal solid waste combustion applications as not practical because of potential fouling. Even though MHI indicated that catalysts are available with wider pitches to handle higher particulate loadings, MHI suspects that particulate fouling would still occur (ENSR, 1991). This fouling has been confirmed with additional testing. Attempts to place SCR catalyst as a "hot-side" unit before pollution control in MWCs has continued to show rapid de-activation of the catalyst. In a discussion with a representative of Babcock-Borsig Power, the primary problem that caused catalyst de-activation was lead and other trace metals in the flue gases (Licata, T., 2001). European facilities have overcome this catalyst de-activation by placing the SCR system downstream of pollution control equipment.

Acid gas attack, metals poisoning and particulate fouling may be avoided by placing the catalyst downstream of the pollution control equipment, allowing the SCR unit to treat flue gases free of these contaminants. This is undesirable, however, for two reasons: (1) conventional catalysts do not perform well at the lower temperatures required for effective removal of acid gas and organic constituents and (2) flue gas reheat would be needed to raise the flue gas temperatures to the optimum range, the latter imposing severe energy penalties, while adding additional pollutant emissions to the flue gas. In order to reduce flue gas reheat, catalyst manufacturers have been developing low temperature

SCR catalysts. However, the ability of the catalyst to operate at low temperatures is often dependent on the quantity of competing contaminants in the flue gas (Hober, M., 2001a).

Table 4-3 provides a sample list of European municipal waste combustion facilities utilizing SCR. Additional facility listings are provided in Attachment D. As can be seen, the SCR units have often been placed at the end of relatively complex, multi-stage air pollution control trains. As stated previously, many of these facilities were constructed, and the air pollution control equipment installed, with little consideration to cost and thermal efficiency of the plant. The result of this has been a shift in European design of new facilities with fewer control stages (Schüttenhelm, et al., 2000).

Table 4-4 provides NOx outlet emissions information received from a number of European facilities. The data provided consisted only of outlet emissions data. As shown, control efficiencies were not reported as well as averaging times and emissions compliance testing procedures. Although relatively low outlet NOx emissions are reported, it is difficult to determine the true applicability of these levels relative to the requirement to guarantee a continuous emission level tied to a short-term averaging period as required of U.S. MWCs. This problem was highlighted by USEPA during the development of the NSPS for MWCs in that the agency did not utilize European MWC data in the establishment of NOx emission limits (59 FR 48198-48228). The reason for this is that substantial error can be introduced in comparing data collected utilizing test methods and procedures different than those required by U.S. regulatory agencies. Thus, the emissions data presented in Table 4-4 must be viewed as indicators, for these do not provide reasonable assurance of long-term, consistently achievable emission levels that are directly comparative to the U.S. facilities due to differences in test methods.

The most recent identified application of a SCR system applied to a MWC is a system installed at a modified MWC in the Peel region of Ontario, Canada. The KMS Peel facility utilizes five Consumat® two-stage MWC units, each rated at 100 tons per day. The facility experienced design and initial construction problems but commenced operation in the fall of 2001. SCR was chosen as the preferred NOx control technology because it was determined that application of SNCR was technically infeasible with the Consumat® combustors due to their wide temperature variations (Heath, S., 2002). The NOx standard established for the facility is 110 ppmdv at 11% O_2 (154 ppmdv when corrected to 7% O_2) averaged over 24 hours. Three days of preliminary testing of NOx emissions from facility continuous emissions monitors (CEMs) showed 24-hour average values of 90.0, 100 and 95.4 ppmdv at 11% O_2 (127.6, 140.4 and 134 ppmdv at 7% O_2 respectively). With projected inlet NOx concentrations of 270 ppmdv at 11% O_2 (380 ppmdv at 7% O_2), the calculated NOx control efficiency across the SCR unit ranged from 63-66% for this data set. The proposed Unit 3 NOx emission limit is 180 ppmdv at 7% O_2 averaged over a 24-hour period for the first full-year of operation and 150 ppmdv at 7% O_2 averaged over a 24-hour period thereafter, based on application of SNCR. Thus, the Peel facility has a higher allowable NOx emission limit with SCR than the proposed Unit 3 NOx limit with SNCR.

TABLE 4-3
SAMPLE LIST OF EUROPEAN
MUNICIPAL WASTE COMBUSTION FACILITIES
UTILIZING SCR AND THEIR AIR POLLUTION
CONTROL EQUIPMENT CONFIGURATION[ab]

Municipal Waste Combustion Facility Name	Location	Air Pollution Control Equipment Configuration
AVR Rotterdam	Rotterdam City, The Netherlands	ESP, Two Scrubbers, Fixed Carbon Filter, SCR
SITA ReEnergy	Roosendaal, The Netherlands	ESP, Gas Suspension Absorber (lime injection), ACI, FF, SCR
COMMUNAUTE URBAINE DE LILLE	Lille, France	SDA With Rotary Atomizer, FF, Wet Scrubber, SCR
U.V.E. SMEDAR (SICDOM)	Rouen, France	ESP, SDA With Rotary Atomizer, FF, SCR
RMHKW Boblingen	Boblingen, Germany	FF, 2-Stage HCl Scrubber, 1-Stage SO_2 Scrubber, ACR, SCR
MVA Koln	Koln, Germany	Spray Dryer, FF, 1-Stage Prescrubber, 1-Stage SO_2 Scrubber, SCR, ACR
AEZ Kreis Wesel	Wesel, Germany	Spray Dryer, ESP, 1-Stage Prescrubber, 1-Stage SO_2 Scrubber, SCR, ACR
GML	Ludwigshafen, Germany	SDA With Diffusers, ESP, WS, SCR
AVI TWENTE b.v.	Twente, The Netherlands	ESP, SDA With Rotary Atomizer, ESP, WS, Filsorption, SCR

Note: ESP = Electrostatic Precipitator, SCR = Selective Catalytic Reduction
ACI = Activated Carbon Injection, ACR= Activated Carbon Reactor
FF = Fabric Filter Baghouse, SDA = Spray Dry Absorber
WS = Wet Scrubber

[a] Sources: Fleck, E., 2001; Heath, S., 2001c; Heath, S., 2001e; Licata, T., 2001
[b] See Attachment D of this PSD application for a more complete listing of Municipal Waste Combustion Facilities

TABLE 4-4
EUROPEAN MUNICIPAL WASTE COMBUSTION FACILITY EMISSIONS INFORMATION RECEIVED DURING THE BACT PREPARATION PROCESS[a]

Municipal Waste Combustion Facility (Location)	NOx Emissions (ppmdv)[b]	Averaging Time of Reported Emissions	Testing Procedures Information
AVR (Rotterdam, The Netherlands)	37	24-hour Avg.[c]	Not Specified
SITA ReEnergy (Formerly Heeren) (Roosendaal, The Netherlands)[d]	26-31	Three 1-hour tests	Not Specified
SITA ReEnergy (Roosendaal, The Netherlands)[e]	39, 35, 42[f]	Not Specified	Not Specified
German Municipal Waste Combustion Facilities	19-37	Not Specified	Not Specified
MHKW (Kassel, Germany)	52	Not Specified	Not Specified
Gavi Wijster (The Netherlands)	52	Not Specified	Not Specified
Renova (Gothenburg, Sweden)	45-52	Not Specified	Not Specified
IVAGO (Ghent, Belgium)	37	Not Specified	Not Specified
(Hagen, Germany)	90	Not Specified	Not Specified
NV Huisvuilcentrale N-H (Alkmaar, The Netherlands)	41	Not Specified	Not Specified

[a] Sources: CRI Catalyst Co. UK, Ltd., 1997; Hartenstein, H. and A. Licata, 1996; Heath, S., 2001a; Heath, S., 2001b; Heath, S., 2001c; Heath, S., 2001d; Heath, S., 2001e; Hober, M., 2001a.
[b] Reported NOx emissions are corrected to 7% O_2 at 20C and 1 Atmosphere.
[c] Average based on reported 1-hour average values over a two-week period.
[d] Reference: CRI Catalyst Co. UK Ltd., 1997.
[e] Reference: Heath, S., 2001c.
[f] First value from year 1998, second value from year 1999, third value from year 2000 (No other information provided).

Selective Non-Catalytic Reduction (SNCR)

SNCR involves the intimate contact of injected ammonia (NH_3), urea [$CO(NH_2)_2$] and/or other nitrogen-bearing compounds and NO in the flue gas to control NOx emissions by reducing NOx to N_2 without the use of catalysts. These techniques have been most commonly applied utilizing the injection of anhydrous or aqueous ammonia. A urea injection technique which has been further developed by Fuel-Tech. Inc. (formerly Nalco Fuel-Tech) of Stamford, Connecticut has also been applied to control combustion NOx emissions. To date, both ammonia and urea processes have been demonstrated on municipal waste combustion facilities in the U.S. As a result, discussion of SNCR techniques focuses on ammonia injection and urea injection, as these are the most widely utilized technologies.

With the ammonia injection process, either aqueous or anhydrous ammonia is injected into the upper furnace area of the combustor. Ammonia and NO react according to the following competing reactions:

$$4NO + 4NH_3 + O_2 \rightarrow 4N_2 + 6H_2O$$
$$4NH_3 + 5O_2 \rightarrow 4NO + 6H_2O$$

At 1600-1800°F (871-982C), the first reaction dominates and NO is reduced to N_2. Above 2000°F (1093C), the second reaction dominates and NH_3 is oxidized to NO. Below 1600°F (871C) both reactions proceed slowly and NH_3 remains unreacted. NOx reductions varying from 35-60% can be expected for municipal solid waste combustion facilities.

Furnace temperatures in the upper furnace can vary rapidly due to the variability in combustion characteristics of municipal solid waste. The sensitivity of ammonia-based SNCR reactions to temperature as well as the difficulty in handling and storing anhydrous ammonia (a hazardous substance) are two of the primary reasons behind development of the urea-based process. The only difference between these reagents is the physical form of the reagent. Anhydrous ammonia requires vaporizers to maintain the desired gaseous phase and pressure. Aqueous ammonia is stored in a liquid form with an approximate 20-29 weight percent of ammonia and the remainder being water. Storage and usage of aqueous ammonia instead of anhydrous ammonia has been adopted at numerous facilities to reduce the regulatory burden related to anhydrous ammonia.

Ammonia based SNCR has been applied to numerous municipal waste combustion facilities in the U.S. Significant operational data exists demonstrating the effectiveness of SNCR in reducing NOx emissions from MWCs. The existing LCERF Units 1 and 2 utilize ammonia based SNCR and have consistently achieved permitted NOx emission levels throughout the operational history of the units.

The composition of the gas stream also determines the effectiveness of the SNCR process. Not only are the NOx levels important, but the levels of CO and O_2 (at NH_3 injection points) also affect the process chemistry. High levels of O_2, above 6 percent,

generally aid in NOx reduction. The presence of CO above approximately 100 ppm adversely effects SNCR chemistry. The presence of CO in the combustion gases causes a shift and reduction in the effective NOx/NH_3 temperature reaction range (USEPA, 1989c).

Ammonia emissions may result when the NH_3 is injected outside the desired temperature window at a higher than normal rate. Ammonium chloride can sometimes form due to flue gas chemistry and/or atmospheric conditions. However, there are no known absolute relationships for this process. At the Stanislaus County and Long Beach, CA facilities, a detached ammonium chloride plume has been observed downwind of the stack at times when SNCR is used. (ENSR, 1991) Continued application and experience with SNCR has helped to reduce the frequency of visible plumes.

Corrosion of the boiler tubes by corrosive ammonia salts which are formed from unreacted ammonia and SO_2 or HCl has been hypothesized to be a potential problem with SNCR. However, boiler corrosion problems attributable to ammonia salts have not been identified as a major problem at facilities utilizing SNCR.

The NOxOUT Process, a urea based SNCR process developed under EPRI sponsorship, is licensed by Fuel-Tech, Inc. of Stamford, Connecticut. It is similar to the ammonia based SNCR process except that urea is utilized as the reagent which disassociates to ammonia in the higher temperature regions of the MWC, and reacts with NOx producing nitrogen, carbon dioxide and water vapor. The reaction equation is:

$$CO(NH_2)_2 + 2NO + \tfrac{1}{2}O_2 \rightarrow 2N_2 + 2H_2O + CO_2$$

Urea is stored typically as a 50% by weight aqueous solution. From storage, the urea is further diluted with water to a desired concentration and mixed in the flue gas at the desired urea-to-NOx ratio. For MWCs, this concentration usually is about 4-10% urea at the injectors.

The operating range of the NOxOUT process is 1600-2000°F (871-1093C), similar if not the same as the ammonia based SNCR process. However, Fuel-Tech has tested compounds that can be added to the urea to expand the useful temperature range of the process.

At present, Fuel-Tech sells the additive chemicals to urea suppliers. These suppliers dissolve the urea in water, add the specialty chemicals and sell/haul the blend to the end-user. Many facilities purchase urea directly from chemical suppliers without Fuel-Tech proprietary additives.

The Fuel-Tech NOxOUT process has been installed and demonstrated on a number of utility and industrial boilers in North America and Europe, as well as several MWCs. The NOx reductions achieved at U.S. facilities have ranged similarly to the ammonia based SNCR process. The NOxOUT process has also been used in full-scale European

municipal waste combustion facilities at Frankfurt, Germany, and Switzerland (CDM, 1991).

Lee County is proposing to install SNCR utilizing direct injection of aqueous ammonia at the Unit 3 combustor to meet an outlet emission level of 180 ppmdv corrected to 7% O_2 averaged over a 24-hour period for the first year and 150 ppmdv corrected to 7% O_2 averaged over a 24-hour basis thereafter.

Wet Flue Gas Denitrification (FGD_n)

FGD_n systems may be divided into at least four major process systems: 1) oxidation-absorption-reduction, 2) oxidation-absorption, 3) absorption-reduction, 4) absorption-oxidation. Of these four types, oxidation-absorption-reduction is somewhat more advanced because it is a derivative of already established FGD systems. It is based on the principle that after the NOx is converted from the relatively insoluble NO form to the more soluble NO_2 form, it can be reduced to N_2 by consuming some of the SO_2 already assimilated by the process. Conversion from NO to NO_2 is accomplished by spraying an oxidant such as ozone into the flue gas stream ahead of the wet scrubbers. It is also possible to add oxidizing agents to the SO_2 absorbent circulating with the scrubber fluid. In this case, both NOx and SO_2 can be stripped simultaneously from the flue gases (BEI, 1986).

An FGD system modified in this manner can also accommodate changes in inlet flue gas conditions without much of a loss in removal efficiency. An advantage of this type of system is that high removal efficiencies can potentially be achieved at the same time for both NOx and SO_2 removal. On the negative side, wet scrubbers have a liquid effluent which must be treated. In addition, the high cost of waste treatment and oxidation chemicals consumption are also cited as disadvantages.

A wet scrubber system utilizing oxidation-absorption is characterized by the addition of an oxidizer, such as sodium chlorite ($NaClO_2$) to the flue gas to oxidize NO to NO_2, which is then removed by a sodium-based wet scrubber. This is normally accomplished in a two-stage system with the addition of $NaClO_2$ to an upstream venturi (HCl) scrubber. The addition of $NaClO_2$ adjusts the pH to 3-4 which oxidizes some NO to NO_2. The NO_2 is then removed in the first scrubber as well as in the following second scrubber along with SO_2 (USEPA, 1988b).

Another approach used to deal with the limited reactivity of flue gas NO and its poor absorption in typical wet scrubber operations is absorption/reduction. This method of NO removal was applied a municipal solid waste combustion in Bremerhaven, West Germany, 1987. In this system, ferrous ions (Fe^{2+}) tie up NO in the liquid phase by the formation of ethylene diamine tetraacetic acid (EDTA) complexes. These complexes, in turn, react with HSO_3^- and SO_3^{2-} ions (from SO_2 absorption) leaving N_2 and sulfate (SO_4^{2-}) as reaction products (USEPA, 1988b). This system has not been applied to another facility in Europe as it was found that operation of the systems and chemical usage were cost-prohibitive relative to lesser expensive, more effective technologies.

Absorption-oxidation processes are not as developed as the other previously described wet NOx control systems. Results from pilot-scale facilities indicate high NOx removal efficiencies are achievable, but suggest that the system faces undesirable operational problems (CARB, 1984).

Supplier information was researched from several corporations specializing in pollution control technology with specific experience with wet FGD_n systems. Tri-Mer Corporation attests to having approximately 50 installations currently operating throughout the U.S. The Tri-Mer TRI-NOx technology is proprietary but appears to be a type of absorption-reduction system with oxidation steps, if necessary. Tri-Mer's technology has not been applied to flue gas from a municipal solid waste combustion facility. Tri-Mer Corporation has specialized in controlling emissions from the chemical and metal finishing industries and normally designs systems to handle flue gas flow rates of between 20 and 20,000 scfm. These flow rates are at best an order of magnitude lower than the flue gas flow rate of Unit 3. Also, the industrial flue gases described normally contains substantially higher concentrations of NOx than is found in the flue gas of municipal waste combustion facilities.

Wet FGD_n, though not technically infeasible, cannot be considered BACT for NOx emissions for the proposed LCERF Unit 3 MWC. A summary of the reasons for this is as follows:

- The technology has not yet been demonstrated on modern municipal solid waste combustion facilities in the U.S.
- Wet FGD_n systems produce a liquid effluent that is difficult and expensive to treat.
- Other trace contaminants in the flue gases of MWCs may inhibit the NOx reduction reactions taking place in the scrubber.
- A reasonable estimate of the cost to install and operate such a system is presently unattainable as these systems are typically applied to lower flow rate, higher NOx concentrated flue gases. Based on systems installed for different source categories, the costs appear prohibitively high.
- Wet FGD_n systems produce additional environmental impacts by producing a liquid effluent that is in itself a pollutant, and by secondary pollutant production if combustion is needed for flue gas reheat.

Electron Beam

Another innovative technology for NOx control, which has been demonstrated in other applications and which has potential for success in NOx control from refuse-burning, is the Electron Beam (E-Beam) process. The E-Beam reacts NH_3 or lime, with NOx and SO_2 in the presence of a high-intensity E-Beam, emitted across the flue gas by an electron gun. The E-Beam provides the necessary activation energy for the NOx reaction which takes place in a steel vessel with a concrete shell for radiation shielding. The higher flue

gas temperatures, as required for typical SCR and Thermal DeNOx applications, are not required for this process.

The E-Beam may be fired upstream or downstream of the FF, though an additional NOx removal reactor such as a wet scrubber (followed by flue gas reheat) would be required for the downstream applications. Upstream applications proceed as follows: an open spray absorber, serving as a prescrubber, humidifies the flue gas and removes most of the HCl. The ammonium sulfate, chloride and nitrate by-products which are formed in the prescrubber and E-Beam reactor are removed in the FF.

Early pilot tests on a Japanese steel plant sintering unit using the E-Beam process with ammonia were sufficiently successful to encourage further development. Process demonstration units were developed and operated, but not in refuse-burning applications. Most current applications of E-Beam technology are for control of VOCs and other organics in low-flow flue gas situations.

The E-Beam process, though tested on combustion facilities, has not been tested or demonstrated on modern MWC units. A search of potential providers of E-Beam systems did not identify manufacturers marketing systems for NOx removal on large-scale MWCs. Thus, no cost or operational data could be obtained. It is expected that costs for this system would be substantially higher than other proven NOx control technologies in the marketplace. In addition, due to a lack of E-Beam experience and test data on large scale MWCs additional reaction species are unknown. Thus, other potentially negative environmental impacts are therefore possible.

The E-Beam process, though not technically infeasible, is an undemonstrated technology for NOx control on large scale, modern MWCs that is not expected to remove NOx as efficiently as either SCR or SNCR. This technology cannot be considered BACT and will not be evaluated further.

Innovative NOx Control Methods

Emerichem, LLC (formerly Goalline Environmental Technologies) markets the SCONOX® pollution control technology. SCONOX® is a catalytic control method for NOx that does not utilize ammonia (or urea) as a reagent. SCONOX® has been applied to clean-fuel fired combustion equipment, such as natural gas-fired boilers and turbines, and has demonstrated high NOx removal efficiencies. SCONOX® has not been tested or applied to a large-scale MWC for NOx control and is not currently marketed in this application. Furthermore, a representative of Emerichem stated that the company would decline from offering to provide SCONOX® in this application due to the potential for catalyst fouling and deactivation from trace materials in the flue gases. (Hober, M., 2002a) Hence, this innovative technology must be considered technically infeasible at this time for application to Unit 3.

4.6.4 RANKING OF ALTERNATIVE CONTROL TECHNOLOGIES

Due to technical problems and system non-availability associated with wet FGDn, the E-Beam process, and the SCONOX® process, these technologies will not be evaluated further. Relative to NOx control, the "top" control method to be evaluated is SCR with a stack emission limit of 100 ppm NOx. SNCR with a stack emission limit of 150 ppm NOx is considered the second most effective option and will be evaluated as the "base case" relative to SCR.

4.6.5 ENVIRONMENTAL IMPACT

Neither the SCR, nor SNCR systems produce liquid or solid wastes during continuous operation of the NOx reduction process. Lee County is proposing to utilize aqueous ammonia for the Unit 3 SNCR system. There is a risk associated with the release of aqueous ammonia during shipping, handling, storage, or catastrophic failure of the ammonia storage tank(s). However, use of aqueous ammonia avoids the storage issues associated with anhydrous ammonia while providing the same process capabilities. An environmental concern with any ammonia-based SNCR and SCR process is the ammonia slip produced, which may also result in visible emissions. The presence of ammonia in the flue gases allows the possibility of a visible plume when utilizing either SCR or SNCR.

Additional secondary environmental impacts are expected from the SCR system due to fossil fuel firing for flue gas reheat. Flue gas reheat will not be necessary when utilizing SNCR. The SCR technology will create catalyst waste over time that, if not capable of regeneration, will most likely need to be disposed as a hazardous waste.

4.6.6 ECONOMIC IMPACT

A determination of economic impacts of various control technology options, as previously described, involves an assessment of capital equipment costs, system installation and startup costs and annual operating costs. This is typically derived through literature data on similar applications of the technology to other categorically similar facilities. No U.S. municipal waste combustion facility currently operates with SCR for NOx control. Thus, no capital equipment cost data exists relative to SCR application to a U.S. municipal solid waste combustion facility. Efforts to obtain cost and other information from European and Asian facilities did not yield information useful in development of a capital equipment cost estimate for an economic impact analysis. Significant literature data exists regarding application of SCR to utility boilers and gas-fired turbines. However, the bulk of this information applies to "hot-side" SCR systems with relatively consistent flue gas makeup from fossil fuel combustion. Suppliers of catalysts and catalysts systems to the municipal solid waste industry informed Lee County that the only SCR systems that could be made available are "cold-side" units due to potential catalyst poisons in the flue gas from municipal solid waste combustion. Cold-side SCR units are substantially cost-disadvantageous relative to hot-side units due to the need for flue gas reheat and the fuel costs involved.

Another method of developing a capital equipment cost estimate for an economic impact analysis, in lieu of more applicable data, is to utilize standardized methods presented in the USEPA Office of Air Quality Planning and Standards (OAQPS) Air Pollution Control Costs Manual. Until only recently, this manual did not contain a costing methodology for SCR systems. The most recent (sixth) edition, published in January of 2002 (and revised in April 2002) contained a draft procedure for developing costs for a hot-side SCR system on a utility boiler. As stated on page 2-41 of the procedure "The costs for the tail-end arrangement [cold-side SCR], however, cannot be estimated from this report because they are significantly higher than the high-dust [hot-side SCR] systems due to flue gas reheating requirements." (USEPA, 2002a) As the procedure is not applicable to a cold-side tail-end SCR application, it was decided not to utilize the recent OAQPS procedure for the development of a capital cost estimate for SCR.

In order to prepare the economic impact analysis, budgetary quotes to provide a tail-end SCR system for Unit 3 were solicited from a number of SCR catalyst and catalyst system suppliers including:

- Siemens
- KWH
- Cormetech
- Mitsubishi Heavy Industries
- Babcock Borsig
- Foster Wheeler
- Mobotec
- Alstom Power
- CRI Catalyst Company
- Haldor Topsoe A/S

Four budgetary quotes were received, one each from Babcock-Borsig Power and SEGHERs and two from Haldor Topsoe A/S. Copies of these budgetary estimates, and subsequent correspondence, are contained in Attachment E. Each budgetary estimate provided a capital equipment cost. However, only Babcock-Borsig provided a budgetary installation cost. Significant disparity exists between the three budgetary estimates provided as they were not consistent relative to systems provided and guaranteed NOx reduction levels. Babcock-Borsig estimated that their costs would be within 10% of actual costs based on over 34 installations of SCR units to the municipal solid waste industry. Facility listings provided by these system suppliers were included in Attachment D.

In a personal communication with a representative of Haldor Topsoe, Inc., it was conceded that their estimate could be 25-30% low relative to actual costs. Upon request for references to the application of a Haldor Topsoe catalyst system to a municipal waste combustor, Haldor Topsoe has managed to provide one reference to a municipal solid waste combustion facility in Italy. Additional information about the facility regarding achieved outlet concentrations of NOx, operational history and installation and

operational costs were not made available by Haldor Topsoe. Another facility identified as a MSW combustion facility in Spain is actually a liquid waste incinerator for a fine chemicals factory. One problem with the Haldor Topsoe provided system that was communicated by the facility in Spain is a particulate settling problem that requires shutdown and cleaning of the catalyst every 300 hours of operation. As noted, Haldor Topsoe's estimate was the least complete and contained only one reference. Haldor Topsoe is primarily a catalyst supplier that does not specialize in supplying a total control system. Further, they provided two quotes, one with outlet NOx emissions as 100 ppmdv and one at 150 ppmdv. The more stringent control option, 100 ppmdv outlet NOx, was quoted at a lower price than the 150 ppmdv outlet (see Attachment E). Therefore, a high degree of uncertainty exists relative to the accuracy of the Haldor Topsoe quote versus the other two suppliers. Consequently, we have only used the Babcock-Borsig and Seghers cost estimates in the economic impact analysis.

Table 4-5 presents a comparison of the budgetary estimates provided by the three suppliers. As can be seen, the most expensive was the Babcock-Borsig estimate and it was the most inclusive. The Babcock-Borsig estimate also included the longest catalyst life, lowest ammonia slip, and more ancillary systems and components than the other two estimates. Thus, it is expected that actual costs from each supplier would be more similar with consistency in systems and components included in the budgetary estimates.

With capital equipment budgetary estimates provided by catalyst and SCR system suppliers, estimated installation, startup and annual operating costs were derived using typical OAQPS cost estimating factors (USEPA, 2002a). To estimate economic impacts of a particular control option, the capital equipment, installation and startup costs are summed and amortized over an assumed equipment lifetime. The annual costs resulting from the amortization is summed with annual operating costs for total annual cost of the control technology. This total annual cost, when divided by the tons of pollutant (NOx) removed by the control device, defines the economic impact on a dollars per ton of NOx removed basis.

Attachment F contains several evaluations of economic impacts of a tail-end SCR system based on the three budgetary estimates. Each budgetary quote is evaluated for the following five amortization periods:

- 7% interest, 10 years
- 7% interest, 15 years
- 7% interest, 20 years
- 10% interest, 10 years
- 10% interest, 15 years

The multiple evaluations were performed due to the inconsistency of regulatory guidance regarding the proper amortization period and interest rate for perspective control options.

TABLE 4-5
COMPARISON OF COST ITEMS IN SCR BUDGETARY ESTIMATES RECEIVED DURING BACT PREPARATION

Line Item[a]	Babcock Borsig	SEGHERs	Haldor Topsoe
Estimated Material Costs	US$ 6,300,000	US$ 8,000,000	EUR$ 1,450,000
Ammonia Slip (ppmdv @ 7% O_2)	5	Not Specified	<10
SCR Inlet Duct	Included	Included	Not Included
SCR System Bypass Duct	Included	Not Specified	Not Included
SCR Outlet Duct	Included	Included	Not Included
Heat Exchanger	Gas to Gas	Not Specified	Gas to Gas
Bypass and Isolation Dampers	Included	Not Specified	Not Included
Flue Gas Preheater	Steam/Gas	Gas	Oil/Gas
Reactor Casing and Internals	Included	Included	Included
Catalyst (Initial Loading)	Included	Included	One Charge
Catalyst Life	24,000 Hours	2 Years	16,000 Hours
Foundation Information	Included	Not Specified	Not Included
Structural Steel (Stairs, Platforms, Ladders, etc.)	Included	Included	Not Included
Catalyst Handling System (Hoist)	Included	Not Specified	Not Included
Solid Modeling for Flue Gas Flow Analysis	Included	Not Specified	Not Included
Aqueous NH_3 Storage Systems	2 Storage Tanks	Included	Not Included
NH_3 Delivery System to Inlet	Included	Not Specified	Included
Control System	Included	Included	Included
Instruments for Reactor Control	Included	Included	Included
Operator/Maintenance Training	Included	Not Specified	Not Included
Ammonia Leak Detectors	Included	Not Specified	Not Included
Boiler to Heat Exchanger Duct	Not Included	Not Specified	Not Included
Upgrade of Existing Equipment	Not Included	Not Included	Not Included
Fire Protection Equipment	Not Included	Not Specified	Not Included
Safety Equipment	Not Included	Not Specified	Not Included
SCR Building/Enclosure	Not Included	Not Specified	Not Included
Wind Load Design for Structural Steel	Not Included	Not Specified	Not Specified
Startup, Commissioning, Testing	Included	Not Specified	Not Included

[a] Note: Items not specified in the budgetary estimate are assumed to be not included in the price provided.

TABLE 4-5
COMPARISON OF COST ITEMS IN SCR BUDGETARY ESTIMATES RECEIVED DURING BACT PREPARATION (CONCLUDED)

Line Item[a]	Babcock Borsig	SEGHERs	Haldor Topsoe
Estimated Construction Costs	US$ 5,675,000	Not Specified[b]	Not Specified[c]
Erection Labor and Equipment for Installation of Proposed Equipment	Included	Included	Not Included
Foundations and Civil Work	Included	Included	Not Included
Electrical Equipment (Switchgear, MCCs, Wire, etc.)	Included	Included	Not Included
Modification to Existing Structures	Not Included	Not Included	Not Included
Relocation of Overhead and Underground Utilities	Not Included	Not Specified	Not Included
Roads and Civil Betterments	Not Included	Not Specified	Not Included
System Enclosures/Buildings	Not Included	Not Included	Not Included
Hazardous Waste Material Abatement	Not Included	Not Specified	Not Included
Piping, etc.	Included	Included	Not Specified
Painting	Not Specified	Included	Not Specified
Insulation	Not Specified	Included	Not Specified

[a] Note: Items not specified in the budgetary estimate are assumed to be not included in the price provided.
[b] SEGHERs provided a cost of US$ 8,000,000 for 'Turn Key Capital Cost for SCR'.
[c] Estimated Construction Costs are not specified in the Budgetary Estimate provided by Haldor Topsoe. In telephone conversations between Richard Newland (Haldor Topsoe) and Michael Hober and Scott Heath (RTP Environmental Associates, Inc.) (Hober, M., 2002b) construction costs are estimated at a factor of 2.5 times provided material capital costs.

In the USEPA Air Pollution Control Cost Manual, it is stated that "the interest rate employed in this manual differs from that used in non-governmental financial analyses. It represents a social interest rate established by the Office of Management and Budget (OMB) for comparison to public policy issues." (USEPA, 2002a) Although, in the past, OMB has required the use of a 10% interest rate, it is stated in the recent OAQPS update that the OMB has revised this rate to seven percent (USEPA, 2002a). USEPA goes on to state that "However, the social rate of interest is probably not appropriate for industry. When choosing between alternative air pollution control devices, the industrial planner must not only take into consideration the costs of each device, they must also understand how the cost of each fits into the financial structure of their business". (USEPA, 2002a) In this case, it is assumed that USEPA identifies industry as subject to competitive pressures. This is exemplified within the OAQPS cost manual itself in that example problems presented in costing procedures for equipment typical to industry, rather than utility, employ higher interest rates and shorter amortization periods (i.e., thermal incinerators and carbon absorbers at 10 years, 7% versus fabric filters at 20 years, 7%). In the USEPA Alternative Control Techniques Document for Industrial/Commercial/ Institutional (ICI) Boilers (USEPA, 1994), USEPA amortizes NOx control costs utilizing a 10% interest rate over 10 years. In the USEPA document on the NSPS Subpart Da (1997a), USEPA amortizes NOx control costs for utility boilers utilizing a 7% interest rate over 20 years. One can conclude that USEPA has identified that shorter amortization periods at higher interest rates are necessary when dealing with industrial applications of air pollution control. This is reinforced in the fact that the Internal Revenue Service requires companies to recoup capital investments over eight years. Regardless of the examples provided by USEPA, it is important to note that the agency does not endorse the amortization periods and interest rates provided in example calculations in their guidance documents, especially in the case of industrial applications of pollution control. At all times it is stated that the example calculation uses an "assumed" interest rate and amortization period. USEPA recognizes that the determination of interest rate and amortization period is best left to the industrial applicant to base these cost criteria on "the financial structure of their business" (USEPA, 2002a).

Relative to Unit 3, it was considered that the suggested amortization period and interest rate in the ICI Boiler ACT Document (10% over 10 years) is more representative than that assumed relative to substantially larger utility boilers. However, to address FDEP concerns related to this issue, multiple amortization periods at various interest rates were used to provide a range of economic impacts that are expected to bind the upper and lower levels for the applicable control devices. Economic impact evaluations were developed for the two budgetary estimates. In additional evaluation was done relative to the Babcock-Borsig estimate, which provided the option to use steam for flue gas reheat instead of fossil fuel.

Thus, costs to achieve an outlet NOx emission of 100 ppmdv corrected to 7% O_2 utilizing SCR ranged from $8,388 to $15,844 per ton of NOx removed. Costs to achieve an outlet NOx emission of 150 ppmdv corrected to 7% O_2 utilizing SNCR ranged from $2,016 to $2,586 per ton of NOx removed. Thus, the incremental cost of the application of SCR for increased NOx control would be substantially higher than the costs stated above. The

costs presented for application of SCR substantially exceed those typically considered acceptable for the application of a control technology under BACT guidelines.

4.6.7 ENERGY IMPACT

Increased electrical energy is expected for the SCR system over the SNCR system due to the increased fan pressure needed to overcome the pressure drop across the catalyst bed. The SCR system will require a certain amount of flue gas reheat that will utilize a substantial amount of fossil fuel. SNCR does not require flue gas reheat.

4.6.8 SELECTION OF BACT

Based on a review of environmental, economic and energy impacts, SCR is rejected as BACT for Unit 3 at the LCERF and SNCR is determined to be BACT. Lee County is proposing to install SNCR to meet an outlet NOx emission level of 180 ppmdv at 7% O_2 averaged over a 24-hour period for the first year of operation and 150 ppmdv at 7% O_2 thereafter. This is an aggressive limit and will require 'fine tuning' of the SNCR control system. As noted by USEPA (60 Federal Register 65387-65436), the process of achieving 150 ppmdv would require a sufficient time period to balance facility systems in combination with the SNCR system to provide continuous compliance.

4.7 BACT REVIEW FOR CARBON MONOXIDE

CO is formed by the incomplete combustion (oxidation) of carbon containing compounds in the MSW fuel. Elevated emissions of CO in municipal waste combustion facilities may be due to a number of conditions, including:

- Insufficient bulk oxygen levels for variations in waste composition/feed characteristics
- Insufficient combustion temperatures that result in quenching of reactions
- Poor air distribution, and/or inadequate mixing which results in localized oxygen deficient conditions
- Excessive carryover of particulate-bound organics from the furnace into lower temperature regions of the combustion system prior to completion of combustion (USEPA, 1989d and USEPA, 1995d)

Emissions of CO are controlled by minimization of the above-mentioned conditions that promote increased CO emissions. Post-combustion control such as thermal oxidizers and oxidation catalyst systems for the removal of CO in flue gas streams have been utilized with other combustion sources but, have not been employed on MWCs.

4.7.1 FORMATION MECHANISMS

CO is a product of incomplete oxidation of carbon compounds. The source of carbon compounds at MWCs can be the fuel, pyrolysis products formed near the fuel bed, compounds in the combustion air, and/or intermediate combustion products. Factors

including fuel-rich conditions and low combustion temperatures cause incomplete oxidation of carbon compounds. Such factors can be produced by introducing overly wet or low BTU content fuel to the furnace, or by suppressing combustion by very high overfire air rates or providing inadequate combustion air and residence times.

The factors that are associated with elevated levels of CO can be divided into five separate components:

- Waste feed rate
- Combustion temperatures and residence time
- Amount and distribution of combustion air
- Air/fuel mixing
- Particulate Matter (PM) carryover

Waste Feed Rate

Combustion characteristics can be affected significantly by variations in waste composition or feed characteristics (e.g., moisture content, heating value, volatiles content). Excursions in waste feed rates or waste properties can deplete local oxygen levels in the furnace, allowing organics to escape complete oxidation. Alternately, combustion of low heating value fuel can lead to quenching of combustion reactions, which also allows CO to escape oxidation. Both of these conditions are accompanied by elevated concentrations of CO. Flue gas CO concentrations are continuously monitored to provide a continuous indication of proper combustion feed conditions. The appropriate design and operating procedures to minimize waste feed excursions vary according to combustor technology, and may include measures such as fuel blending by the crane operator, use of ram feeders, and use of air preheat.

Combustion Temperatures and Residence Time

The ability of a MWC to minimize CO formation is a fundamental requirement of GCP. The occurrence of spatial and temporal temperature variations during normal operating conditions necessitates that municipal waste combustion facilities be designed and operated in a manner that will ensure that all combustion products are exposed to minimum destruction temperatures for sufficient residence times. Furnace combustion gas residence time is also an important requirement to ensure minimum CO formation. Emissions of CO are limited under USEPA's definition of GCP.

Amount and Distribution of Combustion Air

The proper amount and distribution of combustion air are essential for efficient combustion. The amount of excess air introduced to the combustor must be sufficiently high to minimize the existence of fuel-rich pockets and sufficiently low to avoid quenching of combustion reactions. The range of excess air levels that will satisfy these objectives varies for each combustor technology. CO emissions typically increase when

insufficient O_2 is available to complete combustion, or when excessive amounts of O_2 quench combustion reactions. High excess air levels can also cause PM carryover.

For large MWCs such as Unit 3, total combustion air is typically split between primary and secondary supplies. The amount and distribution of primary (underfire) air controls bed burning stoichiometry and waste burnout. Secondary air is used to adjust local stoichiometry to levels needed to achieve complete combustion, to control flame height, and to complete the mixing process. Failure to distribute combustion air in the correct proportions to primary and secondary supplies can result in elevated CO emissions and PM carryover.

Air/Fuel Mixing

Mixing of combustion products and air is a key requirement to ensure destruction of CO in the furnace. The most common method used to achieve good mixing in MWCs is properly designed and operated secondary (overfire) air systems. Mixing can also be effected through combustor design measures such as bull noses, baffles, turns, and changes in duct shape or cross-sectional area. Mixing failures can be accompanied by spikes or bulk increases in CO emissions.

Particulate Matter (PM) Carryover

PM carryover is defined as the amount of entrained particulate matter, which is carried out of a combustor with flue gases. The amount of PM carryover from municipal waste combustion facilities can affect the ultimate emission of other pollutants in addition to CO. Carryover of unburned carbon from the furnace into lower temperature regions of the combustion system prior to completion of combustion will result in elevated emissions levels of CO and products of incomplete combustion. Parameters affecting PM carryover include operating load, excess air levels, and primary/secondary air ratios.

4.7.2 SOURCE SEPARATION IMPACT ON CARBON MONOXIDE

The Lee County Materials Separation Plan encourages residents to separate newsprint, magazines, corrugated cardboard, kraft paper bags, and telephone books; glass bottles; aluminum cans and foil; steel cans; and plastic containers. Commercial businesses and institutions voluntarily separate recyclable materials for collection.

While certain materials separation efforts are considered in this document because of their potential to reduce air emissions, the amount of emissions reductions cannot be quantified. For this reason, materials separation activities are discussed in this BACT analysis; however, materials separation should not be imposed as BACT. There is no evidence to demonstrate that source separation of certain components by itself provides for consistent and measurable reductions of CO. Because it is not possible to quantify the effect of source separation, source separation does not qualify as a technology or clean fuel process.

4.7.3 AVAILABLE CONTROL TECHNOLOGIES

Emissions of CO can potentially be reduced at municipal waste combustion facilities by two main methods: 1) utilizing good combustion design and operation to maximize the oxidation of CO to CO_2, and 2) reducing the quantity of CO in the post-combustion flue gas stream (flue gas controls).

GCP, as established by USEPA, involves continuous compliance of three parameters: a CO emission limit, a load limit, and a temperature limit at the inlet of the particulate matter control device. The use of GCP reduces CO emissions by promoting more thorough combustion.

Tail gas control techniques for CO have most commonly consisted of oxidation catalyst systems or thermal oxidizers. The presence of an oxidation catalyst in the flue gas pathway allows the oxidation reaction converting CO to CO_2 to proceed at a lower temperature than would otherwise be needed. Oxidation catalysts for CO control have been installed on a number of combustion turbines fired with natural gas or clean gas derivatives (e.g., digester gas or refinery gas) in the U.S. and abroad. Oxidation catalysts have not been demonstrated with facilities that combust mixed fuel or MSW that can contain trace contaminants that would deactivate (poison) the catalyst.

Thermal oxidizers employed in industrial applications include recuperative oxidizers, catalytic oxidizers and regenerative thermal oxidizers.

Oxidation Catalyst Systems

Oxidation catalysts are precious or semi-precious metal catalysts that tend to be easily poisoned by contaminants such as sulfur, phosphorous, and trace metals in flue gases. Oxidation catalysts generally cannot be installed for sources burning sulfur emitting fuels. Therefore, fuel sulfur must be limited for oxidation catalyst applications to avoid catalyst poisoning problems (EPRI, 1989).

A number of catalysts manufacturers and suppliers were researched to obtain information concerning the state-of-the-art in catalytic control of CO for municipal waste combustion facilities. Several of these companies have oxidation catalyst systems currently operating on combustion sources. It was not identified that these companies have installed oxidation catalyst systems on a municipal solid waste combustion facility. The main reason for non-application of this technology to municipal waste combustion facilities was inferred as the non-homogeneous nature of MSW, and thus, the non-homogeneous nature of the flue gas. Current species of oxidation catalysts could be quickly poisoned by potential trace contaminants in a municipal waste combustion facility's flue gas and would be prohibitively expensive to continuously replace.

Therefore, application of an oxidation catalyst to a municipal waste combustion facility is considered technically infeasible at this time. Hence, tail gas control of CO emissions

from Unit 3 utilizing a CO catalyst system cannot be considered as a viable option for BACT.

Thermal Oxidation

Thermal oxidation has been accomplished at industrial facilities utilizing three main types of thermal oxidizers:

- Recuperative Thermal Oxidizer (RCTO)
- Catalytic Thermal Oxidizer (CTO)
- Regenerative Thermal Oxidizer (RTO)

Thermal oxidation, regardless of type, works on the principal of raising the flue gas temperature to the oxidation temperature of CO for conversion to CO_2. Recuperative thermal oxidizers achieve oxidation temperatures typically through direct flame incineration. Hence, RCTOs are typically the costliest option relative to fuel use. Also, thermal efficiency of RCTOs is typically limited to a maximum of 70% before capital costs for heat exchange increase steeply. Thermal oxidizers incorporating catalysts utilize catalysts to lower the oxidation temperature of CO to reduce fuel costs. However, it is expected that the catalyst would experience deactivation and/or fouling from contaminants in the flue gas; thus, CTOs will not be considered further. Regenerative thermal oxidizers, like recuperative oxidizers, achieve CO control through heating flue gas to proper oxidation temperatures. However, in regenerative thermal oxidizers, the heat is contained in a series of ceramic beads that are alternately heated and re-heated to maximize heat efficiency. RTOs tend to have higher capital costs than catalytic or recuperative thermal oxidizers. However, RTOs typically have significantly lower operating costs due to the greater heat efficiency of the ceramic bed design which results in substantially lower fuel usage than catalytic or recuperative thermal oxidizers. RTOs have experienced problems with fouling of the ceramic heat exchange surface from flue gas contaminants and may require added filtration of flue gases prior to entry into the RTO.

Based on available data, catalytic oxidizers, recuperative thermal oxidizers, and RTOs have not been specified as BACT for MWCs nor were they evaluated as part of the USEPA's effort to establish the NSPS for new and existing MWCs. However, as thermal oxidation cannot be considered technically infeasible, application of a thermal oxidizer (either RCTO or RTO) will be evaluated on the basis of energy, environmental and economic feasibility.

4.7.4 RANKING OF ALTERNATIVE CONTROL TECHNOLOGIES

With oxidation catalyst systems and catalytic thermal oxidizers determined to be technically infeasible, thermal oxidation utilizing either a RCTO or RTO is assumed to provide enhanced CO control over good combustion design and operation and is ranked higher. In the case of Unit 3, the MWC will be designed to achieve very low CO emissions inherently; thus, thermal oxidation will only reduce CO emissions from the

already low emissions resulting from the facility. It is assumed that 90% of emitted CO (113.25 tons) is controlled by the thermal oxidizer. This is questionable in that Lee County is proposing CO emissions of 100 ppmdv with good combustion design and operation. A 90% reduction would reduce CO emissions to levels below which current instruments could accurately monitor. Also, most thermal oxidizer manufacturers will not guarantee outlet CO emissions below 50 ppmdv.

4.7.5 ENVIRONMENTAL IMPACT

As has been previously described, implementation of good combustion design and operation will provide the lowest environmental impact for control of CO. Based on current information, no adverse environmental impacts are projected from utilization of this technology. Utilization of thermal oxidation will result in secondary pollutant production from combustion of fossil fuels to maintain flue gas temperatures at the CO oxidation temperature.

4.7.6 ECONOMIC IMPACT

No adverse economic consequences are foreseen utilizing good combustion design and operation as it is the baseline operational requirement and it will be inherent in the design of the Martin combustor. The economic impact of applying a RCTO or RTO were determined using cost estimation algorithms provided in the USEPA's EPA Air Pollution Control Cost Manual, Sixth Edition (USEPA, 2002a). At an assumed CO reduction efficiency of 90% (113.25 tons CO), estimated costs for a RCTO ranged from $21,200.00-$22,600.00 per ton of CO removed. Estimated costs for a RTO ranged from approximately $12,000.00-$13,600.00 per ton of CO removed. Actual costs would most likely exceed these monetary values.

4.7.7 ENERGY IMPACT

No adverse energy utilization consequences are foreseen in the use of good combustion design and operation as the proposed control technology for CO. Application of either a RCTO or RTO would require increased electrical energy and fan power to drive the system. In addition, substantial amounts of fossil fuel would need to be fired to maintain temperatures for the thermal oxidizer to operate properly. Annual energy impacts based on OAQPS estimates ranged from approximately $697,500.00 for the RTO to approximately $1,990,000 for the RCTO.

4.7.8 SELECTION OF BACT

Based on a review of energy, environmental and economic impacts, thermal oxidation utilizing a RCTO or RTO is rejected as BACT and good combustion design and operation is determined to be BACT for CO. The BACT for CO will be achieved through the design and control of the combustion process. CO emissions will be limited to 100 ppmdv at 7% O_2 for 4-hour block averaging periods, exclusive of start-up, shut-

down, and malfunction conditions. The emission rate for CO given in Section 3 represents the BACT as per PSD regulations and FDEP requirements.

4.8 BACT REVIEW FOR MWC ORGANICS

MWC organics are defined by the USEPA in 40 CFR 60.51b as organic compounds emitted in the exhaust gases from municipal waste combustor units and includes tetra- through octa- chlorinated dibenzo-p-dioxins and dibenzofurans. MWC organics can be formed and/or emitted as a result of incomplete combustion of carbon containing compounds in MSW fuel.

Stack emissions of MWC organics are controlled by utilizing GCP and by utilization of post-combustion flue gas controls. GCP, as defined by USEPA, consists of three components: a CO emission limitation, a load limit, and a temperature limitation at the inlet of the PM control device (USEPA, 1995d). Post combustion control such as thermal oxidizers and oxidation catalyst systems for the removal of MWC organics in flue gas streams have not been employed on MWCs in the U.S.

4.8.1 FORMATION MECHANISMS

MWC organics are products of incomplete oxidation of carbon compounds. The source of carbon compounds at MWCs can be the fuel, pyrolysis products formed near the fuel bed, compounds in the combustion air, and/or intermediate combustion products. The actual formation of MWC organics in the flue gases is not well understood. USEPA has determined that three continuous compliance parameters: CO emissions, load limit, and temperature at the inlet of the PM control device, have been shown to correlate with either the formation or emission of MWC organics (USEPA, 1995d).

4.8.2 SOURCE SEPARATION IMPACT ON MWC ORGANICS

The Lee County Materials Separation Plan encourages residents to separate newsprint, magazines, corrugated cardboard, kraft paper bags, and telephone books; glass bottles; aluminum cans and foil; steel cans; and plastic containers. Commercial businesses and institutions voluntarily separate recyclable materials for collection.

While certain materials separation efforts are considered in this document because of their potential to reduce air emissions, the amount of emissions reductions cannot be quantified. For this reason, materials separation activities are discussed in this BACT analysis; however, materials separation should not be imposed as BACT. There is no evidence to demonstrate that source separation of certain components by itself provides for consistent and measurable reductions of MWC organics. Because it is not possible to quantify the effect of source separation, source separation does not qualify as a technology or clean fuel process.

4.8.3 AVAILABLE CONTROL TECHNOLOGIES

Emissions of MWC organics can potentially be reduced at municipal waste combustion facilities by two main methods: 1) GCP which utilize good combustion design and operation to maximize the oxidation of CO to CO_2, and 2) flue gas controls, which reduce the quantity of MWC organics in the post-combustion flue gas stream.

Flue gas control techniques for organic compounds have most commonly consisted of thermal oxidizers. Thermal oxidizers employed in industrial applications include recuperative oxidizers, catalytic oxidizers and regenerative thermal oxidizers.

Good Combustion Practices

Good combustion practices were developed by the USEPA to minimize both formation and emissions of dioxins/furans and other trace organics. GCP involves continuous compliance of three parameters: a CO emission limit, a load limit, and a temperature limit at the inlet of the particulate matter control device. All three of these continuous compliance parameters have been shown to correlate with either formation or emission of dioxins/furans (USEPA, 1995d). The use of GCP reduces emissions of MWC organics by promoting thorough combustion, minimization of particulate carryover and condensation of vapor phase constituents through baghouse temperature control.

Low CO level is a surrogate parameter used to indicate the operation at combustion conditions conducive to the furnace destruction of trace organics. The load limit is used to control excessive entrainment PM (PM carryover) which can lead to formation of dioxins/furans downstream of the combustor. The PM control device inlet temperature limit is to limit formation of dioxins/furans on fly ash within the PM control device by controlling formation rates. Peak formation rates occur near 300 C (570 °F) and decrease with decreasing temperatures. Below about 225 to 250 C (435-480 °F) the formation rates are negligible. The temperature limit also controls partitioning of dioxin/furan between the solid and vapor phases. At lower temperatures, dioxins/furans remain absorbed on PM and are disposed with the collected fly ash. There is no evidence that dioxins/furans absorbed on fly ash can be volatized at ambient temperatures nor leached in landfills (USEPA, 1995d).

The USEPA spent a substantial amount of resources investigating, developing and documenting GCP. USEPA's data gathering efforts were presented in a report on the combustion control of organics, *Municipal Waste Combustion Study - Combustion Control of Organic Emissions* (USEPA, 1987b and USEPA, 1995d).

Thermal Oxidation

Thermal oxidation has been accomplished at industrial facilities utilizing three main types of thermal oxidizers:

- Recuperative Thermal Oxidizer (RCTO)

- Catalytic Thermal Oxidizer (CTO)
- Regenerative Thermal Oxidizer (RTO)

Thermal oxidation, regardless of type, works on the principal of raising the flue gas temperature to the oxidation temperature of CO for conversion to CO_2. Recuperative thermal oxidizers achieve oxidation temperatures typically through direct flame incineration. Hence, RCTOs are typically the costliest option relative to fuel use. Also, thermal efficiency of RCTOs is typically limited to a maximum of 70% before capital costs for heat exchange increase steeply. Thermal oxidizers incorporating catalysts utilize catalysts to lower the oxidation temperature of organics to reduce fuel costs. However, it is expected that the catalyst would experience deactivation and/or fouling from contaminants in the flue gas; thus, CTOs will not be considered further. Regenerative thermal oxidizers, like recuperative oxidizers, achieve organics control through heating flue gas to proper oxidation temperatures. However, in regenerative thermal oxidizers, the heat is contained in a series of ceramic beads that are alternately heated and re-heated to maximize heat efficiency. RTOs tend to have higher capital costs than catalytic or recuperative thermal oxidizers. However, RTOs typically have significantly lower operating costs due to the greater heat efficiency of the ceramic bed design which results in substantially lower fuel usage than catalytic or recuperative thermal oxidizers. RTOs have experienced problems with fouling of the ceramic heat exchange surface from flue gas contaminants and may require added filtration of flue gases prior to entry into the RTO.

Based on available data, catalytic oxidizers, recuperative thermal oxidizers, and RTOs have not been specified as BACT for MWCs nor were they evaluated as part of the USEPA's effort to establish the NSPS for new and existing MWCs. However, as thermal oxidation cannot be considered technically infeasible, application of a thermal oxidizer (either RCTO or RTO) will be evaluated on the basis of energy, environmental and economic feasibility.

4.8.4 RANKING OF ALTERNATIVE CONTROL TECHNOLOGIES

Oxidation catalyst systems and catalytic thermal oxidizers are determined to be technically infeasible based on analysis presented in Section 4.7. Thermal oxidation utilizing either a RCTO or RTO is assumed to provide enhanced MWC organics control over GCP and is ranked higher. In the case of Unit 3, the MWC will be designed to incorporate GCP inherently; thus, thermal oxidation will only reduce MWC organics emissions from the already low emissions resulting from GCP. For purposes of developing a conservative estimation of economic impacts, it is assumed that 90% of emitted MWC organics can be controlled by the thermal oxidizer. This assumption is conservative because Lee County is proposing MWC organics emissions of 13 ng/dscm at 7% O_2 with GCP. It is not typically possible to achieve a control level of 90% with such a low inlet level.

4.8.5 ENVIRONMENTAL IMPACT

As has been previously described, implementation of GCP will provide the lowest environmental impact for control of MWC organics. Based on current information, no adverse environmental impacts are projected from utilization of this technology. Utilization of thermal oxidation will result in secondary pollutant production from combustion of fossil fuels to maintain flue gas temperatures at the MWC organics oxidation temperature.

4.8.6 ECONOMIC IMPACT

No adverse economic consequences are foreseen utilizing GCP as it is the baseline operational requirement and it will be inherent in the design of the Martin combustor. The economic impact of applying a RCTO or RTO were determined using cost estimation algorithms provided in the USEPA's EPA Air Pollution Control Cost Manual, Sixth Edition (USEPA, 2002a). At an assumed MWC organic reduction efficiency of 90%, estimated costs for both the RCTO and a RTO would substantially exceed $1,000,000 per ton removed.

4.8.7 ENERGY IMPACT

No adverse energy utilization consequences are foreseen in the use of GCP as the proposed control technology for MWC organics. Application of either a RCTO or RTO would require increased electrical energy and fan power to drive the system. In addition, substantial amounts of fossil fuel would need to be fired to maintain temperatures for the thermal oxidizer to operate properly. Annual energy impacts based on OAQPS estimates ranged from approximately $697,500 for the RTO to approximately $1,990,000 for the RCTO.

4.8.8 SELECTION OF BACT

Based on a review of energy, environmental and economic impacts, thermal oxidation utilizing a RCTO or RTO is rejected as BACT and GCP is determined to be BACT for MWC organics. The BACT for MWC organics will be achieved through the advanced design of the combustion chamber and temperature control found in the Martin combustor. MWC organics emissions will be limited to 13 ng/dscm at 7% O_2. The emission rate for MWC organics given in Section 3 represents the BACT as per PSD regulations and FDEP requirements.

4.9 BACT REVIEW FOR MERCURY EMISSIONS

Mercury (Hg) is a metal that exists in the liquid phase and is relatively volatile at ambient temperatures. Mercury, as a product of combustion, is quantitatively a function of the Hg content of the waste.

4.9.1 FORMATION MECHANISMS

Mercury and mercuric compounds have boiling points ranging from 575-1200°F (302-649C). These compounds vaporize when heated due to their relatively low vapor pressures and can have a tendency to remain in the vapor phase at the outlet of the air pollution control equipment (BEI, 1986). It is theorized that flue gas cooling encourages deposition or enrichment of these compounds on fine particulate matter.

4.9.2 SOURCE SEPARATION IMPACT ON MERCURY EMISSIONS

The USEPA sponsored a field research program (Franklin Associates, 1991) to identify the characteristics of products containing mercury in MSW. An analysis of mercury in municipal solid waste for 1989 indicated the following categories:

Batteries	88%
Lighting	5%
Thermometers	2%
Thermostats	2%
Pigments	2%
Others	1%
	100%

This analysis demonstrates that discarded batteries contributed to the majority of mercury emissions at the time of the study. Since this study, no more relevant data representing the mercury content of MSW has been issued in the public domain. Later USEPA documents presenting projections of mercury content were based on this same data (Marks, M. 2002a; and Marks, M., 2002b). Two types of batteries are accountable for the mercury value: alkaline and mercury zinc. Voluntary reductions of mercury content by the battery manufacturers have significantly reduced the potential for mercury emissions from MWCs (Franklin Associates, 1991). This has been validated in annual reports prepared by the National Electrical Manufacturers Association (NEMA) regarding analyses of mercury from consumer batteries in the waste stream. In analyses conducted on a sample quantity of batteries collected annually in the Lee County Materials Separation Program from 1996 to 2000, the percentage of consumer batteries containing no added mercury increased from 62% in 1996 to 88% in 2000. This change led NEMA to project that "the average mercury level will decline exponentially, decreasing by approximately 50% every two years. This would result in mercury levels from batteries in the waste stream falling to background levels (less than 5 parts per million) by the year 2008 (NEMA, 2001)." Additionally, source separation of all of the other products above will further reduce the potential for mercury emissions Unit 3.

Another study of typical MSW stream components showed approximately 85% of the Hg content in normal household waste is contained in metal components (primarily household batteries), 5% in plastics, and 3% in paper products (Shaub, 1988). Thus, an effective means of reducing Hg components in the MSW stream would be separation of batteries, paper and plastics. As discussed earlier, the Lee County Materials Separation

Plan provides curbside collection for residential recycling of batteries and various paper and plastic materials. Commercial businesses and institutions also voluntarily recycle these materials, thus removing more from the waste stream. Lead-acid vehicle batteries are excluded from the normal waste stream for collection at established centers.

While certain materials separation efforts are considered in this document because of their potential to reduce air emissions, the amount of emissions reductions cannot be quantified. For this reason, materials separation activities are discussed in this BACT analysis; however, materials separation should not be imposed as BACT. There is no evidence to demonstrate that source separation of certain components by itself provides for consistent and measurable reductions of Hg. Because it is not possible to quantify the effect of source separation, source separation does not qualify as a technology or clean fuel process.

4.9.3 AVAILABLE CONTROL TECHNOLOGIES

The control technologies for removing Hg emissions from MWC flue gases are continuing to evolve. Methods of reducing mercury include:

- Reagent injection such as sodium sulfide or activated carbon upstream, within, or downstream of the SDA and upstream of the FF (or ESP)
- Wet scrubbing techniques
- Spray dryer followed by an FF (or ESP)
- Flue gas cooling
- Activated carbon reactor
- Source separation

In developing the MWC emissions guidelines and NSPS for mercury emissions, USEPA evaluated data and conducted tests of an activated carbon injection system at two U.S. MWCs, Stanislaus County (California) and Camden County (New Jersey). Stanislaus County utilized a SDA/FF and SNCR and the Camden facility utilized a SDA/ESP and SNCR. Use of activated carbon was evaluated, because at that time available data had shown that this reagent effectively removed mercury, and activated carbon was less expensive than other sorbents in use at that time. Based on these tests, USEPA determined that the two primary variables affecting both Hg emission and control efficiency were reagent (carbon) feed rate and uncontrolled Hg levels. Reductions in excess of 80% were achieved with high carbon feed rates. At low carbon feed rates, Hg emissions were much more variable. In addition, SNCR reagents did not appear to interfere with Hg removal nor did Hg leach from the ash over a 28-day period (USEPA, 1992b). This led to establishment of the Subpart Eb NSPS level of 80 milligrams per dry standard cubic meter (dscm) or 85% control, whichever is least stringent.

Though the Stanislaus County and Camden County testing is dated, stack test results from numerous MWCs in the U.S., including LCERF Units 1 and 2, utilizing reagent (activated carbon) injection have demonstrated compliance with the NSPS Hg emission limits. Tested levels at Lee County Units 1 and 2 from 1994 to 2000 have ranged from

non-detected to 75 mg/dscm at 7% O_2. USEPA has recognized reagent (activated carbon) injection in combination with a FF as a very effective control system for mercury.

For mercury emissions, Unit 3 will benefit from source separation and removal of mercury containing wastes due to both nationwide and local efforts. Flue gas temperatures will be cooled in the SDA/FF to assist in removal and collection of mercury. Reagent (activated carbon) is proposed for enhanced mercury control. Thus, of the available control methods discussed above, only wet scrubbers and activated carbon reactors may warrant further evaluation in comparison to reagent injection.

Reagent Injection

As stated, Lee County is proposing installation of an activated carbon injection system with subsequent collection in the downstream FF for mercury control. Other reagents such as sodium sulfide and Sorbalit® have been tested and used at other facilities. However, testing has shown that other existing reagents/sorbents are no more effective than activated carbon and typically these materials are substantially more expensive. In fact, several facilities that started utilizing these other sorbents have since switched to activated carbon.

USEPA tests and recent data from operating U.S. MWCs have shown that activated carbon injection effectively limits outlet Hg emissions to levels below the USEPA NSPS and Florida Mercury Rule levels.

Wet Scrubbing Techniques

It has been reported (Vogg, et al., 1986) that wet scrubber systems can provide effective control of Hg emissions from MWCs. However, for this to be effective, measures must be taken to avoid secondary reduction reactions of Hg compounds with SO_2. This can be done by utilizing a strong acid scrubbing solution or a similar method such as addition of an oxidizing agent (Vogg, et al., 1986).

Test results from the Coburg, Germany, facility equipped with a SDA/FF and wet scrubber have indicated that the Hg emission rates are similar to the emission rates from facilities equipped with SDA/FF only (Ogden Martin Systems, Inc., 1991).

No other more recent data relative to Hg emissions reductions from MWCs equipped with wet scrubbers was identified that showed that potential for higher removal capability than activated carbon injection.

Activated Carbon Reactors

European facilities have incorporated activated carbon reactors as tail gas control method for Hg, as well as other trace metals and air toxics. These can be either fixed bed carbon adsorbers or circulating carbon beds. In European designs, these are used as flue gas

polishing steps at the end of the pollution control train, but typically before the NOx SCR step to allow as contaminant free flue gas as possible to enter the SCR reactor and if installed, the oxidation catalyst system. This flue gas polishing step has been installed on some European MWCs in response to a political desire in several countries (including Germany, Austria, Switzerland and the Netherlands) to reduce all air pollutants to the maximum extent possible, typically without regard to cost or the effect on plant efficiency (Hartenstein, et al, 1996). No data has been identified that indicates that significant additional Hg removal would occur with the activated carbon reactor over carbon injection with a SDA/FF. In fact, with activated carbon in the filter cake of the FF, a similar effect of an activated carbon reactor is created. Thus, for purposes of this review, it is considered that activated carbon injection in conjunction with a SDA/FF would provide equivalent control as an activated carbon reactor.

4.9.4 RANKING OF ALTERNATIVE CONTROL TECHNOLOGIES

Control of Hg emissions have been demonstrated via proper operation of acid gas/particulate control devices with low scrubber outlet temperature in conjunction with activated carbon injection. Wet scrubbers or activated carbon reactors have not demonstrated a higher removal efficiency for Hg from MWC flue gases. Using this criteria for ranking, it appears that an SDA/FF and additional control by reagent (activated carbon injection) ranks as the most effective or "top" technology for flue gas Hg removal.

4.9.5 SELECTION OF BACT

Based upon the previously set forth rationale, the proposed control technology for Hg is injection of activated carbon in conjunction with a semi-dry scrubber system consisting of an SDA and FF. This technology is considered to be the most effective in controlling Hg and therefore represents the highest ranking control technology from a top-down BACT perspective.

Hg emissions will be controlled to a level of 70 mg/dscm corrected to 7% O_2 or 85% control, whichever is least stringent.

4.10 SUMMARY OF PSD APPLICABLE POLLUTANTS AND PROPOSED BACT

Table 4-6 below summarizes those pollutants that are subject to PSD review for the proposed Unit 3 project at the LCERF. Table 4-6 also includes a summary of the proposed BACT for each pollutant.

TABLE 4-6
POLLUTANTS APPLICABLE TO PSD REVIEW AND PROPOSED BACT

PSD Pollutant	Proposed BACT
PM_{10}	FF
MWC Metals (as PM)	FF
MWC Acid Gases[a]	SDA/FF
SO_2	SDA/FF
SAM	SDA/FF
NOx	SNCR
CO	GCP
Mercury	ACI
MWC Organics[b]	GCP

[a] MWC Acid Gases as HCl and SO_2.
[b] MWC Organics as Total Dioxins and Furans (measured as total tetra- through octa- chlorinated dibenzo-p-dioxins and dibenzo furans).

LEE COUNTY ENERGY RECOVERY FACILITY
PREVENTION OF SIGNIFICANT DETERIORATION
APPLICATION FOR MUNICIPAL WASTE COMBUSTOR UNIT 3

SECTION 5
EXISTING AMBIENT AIR QUALITY

October 31, 2002

SECTION 5
EXISTING AMBIENT AIR QUALITY

The two main factors influencing air quality are the types and amounts of pollutants, both natural and man-made, emitted directly into the atmosphere (i.e., "primary" pollutants) and the subsequent atmospheric (i.e., meteorological) conditions that disperse and transport these emissions. Meteorological conditions also determine the rate of chemical reactions that form "secondary" pollutants like ozone, which are not emitted directly from emission sources.

5.1 AMBIENT AIR QUALITY STANDARDS

The effect of pollutants on ambient air quality depends on the duration and level of pollutant concentrations. Ambient air quality standards (AAQS) specify the allowable limits of pollutant concentrations for specific durations. National AAQS have been promulgated by the U.S. Environmental Protection Agency (USEPA) in Title 40, Part 50 of the Code of Federal Regulations (40 CFR 50). Primary AAQS are designed to protect public health with an adequate margin of safety for sensitive groups of individuals (e.g., children and asthmatics). Secondary AAQS are designed to protect the public welfare from any known or anticipated adverse effects associated with air pollution. Protection of the public welfare includes the protection of property, materials, plants and animal life. The State of Florida has adopted State AAQS in Chapter 62-204, Florida Administrative Code (F.A.C.) that are at least as stringent as the National AAQS. AAQS were promulgated by USEPA and Florida for six "criteria" pollutants: sulfur dioxide (SO_2); nitrogen dioxide (NO_2); carbon monoxide (CO); lead (Pb); ozone (O_3); and particulate matter less than 10 microns (PM_{10}). Compliance with the SO_2, NO_2, CO, and Pb AAQS requires the second-highest short-term concentration (24-hours or less) and the long-term average concentrations (quarterly and annual) measured each year at a particular monitoring site to be less than or equal to the AAQS. Compliance with the short-term O_3 and PM_{10} AAQS requires the fourth-highest concentration over three consecutive years to be less than or equal to the AAQS for "complete" datasets. These National and Florida AAQS are shown on Table 5-1.

5.2 AMBIENT MONITORING DATA

Air quality in Florida is measured by the Florida Department of Environmental Protection (FDEP) and local agencies. Table 5-2 shows the nearest monitoring sites to the Lee County Energy Recovery Facility (LCERF). Because of the LCERF's rural location, there are few monitoring sites in the immediate vicinity. Most nearby monitors are located in more urban or suburban areas. Because of their more urbanized setting, these monitoring locations are conservative for determining baseline air quality (i.e., measured concentrations would be higher than expected for the LCERF vicinity). The nearest PM_{10} monitors are located 12 kilometers (km) from the LCERF in Lee County at the Fort Myers Water Treatment Plant and 56 km from the facility in Collier County. There are two O_3 monitor sites in Lee County -- in Cape Coral 20 km from the LCERF and in Fort Myers Beach 24 km from the LCERF. The nearest

TABLE 5-1
NATIONAL AND FLORIDA STATE AMBIENT AIR QUALITY STANDARDS[a]

Pollutant/Averaging Time	Florida AAQS	National AAQS	Primary/Secondary
SO_2 3-Hour Average	1300 ug/m^3 (0.5 ppm)	0.5 ppm (1300 ug/m^3)	Secondary
SO_2 24-Hour Average	260 ug/m^3 (0.1 ppm)	0.14 ppm (365 ug/m^3)	Primary
SO_2 Annual Arithmetic Mean	60 ug/m^3 (0.02 ppm)	0.030 ppm (80 ug/m^3)	Primary
NO_2 Annual Arithmetic Mean	100 ug/m^3 (0.05 ppm)	0.053 ppm (100 ug/m^3)	Primary & Secondary
CO 1-Hour Average	35 ppm (40,000 ug/m^3)	35 ppm (40,000 ug/m3)	Primary
CO 8-Hour Average	9 ppm (10,000 ug/m^3)	9 ppm (10,000 ug/m3)	Primary
PM_{10} 24-Hour Average[b]	150 ug/m^3	150 ug/m^3	Primary & Secondary
PM_{10} Annual Arithmetic Mean	50 ug/m^3	50 ug/m^3	Primary & Secondary
Lead Quarter Arithmetic Mean	1.5 ug/m^3	1.5 ug/m^3	Primary & Secondary
O_3 Max. Daily 1-Hour Average[b]	0.12 ppm (235 ug/m^3)	0.12 ppm (235 ug/m^3)	Primary & Secondary

SOURCE: Rule 62-204.240, F.A.C. (Ambient Air Quality Standards) for Florida AAQS and 40 CFR 50 (National Primary and Secondary Ambient Air Quality Standards) for National AAQS.

[a] Except as noted, short-term AAQS (i.e., averaging times of 24-hour or less) are not to be exceeded more than once a calendar year and long-term AAQS (i.e., quarterly and annual averaging times) are never to be exceeded.

[b] Compliance with 24-hour PM_{10} and 1-hour O_3 AAQS is achieved, in simplest terms, when the expected number of days exceeding the AAQS is less than or equal to 1.0 per calendar year when averaged over a consecutive three year period. Or, if data completeness criteria are met, when the fourth-highest daily maximum concentration in three consecutive years is less than or equal to the AAQS.

TABLE 5-2
NEAREST AMBIENT AIR QUALITY MONITORING SITES[a]

County/Site ID	Measured Pollutant(s)	UTM Coord. (km) East, North	Distance (km), Direction[b] from LCERF
Lee County			
071-0005	PM_{10}	412.492, 2942.575	12.1, WSW
071-2001	O_3	404.400, 2945.800	19.8, W
071-3002	O_3	400.824, 2940.837	23.9, WSW
Collier County			
021-0003	PM_{10}	423.500, 2890.430	55.3, S
Sarasota County			
115-0014	CO	358.780, 2995.250	82.1, NW
115-0013	PM_{10}	350.800, 3019.350	104.0, NW
115-1002[c]	SO_2, O_3	349.150, 3020.375	105.9, NW
115-1006[c]	SO_2, O_3	353.620, 3025.910	106.8, NW
115-1004	CO	348.530, 3024.360	109.1, NW
115-1005	SO_2, O_3	344.600, 3021.250	109.7, NW
Hillsborough County			
057-0081	NO_2, SO_2, O_3	355.544, 3069.100	141.2, NNW
057-1066[d]	Pb	364.000, 3093.400	159.5, NNW
057-1073[d]	Pb	364.310, 3093.990	159.9, NNW
057-1074[d]	Pb	364.050, 3094.640	160.6, NNW
Broward County			
011-0031	NO_2, O_3	570.365, 2905.871	151.5, ESE
Pinellas County			
103-0024[e]	Pb, CO	329.745, 3075.255	160.3, NW
103-3005[e]	Pb	333.000, 3084.420	166.0, NNW
Palm Beach County			
099-0018	Pb	584.561, 2964.829	161.5, E

[a] Only the two nearest monitoring sites for each pollutant are shown in this table.
[b] Distance (km) and direction are measured from the LCERF's UTM coordinates (Zone 17) of 424.2 km East and 2945.7 km North.
[c] Site was moved in mid-1999 (ID changed from 115-1002 to 115-1006) - considered as one site.
[d] The Hillsborough County lead monitoring sites were not used for background because these are special purpose monitors for an industrial lead emissions source.
[e] The lead monitoring at site 103-0024 (Pinellas County) was discontinued in early 1999. Lead monitoring site 103-3005 (Pinellas County) was initiated in 1999, so both are considered a single site for lead.

CO and SO_2 monitors are located in Sarasota County -- CO is measured at two locations 82 and 109 km from the LCERF while SO_2 is measured at different locations 106 and 110 km from the LCERF. The two closest NO_2 monitoring stations are in Hillsborough (141 km) and Broward (152 km) counties.

Lead monitoring has been discontinued in most areas of Florida, including Lee County. Lead concentrations in general are very low and have been decreasing statewide. Lead concentrations at the nearest monitoring sites in Hillsborough County were not considered because these monitors are special purpose monitors used to measure localized lead impacts in the vicinity of an industrial emission source. Lead concentrations at the next closest monitors (approximately 160 km away in Palm Beach and Pinellas Counties) have been used to determine background levels.

Maximum ambient concentrations measured during the last three available calendar years (1998-2000) are shown on Table 5-3. Three years are shown when available because this is the time period generally used by USEPA for determining compliance with AAQS as described above and in Table 5-1. Concentrations were generally higher in 1998 due to widespread fires in Florida and Mexico. Some, but not all, of the high PM_{10} and O_3 concentrations due to the 1998 wildfires were excluded by USEPA from the data as extraordinary events. In spite of the high concentrations remaining in the database for 1998-2000, the data show that the area surrounding the LCERF is in compliance with the AAQS.

5.3 BASELINE AIR QUALITY

Baseline or background air quality represents the air quality in the project vicinity prior to operation of the proposed source. It is generally based on actual measurements of ambient air quality. Maximum concentrations from the two nearest monitoring sites are summarized on Table 5-4 as a conservative estimate of background air quality. Baseline concentrations are shown on Table 5-4 in the form of the applicable AAQS (e.g., the high second-high 8-hour CO concentration over three years).

The status of baseline air quality is generally evaluated by comparing baseline concentrations to the AAQS. Baseline SO_2 and NO_2 concentrations are less than one-fifth of the most restrictive National or State AAQS for all averaging times. Baseline CO concentrations are about one-third and two-thirds of the 1-hour and 8-hour AAQS, respectively. Baseline PM_{10} concentrations are less than one-third and one-half of the PM_{10} 24-hour and annual AAQS, respectively. Baseline O_3 concentrations are about 80% of the 1-hour AAQS. Maximum measured quarterly Pb concentrations are generally below the detection limits of the monitoring methods and are less than 1% of the quarterly AAQS. Thus, baseline ambient air quality as summarized above complies with all AAQS. Since the air quality monitoring sites are from more urbanized areas than the LCERF site, the baseline concentrations selected are a conservative representation of the project location (i.e., the baseline concentrations are higher than ambient concentrations which would actually be measured near the Facility).

TABLE 5-3
NEARBY AMBIENT AIR QUALITY DATA

Pollutant/Avg. Time/ Year	Concentration at Nearest Monitoring Site	Concentration at Next Closest Monitoring Site
SO_2/3-hour Second-Highest Concentration (ppm)		
1998	**0.057 ppm**[a] Sarasota County	0.056 ppm Sarasota County
1999	0.033 ppm 115-1002 (98-99)	0.032 ppm 115-1005
2000	0.044 ppm 115-1006 (99-00)	0.045 ppm
SO_2/24-hour Second-Highest Concentration (ppm)		
1998	**0.019 ppm** Sarasota County	0.014 ppm Sarasota County
1999	0.011 ppm 115-1002 (98-99)	0.011 ppm 115-1005
2000	0.016 ppm 115-1006 (99-00)	0.019 ppm
SO_2/Annual Arithmetic Mean Concentration (ppm)		
1998	0.002 ppm Sarasota County	**0.003 ppm** Sarasota County
1999	0.003 ppm 115-1002 (98-99)	0.002 ppm 115-1005
2000	0.002 ppm 115-1006 (99-00)	0.002 ppm
NO_2/Annual Arithmetic Mean Concentration (ppm)		
1998	0.006 ppm Hillsborough County	0.009 ppm Broward County
1999	0.007 ppm 057-0081	**0.010 ppm** 011-0031
2000	0.008 ppm	0.009 ppm
CO/1-hour Second-Highest Concentration (ppm)		
1998	5.5 ppm Sarasota County 115-0014	**10.9 ppm** Sarasota County 115-1004
1999	3.7 ppm	4.5 ppm
2000	4.2 ppm	6.6 ppm
CO/8-hour Second-Highest Concentration (ppm)		
1998	2.6 ppm Sarasota County 115-0014	**5.6 ppm** Sarasota County 115-1004
1999	2.6 ppm	3.3 ppm
2000	2.1 ppm	4.3 ppm
O_3/1-hour Maximum, Fourth-Highest Day over three years (ppm)[b]		
1998-2000	0.096 ppm Lee County 071-2001	**0.098 ppm** Lee County 071-3002

[a] The baseline concentration selected (i.e., the maximum concentration appropriate for the AAQS) from both nearest monitoring sites is **bolded** and shown on Table 5-4.

[b] Round to two significant digits before AAQS comparison as required by regulations (i.e., 0.098 ppm rounds to 0.10 ppm).

TABLE 5-3
NEARBY AMBIENT AIR QUALITY DATA
(CONCLUDED)

Pollutant/Avg. Time/ Year	Concentration at Nearest Monitoring Site	Concentration at Next Closest Monitoring Site
PM_{10}/24-hour Fourth-Highest Concentration over three years (ug/m3)		
1998-2000	36 ug/m^3 Lee County 071-0005	**39 ug/m^3**[a] Collier County 021-0003
PM_{10}/Annual Arithmetic Mean Concentration (ug/m3)		
1998	18 ug/m^3 Lee County 071-0005	19 ug/m^3 Collier County 021-0003
1999	**19 ug/m^3**	17 ug/m^3
2000	19 ug/m^3	18 ug/m^3
Pb/Maximum Quarterly Arithmetic Mean Concentration (ug/m3)		
1998	**0.01 ug/m^3** Pinellas County	0.00 ug/m^3 Palm Beach County
1999	0.01 ug/m^3 103-0024 (98-99)	0.00 ug/m^3 099-0018
2000	0.01 ug/m^3 103-3005 (99-00)	N/A (1999 shutdown)

[a] The baseline concentration selected (i.e., the maximum concentration appropriate for the AAQS) from both nearest monitoring sites is **bolded** and shown on Table 5-4.

TABLE 5-4
COMPARISON OF BASELINE CONCENTRATIONS TO AMBIENT AIR QUALITY STANDARDS

Pollutant Name	Averaging Time	Baseline Concentrations (ug/m^3)[a]	AAQS[b] (ug/m^3)	Percent of AAQS
SO_2	3-Hour	149	1,300	11%
SO_2	24-Hour	50	260	19%
SO_2	Annual	8	60	13%
NO_2	Annual	19	100	19%
CO	1-Hour	12,535	40,000	31%
CO	8-Hour	6,440	10,000	64%
PM_{10}	24-Hour	39	150	26%
PM_{10}	Annual	19	50	38%
Pb	Quarter	0.01	1.5	<1%
O_3	1-Hour	196	235	83%

[a] Baseline concentrations are the appropriate maximum concentrations for the applicable AAQS at the two nearest monitoring sites for the most recently available three years of data. Short-term concentrations (24-hours or less) are high second-high concentrations over three years while long-term concentrations (quarterly and annual) are the maximum concentration over three years except for 24-hour PM_{10} and 1-hour O_3 (fourth-highest daily maximum concentration over three consecutive years). SO_2, NO_2, CO and O_3 ppm converted from ppm to ug/m^3 using 2620, 1881, 1150 and 1963 ug/m^3 per ppm, respectively.

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

5.4 ATTAINMENT STATUS

Under Section 107 of the Clean Air Act, each state is required to develop a State Implementation Plan (SIP) which specifies the manner by which all areas within the state will achieve and maintain compliance with the National AAQS. All areas in the United States are designated as either attainment, nonattainment, 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. Nonattainment 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. Nonattainment areas can also be areas which previously did not comply with the National AAQS and necessary SIP revisions have not yet been approved by USEPA. Unclassifiable areas are areas where insufficient data exists to classify the area as either attainment or nonattainment and are assumed to be in attainment with the National AAQS.

Lee County is part of the Southwest Florida Intrastate Air Quality Control Region (AQCR), which includes Charlotte, Collier, De Soto, Glades, Hendry, Highlands, Lee and Sarasota Counties (40 CFR 81.97). Lee County and all of Florida is designated as attainment or unclassifiable (and presumed to be in attainment) with the National AAQS for all currently regulated criteria pollutants (Total Suspended Particulates [TSP], SO_2, NO_2, CO, Pb, and 1-hour O_3 at 40 CFR 81.310 and PM_{10}, SO_2, NO_2, CO, Pb, and 1-hour O_3 at Rule 62-204.340, F.A.C.).

Areas that were once considered to be nonattainment for one or more AAQS but are now designated as attainment or unclassifiable are considered to be "maintenance" areas. The name refers to the various regulatory requirements applied to state agency and/or emission sources in order to "maintain" future compliance with AAQS. In Florida, there are maintenance areas for O_3, Pb, and TSP, which was replaced by the AAQS for PM_{10}). The nearest maintenance areas are in the Miami and Tampa metropolitan areas. The Miami O_3 maintenance area, consisting of Broward, Dade, and Palm Beach Counties, is more than 85 km east of the LCERF. The Tampa O_3 maintenance area (Pinellas and Hillsborough Counties) is about 120 km from the facility while the Tampa Pb and TSP maintenance areas (portions of Hillsborough County) are about 150 km north-northwest of the LCERF. None of these maintenance areas are considered to be "nearby" for regulatory purposes (less than 50 km) so no permitting requirements apply to the LCERF as a result of these maintenance areas.

LEE COUNTY ENERGY RECOVERY FACILITY
PREVENTION OF SIGNIFICANT DETERIORATION
APPLICATION FOR MUNICIPAL WASTE COMBUSTOR UNIT 3

SECTION 6
AIR QUALITY IMPACT ANALYSES

October 31, 2002

SECTION 6
AIR QUALITY IMPACT ANALYSES

Air quality impact analyses for the immediate project vicinity required by the Prevention of Significant Deterioration (PSD) regulations (see Section 2) are addressed in this section. Air quality impact analyses for the Everglades National Park (a Class I area), Air Quality Related Values (AQRV), and other modeling analyses such as the deposition analyses for the Human Health and Ecological Risk Assessments are given in Section 7.

As discussed in Section 1, Lee County intends to expand the Lee County Energy Recovery Facility (LCERF) by adding a third municipal waste combustor (MWC) to the two existing units. Air pollution control (APC) equipment for the new unit will be similar to APC equipment for the two existing units. The APC system will include a spray dry absorber (SDA), a fabric filter (FF) baghouse, an activated carbon injection (ACI) system, and a selective non-catalytic reduction (SNCR) system.

Maximum increases in facility impacts for the criteria pollutants due to the new MWC were determined for comparison to significant impact levels (SILs) as required by the regulations and modeling guidance. As will be shown, these maximum increases are less than the SILs, so additional multi-source modeling analyses are not required. Since such small increases are considered negligible, no assessment of compliance with ambient air quality standards (AAQS) and Class II PSD increments is required. Plume rise for the two existing units will be enhanced by the addition of the third unit so the increases in facility impacts will be less than the proportional increases in facility emissions. Although not required by the modeling guidelines, modeling analyses were performed for all three MWC units to demonstrate that the LCERF will continue to comply with all AAQS and PSD increments. In addition, a comparison of maximum increases in facility impacts to the de minimis monitoring levels is included for PSD pollutants. Finally, a comparison of maximum increases in facility impacts to Florida Ambient Reference Concentrations (ARCs) is included for non-criteria pollutants.

6.1 MODEL SELECTION AND OPTIONS

Air quality models are employed to assess the potential impacts of proposed sources on ambient air quality. The models mathematically simulate the dispersion of pollutants in the atmosphere. The models estimate potential concentrations at user-specified locations (i.e., "receptors") based on the source characteristics, meteorological data, and model options selected by the user. A modeling protocol was submitted to the Florida Department of Environmental Protection (FDEP), Region IV of the U.S. Environmental Protection Agency (USEPA), and the National Park Service (NPS) Federal Land Manager. The modeling of the LCERF was performed in accordance with the modeling protocol and the agency comments.

The LCERF vicinity is relatively flat, with no terrain approaching the height of the facility stack. Therefore, a "simple" terrain model is required for the impact assessment (i.e., complex terrain model not required) and terrain heights were not considered in the

modeling analyses. Since less than 50% of the area within 3 kilometers (km) of the LCERF stack is considered to be urban land uses (i.e., commercial, industrial, or compact residential areas), rural dispersion curves are required in the impact assessment. Therefore, the latest version of the USEPA Industrial Source Complex -- Short-Term (ISCST3) model was selected to estimate facility impacts. ISCST3 is the USEPA-recommended model for estimating point source impacts in simple terrain under rural dispersion conditions.

In addition to flat terrain and rural dispersion curves, other ISCST3 options include concentration estimates assuming non-reactive gaseous emissions using the default regulatory option. Since ISCST3 only considers non-reactive pollutants, secondary pollutants not emitted directly by the facility such as ozone and particulate matter with an aeronautical diameter less than 2.5 microns ($PM_{2.5}$) (with significant contributions from nitrates and sulfates) were not considered. Also, all nitrogen oxides (NOx) emissions (predominantly in the form of nitric oxide [NO]) were assumed to be nitrogen dioxide [NO_2] for comparison to AAQS, SILs, and PSD increments (i.e., the ozone limiting and ambient ratio methods were not used). No plume decay or depletion was considered for the PSD analyses in this section. Wet and dry deposition considering both gaseous and particulate pollutant distributions is discussed in Section 7 for the Risk Assessments. Averaging times of 1-hour, 3-hours, 8-hours, 24-hours, and annual periods appropriate for each pollutant based on the AAQS, SILs, PSD increments, and ARCs were modeled. Maximum and second-high short-term concentrations (24-hours or less) for each year of meteorological data modeled were output from ISCST3 along with annual concentrations for each year. Maximum short-term and annual concentrations from all years were used for comparison to SILs, de minimis monitoring levels, and ARCs. High second-high short-term concentrations and maximum annual concentrations were used for comparison to AAQS and PSD increments. The use of the 24-hour high second-high concentration is more conservative for comparison to the 24-hour PM_{10} AAQS than the sixth-highest concentration over five years sometimes used. Also, maximum modeled 24-hour lead concentrations were conservatively used in place of quarterly concentrations.

Information necessary to execute ISCST3 includes hourly averages of meteorological data, emission source conditions (release height, stack diameter, etc.), and the locations for estimating facility impacts (receptors). These are described below.

6.2 METEOROLOGICAL DATA

ISCST3 considers the effect of meteorology on plume rise and dispersion in order to estimate ambient pollutant concentrations due to modeled emissions sources. Hourly averages of surface meteorological data -- wind speed and direction, temperature, atmospheric stability, pressure, relative humidity, and precipitation -- from the Fort Myers Airport (Page Field) were used in this case. The Fort Myers Airport (Page Field) is the nearest National Weather Service (NWS) surface station and is about 12 kilometers (km) southwest of the LCERF. Given the similar exposure and close physical proximity, data from the Fort Myers (Page Field) airport are very representative of surface meteorological conditions at the LCERF. Radiosonde data from Tampa International

Airport, about 165 km to the north, were also used. Twice-daily mixing heights processed by the National Climatic Data Center (NCDC) for Tampa, the nearest NWS upper air station on the Gulf Coast, are similar to the project site due to similar exposures along the Florida Gulf Coast.

Meteorological data for input to the ISCST3 model were processed with USEPA program PCRAMMET for calendar years 1990 through 1994, the last five full years of complete and available records. Surface characteristics representative of the project vicinity input to PCRAMMET were Minimum Monin-Obukhov length of 2 meters (m), measurement and project site surface roughness lengths of 0.20 m, noontime albedo of 0.20, Bowen ratio of 0.5, fraction of net radiation absorbed by the ground of 0.15, and anthropogenic heat flux of 0 Watts/square-meter. These surface characteristics are based on PCRAMMET recommendations (USEPA, 1999c, pp. 3-6 to 3-8 and Appendix B) for rural agricultural areas or summer values for cultivated land. The Fort Myers anemometer height is 20 feet.

6.3 RECEPTOR DATA

Impacts are calculated by ISCST3 only for locations specified by the user. A careful selection of receptor grids is therefore required to ascertain the magnitude and location of maximum modeled impacts. For the proposed project, ambient areas outside the facility fenceline were modeled in accordance with USEPA modeling guidance. Receptor locations were based on the Universal Transverse Mercator (UTM) coordinate system. Due to the flat terrain in Lee County and southern Florida, terrain (i.e., receptor and source elevations) were not considered in the modeling analyses (FLAT model option). Flagpole receptors were also not used.

While the main facility stack meets Good Engineering Practice (GEP) criteria, maximum facility impacts are still expected in the immediate vicinity (i.e., at or near the facility fenceline) due to the flat terrain and the relatively low exhaust temperatures caused by the spray dry absorber. Therefore, along the facility fenceline and for the area within two kilometers of the stack, "fine grid" receptors spaced 100-meters apart were modeled (the minimum spacing typically required for the stack heights and fenceline distances in this modeling analysis). For two to ten kilometers from the stack, "coarse grid" receptors spaced 500-meters apart were used. Based on the coarse and fine grid results, additional 100-meter "fine grid" receptors were required west-southwest of the original fine grid to locate the maximum annual impact and location (i.e., to cover all areas within 90% of the overall maximum and second-highest impacts for all applicable averaging times with 100-meter spaced receptor grids). This additional "fine grid" was included in all the ISCST3 modeling analyses to determine maximum impacts.

6.4 SOURCE DATA

Like most modern MWCs, there are very few fugitive or minor sources associated with the LCERF. Municipal solid waste (MSW) is delivered to the enclosed tipping floor. Air from the tipping floor is used as makeup air for the combustion process, keeping this area

under negative pressure and minimizing fugitive emissions and odors. Bottom ash from the furnace grate and flyash from the APC equipment is kept wet and handled by covered conveyors or within enclosed areas (i.e., buildings). Therefore, except for increased truck traffic, there will be only negligible increases in fugitive or secondary onsite emissions due to the increase in facility throughput for Unit 3.

The only existing minor point sources at the LCERF regulated by the Title V permit are particulate matter emissions sources -- the lime silo dust collector vent and the ash building baghouse vent. Stack and emission characteristics for these two existing sources are included in Table 6-1. Other insignificant and unregulated sources listed by the Title V permit and not considered for the modeling analysis include small chemical storage tanks and silos and the cooling tower.

USEPA Method 5 stack tests in 1998 and 1999 of the ash building vent measured an average outlet grain loading of only 0.00030 grains per cubic foot (gr/cf) and an average flowrate of 16,500 cubic feet per minute (cfm), or only 0.0424 lbs/hour [0.00030 gr/cf x 16,500 cf/min x 60 min/hr x lb/7000 gr] (Ogden Energy Group, Inc., 1998, 1999a). The ash building vent operates almost continuously (8760 hours per year [hrs/yr]), with actual annual emissions of about 0.2 tons/year (0.0424 lb/hr x 8760 hrs/yr x ton/2000 lbs). Outlet grain loadings and PM emissions would be expected to be relatively insensitive to inlet grain loadings due to the design of the baghouses, the obviously low particulate concentrations inside the ash handling building, and the very low particulate emission rate. Therefore, the change in facility throughput would not be expected to affect PM emissions from the ash building vent. Even if operation of Unit 3 causes a 50% increase in actual emissions, it would only be 186 lbs/year. As can be seen, actual emissions are very much less than permitted emissions of 0.010 gr/cf and 26,290 cfm (2.25 lbs/hr), so no changes are needed to permitted emission levels.

The existing lime silo stores pebble lime used to control acid gas emissions from the two existing MWCs. Unlike volatile organic compound (VOC) storage tanks (with gaseous vapors), no breathing losses would be expected. The only emissions would occur during filling operations when about 26 tons of pebble lime is added to the silo by delivery truck. Filling the existing lime silo typically takes less than 100 minutes. There are approximately 74 deliveries per year under existing conditions based on records for the first half of calendar year 2000. The only permit limit for the existing lime silo dust collector is no visible emissions (less than 5% opacity) during filling operations.

A second lime silo will be added for the proposed third MWC Unit. PM emissions during filling of the additional lime silo will be controlled with a dust collector designed for an outlet grain loading of 0.015 grains per dry standard cubic foot (gr/dscf) and equipped with a fan/motor rated at 1200 scfm. Filling the new proposed lime silo is expected to take about one hour for 20 tons of lime. Based on the current 74 fills/year (at 26 tons per fill) for the existing lime silo, the new lime silo will require about 48 fills/year (at 20 tons per fill). This gives short-term emissions of 0.154 lb/fill (0.015 gr/dscf x 1200

TABLE 6-1
STACK CHARACTERISTICS

FACILITY SOURCES	ENGLISH UNITS	METRIC UNITS
MAIN FACILITY STACK[a]		
Stack Height Above Base	275 feet	83.82 meters
Flue Diameter – New And Old Units	6 feet 2.00 inches	1.880 meters
Effective Diameter – 2 Units	8 feet 8.65 inches	2.658 meters
Effective Diameter – 3 Units	10 feet 8.17 inches	3.256 meters
Stack Location:		UTM Zone 17
East	81° 45' 41" West Longitude	424.20 UTM kilometers
North	26° 37' 54" North Latitude	2945.70 UTM kilometers
EXISTING LIME SILO DUST COLLECTOR VENT[b]		
Stack Height Above Base	102 feet	31.09 meters
Exit Temperature	Ambient	Ambient
Vent Diameter	12 inches	0.305 meters
Exit Flows	1000 acfm[c]	6.5 meters/second
Short-Term PM Emissions (1 fill/day)	0.214 lb/fill	1.12E-3 g/s
Annual PM Emissions (74 fills/year)	15.836 lb/year	2.28E-4 g/s
PROPOSED LIME SILO DUST COLLECTOR VENT[d]		
Stack Height Above Base	85 feet	25.91 meters
Exit Temperature	Ambient	Ambient
Vent Diameter	8 inches	0.203 meters
Exit Flows	1200 acfm[e]	17.5 meters/second
Short-Term PM Emissions (1 fill/day)	0.154 lb/fill	8.09E-4 g/s
Annual PM Emissions (48 fills/year)	7.39 lb/year	1.06 E-4 g/s
ASH HANDLING BUILDING DUST COLLECTOR VENT[f]		
Stack Height Above Base	58 feet 7.25 inches	17.86 meters
Exit Temperature	Ambient	Ambient
Vent Diameter	2.8 feet	0.853 meters
Exit Flows (Design)	25000 acfm	20.6 meters/second
Exit Flows (Actual)	16500 acfm	13.6 meters/second
PM Emissions		
Permit Limit (0.010 gr/cf @ 26290 acfm)	2.25 lb/hr	0.2835 grams/second
Actuals (0.00030 gr/cf @ 16500 acfm)	0.0424 lb/hr	0.0053 grams/second
Actual Increases/Short-Term	0.0212 lb/hr	0.0027 grams/second
Actual Increases/Annual (8760 hrs/yr)	186 lb/yr	0.0027 grams/second

[a] Since the actual stack height (276 feet) is greater than GEP stack height (275 feet), GEP stack height is used in the modeling analyses.

[b] Existing lime silo dust collector vent location (UTM Zone 17): 424.249 km East and 2945.699 km North. Since the actual stack height (102 feet) is less than formula GEP stack height (275 feet), building dimensions were input into ISCST to include building wake effects on this emission source.

[c] There is no lime silo fan – exhaust is due to the displacement caused by the pebble lime and the excess air used to pump the lime into the silo. Approximately 26 tons of pebble lime are delivered in 100 minutes through a pneumatic 4-inch delivery hose. Actual volumetric flow rates would be around 1000 acfm (115 x 26 tons x 2000 lbs/ton / [60 lb/ft^3 x 100 minutes]) assuming a 115:1 air to lime volumetric ratio. This should be conservative in that the pebble lime and air would need to pass through the 4-inch diameter delivery hose at about 130 mph.

[d] Proposed lime silo dust collector vent location (UTM Zone 17): 424.249 km East and 2945.717 km North. Since the actual stack height (85 feet) is less than formula GEP stack height (275 feet), building dimensions were input into ISCST to include building wake effects on this emission source.

[e] Actual flowrates are conservatively assumed to be equal to the dry standard design flowrate and the exhaust temperature is conservatively assumed to be ambient temperature.

[f] Ash handling building dust collector vent location (UTM Zone 17): 424.203 km East and 2945.758 km North. Since the actual stack height (58.6 feet) is less than formula GEP stack height (275 feet), building dimensions were input into ISCST to include building wake effects on this emission source.

dscf/min x 60 min/fill / 7000 gr/lb) and annual emissions of 7.39 lb/year (0.154 lbs/fill x 48 fills/year). Assuming the same outlet grain loading for the existing silo, current emissions are 0.214 lbs/fill (0.015 gr/acf x 1000 acf/min x 100 min/fill / 7000 gr/lb) and 15.836 lb/year (0.214 lb/fill x 74 fills/year). Because these emission rates are negligible, modeling analyses for the three minor PM sources were only included in the final PM modeling analyses. The lime silo information presented above is provided to allow an assessment of the impact from this type of operation based on prior operations. These values should not be included as a permit condition since emissions are insignificant and the County is only requesting an opacity limit.

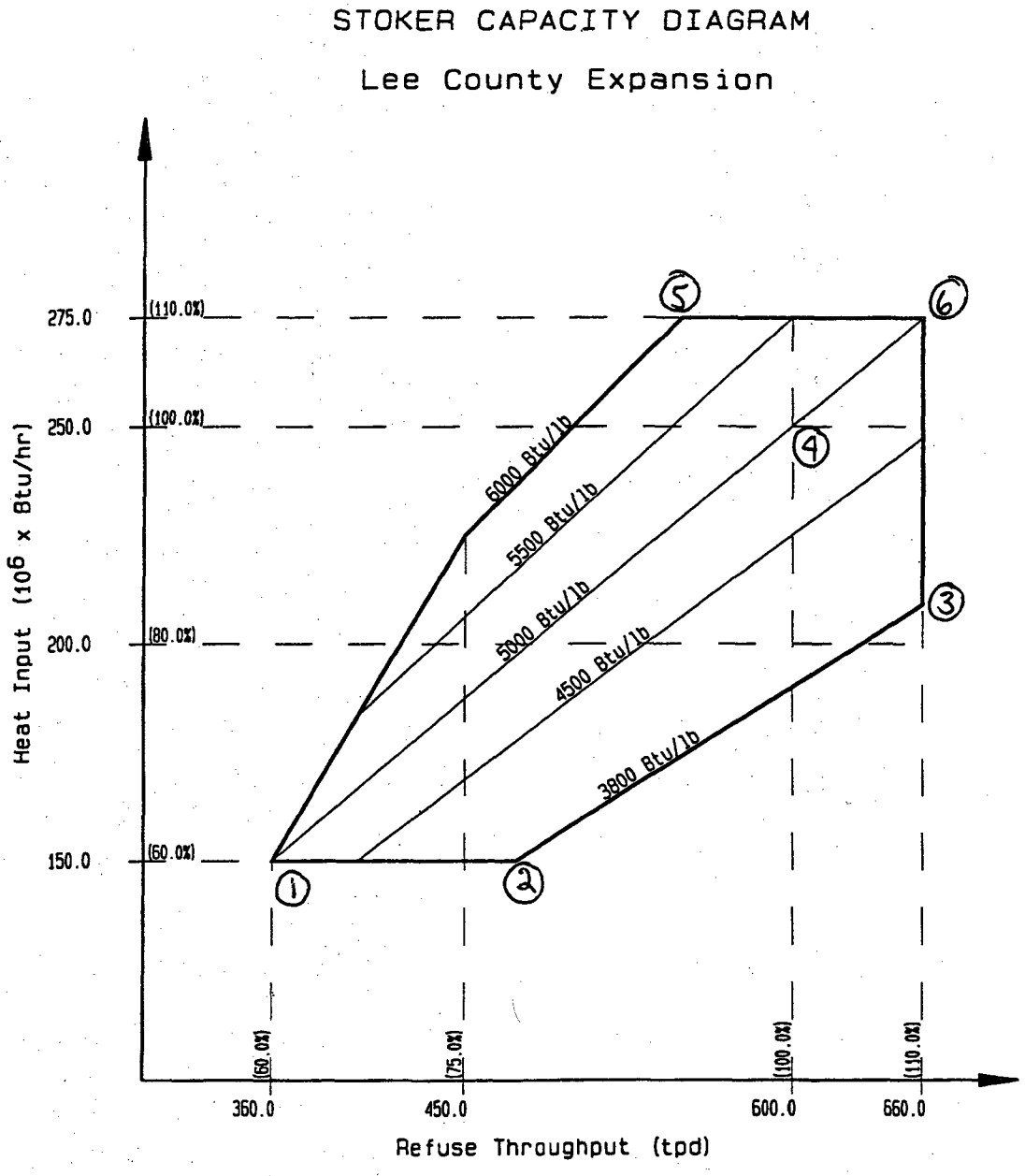
The only PSD significant increase in emissions is due to the proposed MWC unit itself. Emissions for Unit 3 will be vented from a third flue in the existing facility stack shell, which already contains two flues for the existing units. An equivalent stack diameter was therefore used to represent the total area of the flues in service when performing both screening and refined modeling analyses. The main facility stack characteristics are shown on Table 6-1.

Input data to the dispersion models include emissions and stack characteristics. Emission rates reflect the requirements of the best available control technology (BACT) analysis described elsewhere. Due to the heterogeneous nature of MSW, each MWC can operate under a range of conditions. The proposed third unit will be capable of operating under a variety of thermal loads (from 60% to 110% of a nominal 250 million British Thermal Units per hour (MMBTU/hr) gross heat input) and refuse throughputs (from 60% to 110% of a nominal 600 tons/day) based on a wide range of possible MSW heat contents (from about 3,800 to 6,000 BTU per pound of MSW). This operating window is shown on Figure 6-1. Stack characteristics such as flue gas volume, temperature, and emissions for six conditions which bound the operating window are shown on Table 6-2 for the proposed MWC unit.

"Formula" GEP stack height is defined for each nearby structure, or combination of nearby structures, as the structure height plus 1.5 times the lesser of the projected structure height or width. If multiple structures result in more than one GEP stack height for a particular source, then the maximum GEP stack height is controlling. Only "nearby" structures are considered in the GEP analysis. "Nearby" structures are considered to be structures located less than 5.0 times the lesser of the structure height or maximum projected width from the source location. The modeled stack height in air quality analyses for PSD purposes is limited to formula GEP stack height or 65 meters, whichever is greater, for stack heights greater than GEP stack height. Air quality modeling for stacks less than formula GEP stack height must consider building-induced turbulence effects.

The tallest structure at the LCERF is the boiler enclosure building, 110 feet above grade as shown in the cross-sectional view on Figure 6-2. Since this structure is very much wider than tall and within five building heights of all the modeled sources as shown in the plan view on Figure 6-3, GEP stack height for all modeled sources is 275 feet (2.5 times

FIGURE 6-1
MUNICIPAL WASTE COMBUSTOR UNIT 3 OPERATING WINDOW



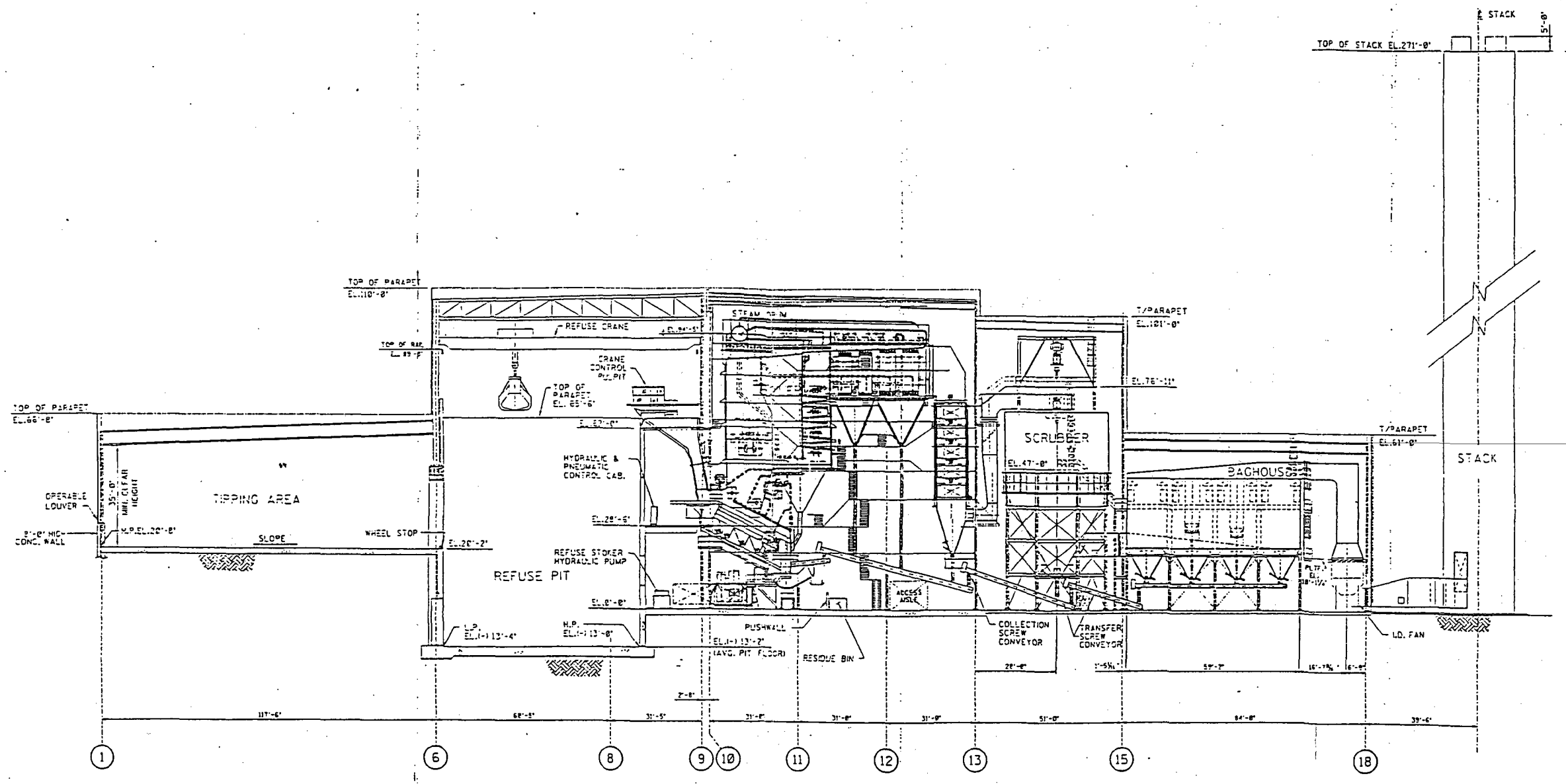
Date: 10/3/01

TABLE 6-2
STACK GAS CONDITIONS FOR PROPOSED MWC UNIT 3

Case Number	1	2	3	4	5	6
BTU/lb HHV	5000	3800	3800	5000	6000	5000
Tons MSW/day	360	474	660	600	550	660
MMBTU/hour	150	150	209	250	275	275
Exit Temperature (°F)	270	270	270	270	270	270
Volumetric Flow (acfm)	82,423	80,174	109,918	137,611	155,805	151,111
Exit Velocity (m/s)	14.019	13.637	18.696	23.406	26.501	25.702
DSCFM at Actual $\%O_2$	49,490	46,026	63,058	82,645	96,091	90,732
Actual %O2 (Dry Basis)	10.90%	10.38%	10.39%	10.90%	11.38%	10.90%
DSCFM at 7% O2	35,598	34,845	47,711	59,461	65,868	65,264

POLLUTANT EMISSIONS FOR PROPOSED MWC UNIT (LB/HR)

CO (100 ppmdv)	15.527	15.199	20.811	25.936	28.730	28.467
NO_x (150 ppmdv)	38.258	37.449	51.276	63.904	70.790	70.141
SO_2 (29 ppmdv) 80% Control (100 ppmdv)	10.300 35.517	10.082 34.765	13.805 47.602	17.204 59.325	19.058 65.718	18.883 65.115
HCl (25 ppmdv) 95% Control (125 ppmdv)	5.054 25.271	4.947 24.737	6.774 33.870	8.442 42.211	9.352 46.760	9.266 46.331
PM (0.009 gr/dscf)	2.746	2.688	3.681	4.587	5.081	5.035
Cd (20 ug/dscm)	2.67e-03	2.61e-03	3.57e-03	4.46e-03	4.94e-03	4.89e-03
Pb (200 ug/dscm)	2.67e-02	2.61e-02	3.57e-02	4.46e-02	4.94e-02	4.89e-02
Hg (70 ug/dscm) 85% Control (172.5 ug/dscm)	9.33e-03 2.30e-02	9.14e-03 2.25e-02	1.25e-02 3.08e-02	1.56e-02 3.84e-02	1.73e-02 4.26e-02	1.71e-02 4.22e-02
Total PCDD/F (13 ng/dscm)	1.73e-06	1.70e-06	2.32e-06	2.90e-06	3.21e-06	3.18e-06
HF (3.5 ppmdv)	0.388	0.380	0.520	0.648	0.718	0.712
VOC (30 ppmdv)	2.667	2.611	3.575	4.456	4.936	4.890
Beryllium (0.16 ug/dscm)	2.13e-05	2.09e-05	2.86e-05	3.56e-05	3.95e-05	3.91e-05
Sulfuric Acid (16.68 ppmdv)	9.070	8.878	12.156	15.150	16.782	16.628
Arsenic (10.74 ug/dscm)	1.43e-03	1.40e-03	1.92e-03	2.39e-03	2.65e-03	2.63e-03
Ammonia (50 ppmdv)	4.712	4.612	6.315	7.871	8.719	8.639



SECTION A-A

FIGURE 6-2

United Engineers & Constructors
A Raytheon Company

GENERAL ARRANGEMENT
SECTION A-A
LEE COUNTY SOLID WASTE RESOURCE RECOVERY FA

OGDEN MARTIN SYSTEMS OF LEE, I

DRAWN D.L.B.	DATE 12/04/92	REVISED	DATE
CHECKED	DATE	PROJECT NO. C-1033	
APPROVED WDD	DATE 3/14/95	DRAWING NO. 7102-E-210901	REV.

SUBCONTRACT OR	FOR BIDDING	FOR AWARD	FOR CONSTRUCTION

COMPANY CONFIDENTIAL
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REVISIONS

A-09/04/92-PRELI
30% ISSUE FOR C
REVIEW & COMME

B-12/04/92-REVIS
BOILER AREA, SCR
BAGHOUSE, I.D. FA
SCREW CONVEYOR

C-02/08/93-REVI
APC AREA & SCR
CONVEYORS, REFU
CRANE ELEVATION
90% ISSUE FOR C
REVIEW & COMME

D-03/23/93-ISSU
CONSTRUCTION

E-08/20/93-REVI
DWG., ACCESS L
TO BAGHOUSE.

F-02/14/95-RECI

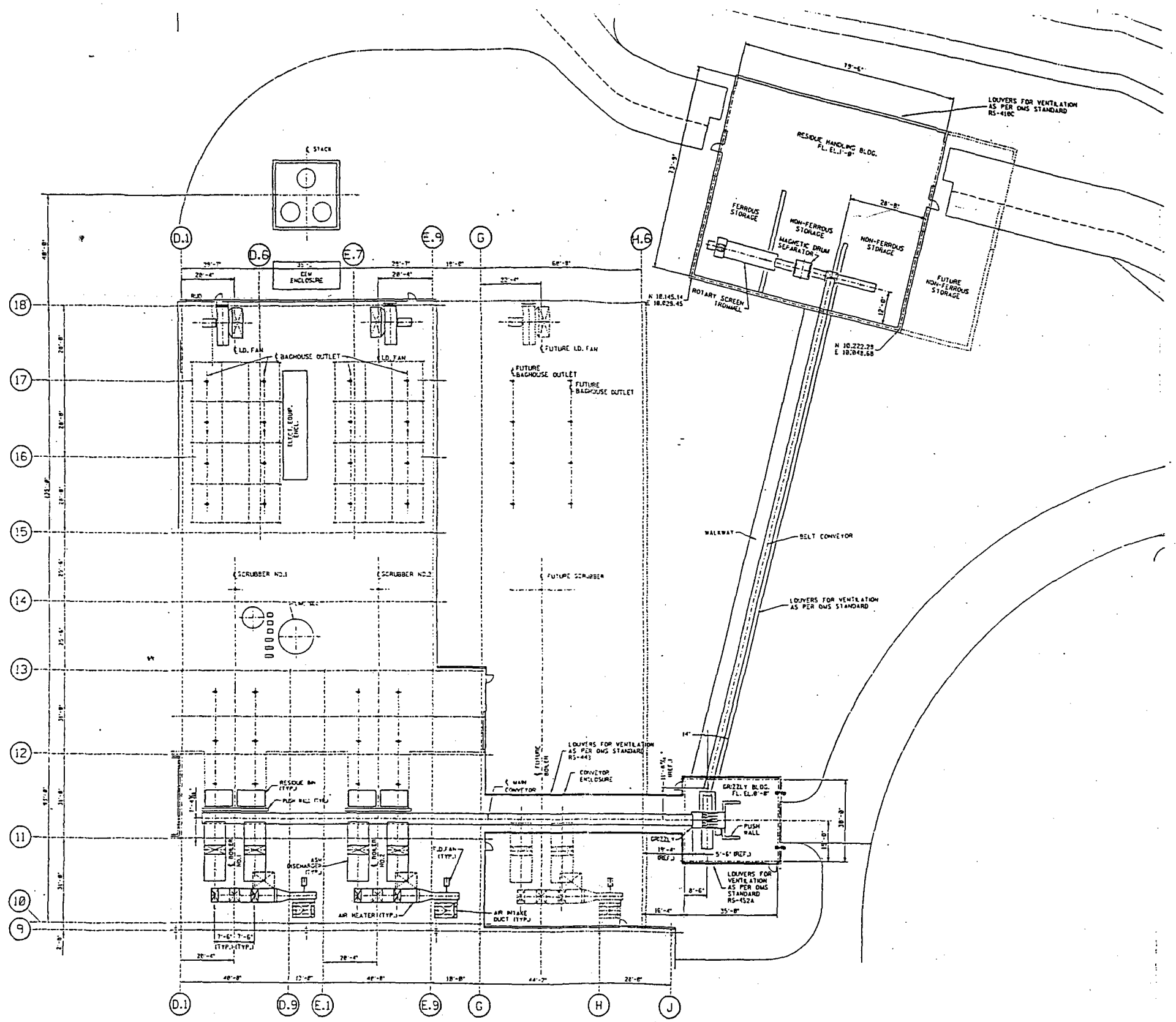

FIGURE 6-3

REV	DISCIPLINE	ISSUED BY	ISSUE/USE	ISSUED BY
	STRUCTURAL		PIPE & CONTROL	
∅	MECH. PIPING		MECH. EQUIPMENT	
	ELECTRICAL		CONSTRUCTION	
	PROCESS		MISC.	

SUBCONTRACT OR PURCHASE ORDER	FOR BIDDING	FOR AWARD	FOR CONSTRUCTION

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United Engineers & Constructors
A Raytheon Company

ASH & RESIDUE HANDLIN(
PLOT PLAN
LEE COUNTY SOLID WASTE RESOURCE RECOVERY

OGDEN MARTIN SYSTEMS OF LEE

DRAWN	DATE	CHECKED	DATE
D.J.B.	04/14/93		
CHECKED	DATE	PROJECT NO.	C-1033
APPROVED	DATE	DRAWING NO.	7102-E-260500
[illegible]	4/14/93		

6-16-92-10
FOR DUST CON
PROCUREMENT.
C-10/28/92-R
CLIENT COMME
6-04/14/93-IS
BEAUMONT BID
LAYOUT OF CO
SYSTEM.

110 feet). Since the main facility stack height of 276 feet is greater than GEP stack height of 275 feet, 275 feet was used as the stack height in all the air quality modeling analyses. Building-induced turbulence need not be considered in the modeling analysis for the main facility stack. However, GEP stack height for the two minor PM sources of 275 feet is greater than their actual stack heights so building wake effects must be considered for these sources. Therefore, Building Profile Input Program (BPIP) was used to determine appropriate building dimensions for input to the final PM_{10} ISCST modeling analyses.

6.5 SCREENING MODELING ANALYSIS

Due to the variability in operating conditions, a screening analysis was performed to determine the "worst-case" source configuration. For the proposed MWC, ISCST3 modeling was performed for each source configuration shown on Table 6-2. These source conditions consider various MSW heat contents (from 3,800 to 6,000 BTU/lb) and facility throughputs (from 360 to 660 tons/day). Since emission limits are specified in ppmdv, gr/dscf, or ug/dscm for dry standard conditions at 7% oxygen, emissions for the proposed MWC unit are proportional to the dry standard flow rates corrected to 7% oxygen. Therefore, for the screening analyses, "unitized" emissions were ratioed from the dry standard flow rates to give MWC unit emissions of 1 gram/second (g/s) at nominal conditions (600 tons/day and 5000 BTU/lb).

In order to tabulate the modeling results for each pollutant shown on the bottom of Table 6-3, the "unitized" screening results shown on the top of Table 6-3 for the appropriate averaging time are multiplied by the emission rates for each pollutant shown on Table 6-2 for nominal (Case 4) conditions and 0.126 g/s per lb/hr (the "unitized" emission rates modeled already include the difference between nominal emissions and emissions for each Case) as follows:

$$\text{Conc(pollutant)}_{\text{Case_X}} = \text{Conc(unitized)}_{\text{Case_X}} \times Q\ \text{lb/hr}_{\text{Case_4}} \times 0.126\ \text{g/s per lb/hr}$$

Maximum ISCST3 screening results are shown on Table 6-3 using all five years (1990-1994) of Fort Myers meteorological data. For the proposed unit, maximum impacts occur for Cases 5 and 6 -- the unit operating at its maximum rated gross heat input capacity of 275 MMBTU/hour with differing BTU/lb wastes. Case 6 represents 660 tons/day at 5,000 BTU/lb while Case 5 represents 550 tons/day at 6,000 BTU/lb. These two cases were also the same cases previously predicted as worst-case in the original PSD permit application (in the original application, these two cases were essentially identical since emissions and dry standard flow rates were based on gross heat input). Generally, Case 5 produces higher impacts for 1-hour and 3-hour maximum impacts and high second-high 24-hour impacts while Case 6 produces higher impacts for maximum and high second-high impacts for other averaging times. Since Case 5 and 6 impacts are similar, the remaining modeling for the PSD permit application considered both cases.

TABLE 6-3
ISCST3 SCREENING RESULTS FOR PROPOSED MWC UNIT ONLY

Case Number	1	2	3	4	5	6
"UNITIZED" EMISSION RATES FOR MODELING PROPOSED UNIT (g/s)[a]						
1 Unit (New)	0.599	0.586	0.802	1.000	1.108	1.098
SCREENING RESULTS FOR "UNITIZED" EMISSION RATES FOR PROPOSED MWC UNIT (ug/m^3)						
1-Hour Maximum	2.05193	2.00739	2.65909	3.24606	3.56857	3.54312
1-Hour High Second-High	1.68613	1.67602	1.84911	1.96352	2.00918	2.06690
3-Hour Maximum	1.16398	1.15890	1.26647	1.29323	1.40802	1.39931
3-Hour High Second-High	0.99772	0.99048	1.11431	1.17944	1.21170	1.21212
8-Hour Maximum	0.70835	0.70475	0.78457	0.85150	0.87588	0.88387
8-Hour High Second-High	0.63273	0.63044	0.68940	0.72073	0.73925	0.74682
24-Hour Maximum	0.31877	0.31684	0.36245	0.38743	0.39863	0.40190
24-Hour High Second-High	0.26549	0.26239	0.24129	0.27316	0.28999	0.28916
Annual Maximum	0.02193	0.02183	0.02428	0.02580	0.02653	0.02677
ISCST3 SCREENING RESULTS BY POLLUTANT (ug/m^3)						
CO 1-Hour Maximum	6.706	6.560	8.690	10.608	11.662	11.579
CO 8-Hour Maximum	2.315	2.303	2.564	2.783	2.862	2.888
NO_x Annual Maximum	0.177	0.176	0.196	0.208	0.214	0.216
SO_2 3-Hour Maximum	8.701	8.663	9.467	9.667	10.525	10.460
SO_2 24-Hour Maximum	2.383	2.368	2.709	2.896	2.980	3.004
SO_2 Annual Maximum	0.164	0.163	0.181	0.193	0.198	0.200
HCl 1-Hour Maximum	10.913	10.676	14.143	17.264	18.980	18.844
HCl Annual Maximum	0.117	0.116	0.129	0.137	0.141	0.142
PM_{10} 24-Hour Maximum	0.184	0.183	0.209	0.224	0.230	0.232
PM_{10} Annual Maximum	0.013	0.013	0.014	0.015	0.015	0.015
Cd 1-Hour Maximum	1.15e-03	1.13e-03	1.49e-03	1.82e-03	2.01e-03	1.99e-03
Cd Annual Maximum	1.23e-05	1.23e-05	1.36e-05	1.45e-05	1.49e-05	1.50e-05
Pb 1-Hour Maximum	1.15e-02	1.13e-02	1.49e-02	1.82e-02	2.01e-02	1.99e-02
Pb Annual Maximum	1.23e-04	1.23e-04	1.36e-04	1.45e-04	1.49e-04	1.50e-04
Hg 1-Hour Maximum	9.93e-03	9.71e-03	1.29e-02	1.57e-02	1.73e-02	1.71e-02
Hg Annual Maximum	1.06e-04	1.06e-04	1.17e-04	1.25e-04	1.28e-04	1.30e-04
Total PCDD/F 1-Hour Max	7.50e-07	7.34e-07	9.72e-07	1.19e-06	1.30e-06	1.29e-06
Total PCDD/F Annual Max	8.01e-09	7.98e-09	8.87e-09	9.43e-09	9.69e-09	9.78e-09
HF 1-Hour Maximum	1.68e-01	1.64e-01	2.17e-01	2.65e-01	2.91e-01	2.89e-01
HF Annual Maximum	1.79e-03	1.78e-03	1.98e-03	2.11e-03	2.17e-03	2.19e-03
Be 1-Hour Maximum	9.20e-06	9.00e-06	1.19e-05	1.46e-05	1.60e-05	1.59e-05
Be Annual Maximum	9.84e-08	9.79e-08	1.09e-07	1.16e-07	1.19e-07	1.20e-07
H_2SO_4 1-Hour Maximum	3.917	3.832	5.076	6.196	6.812	6.763
H_2SO_4 Annual Maximum	0.042	0.042	0.046	0.049	0.051	0.051
As 1-Hour Maximum	6.18e-04	6.05e-04	8.01e-04	9.78e-04	1.07e-03	1.07e-03
As Annual Maximum	6.60e-06	6.57e-06	7.31e-06	7.77e-06	7.99e-06	8.06e-06
Ammonia 1-Hour Maximum	2.035	1.991	2.637	3.219	3.539	3.514
Ammonia Annual Maximum	0.022	0.022	0.024	0.026	0.026	0.027

[a] "Unitized" emissions for screening purposes are calculated by ratioing the dscfm flowrate at 7% O_2 for each case to normal conditions (Case 4), or $g/s_{Case\ X} = DSCFM_{Case\ X} / 59461$ dscfm at 7% O_2.

6.6 REFINED MODELING ANALYSIS

Since the new MWC unit will be operating in addition to the existing units, additional modeling was performed to determine the maximum increase in facility impacts as well as maximum impacts due to the combined facility (proposed unit + existing units). The stack characteristics and permitted emissions for the existing facility are shown on Table 6-4. Stack characteristics from the original PSD application and permitted emission rates are shown as Cases A and B for one and two units, respectively. These two cases were modeled by themselves (as Cases A and B) as well as in combination with Cases 5 and 6 for the proposed unit -- giving rise to Cases C and D for Case 5 conditions and Cases E and F for Case 6 conditions. For the combined (existing + proposed) conditions, stack exit temperatures and oxygen contents were weighted for dry standard flowrates at actual % O_2 conditions shown on Tables 6-2 and 6-4. Dry standard flowrates at actual % O_2 conditions were added and new acfm and dry standard flowrates at 7% O_2 calculated accordingly. The modeled stack diameter was set equal to the equivalent diameter for the number of flues in service as shown on Table 6-1.

Modeling results for the existing (Cases A and B) and combined (Cases C through F) facility configurations are shown on Table 6-5. In order to tabulate the modeling results for each pollutant shown on the bottom of Table 6-5, the "unitized" screening results shown on the top of Table 6-5 for the appropriate averaging time are multiplied by the emission rates shown on Table 6-4 for the appropriate case and 0.126 g/s per lb/hr (since the "unitized" emission rate modeled on this table is 1 g/s for all cases [unlike the previous Table 6-3], emissions from the appropriate case on Table 6-4 must be used) as follows:

$$Conc(pollutant)_{Case_X} = Conc(unitized)_{Case_X} \times Q\ lb/hr_{Case_X} \times 0.126\ g/s\ per\ lb/hr$$

As can be seen on Table 6-5, maximum facility impacts occur with two (Case E) or three (Case F) operating units under Case 6 conditions for the new MWC unit (660 tons/day/unit at 5000 BTU/lb). Maximum 1-hour impacts are greater for two operating units than three due to a single hour of unusual meteorological conditions of limited vertical mixing and plume rise for two vs. three units. Maximum and high second-high impacts for other averaging times (including 1-hour high second-high) occurred for the expected worst-case of three operating units (Case F). In general, all of the impacts from one to three operating units were similar. As can be seen on the bottom of Table 6-6, maximum criteria pollutant impacts for three units are generally only twice the maximum impacts for one proposed or existing unit because there is enhanced plume rise caused by venting the emissions from closely spaced flues in a common stack shell.

In addition to estimating facility impacts due to emissions from both existing and proposed MWC units, modeling analyses were also performed to determine the maximum increase in facility impacts due to the proposed MWC unit. Operation of Unit 3 by itself would be expected to cause the largest increase in facility impacts. This is because plume rise for one or two existing units would be enhanced by the addition of Unit 3. However, netting analyses were included to determine the increase in facility

TABLE 6-4
STACK GAS CONDITIONS FOR LEE COUNTY FACILITY

Facility Configuration	Existing Facility Only		Proposed Case 5 + Existing Facility		Proposed Case 6 + Existing Facility	
Number of Operating Units (Case)	1 (Case A)	2 (Case B)	2 (Case C)	3 (Case D)	2 (Case E)	3 (Case F)
BTU/lb HHV	6000/5000 (Case 5/6)		6000 (Case 5)		5000 (Case 6)	
Tons MSW/Day/Unit	550/660 (Case 5/6)		550 (Case 5)		660 (Case 6)	
MMBTU/Hour/Unit	275 (Case 5/6)		275 (Case 5)		275 (Case 6)	
Exit Temperature (deg. F)	240		256	251	256	251
Volumetric Flow (acfm)	127,000	254,000	238,130	343,406	230,721	335,997
Exit Velocity (m/s)	21.601	21.601	20.251	19.470	19.621	19.050
DSCFM at Actual $\%O_2$	79,409	158,817	175,500	254,908	170,141	249,549
Actual $\%O_2$ (Dry Basis)	10.01%		10.76%	10.52%	10.49%	10.33%
DSCFM at 7% O_2	62,213	124,426	128,055	190,268	127,473	189,686
Pollutant (Existing Unit Basis)	POLLUTANT EMISSIONS (LB/HR)					
CO (100 ppmdv)	27.2	54.4	55.930	83.130	55.667	82.867
NO_x (180 ppmdv)	80	160	150.790	230.790	150.141	230.141
SO_2 (29 ppmdv)	18	36	37.058	55.058	36.883	54.883
80% Control (66 ppmdv)	41	82	106.718	147.718	106.115	147.115
HCl (25 ppmdv)	8.85	17.70	18.202	27.052	18.116	26.966
95% Control (50 ppmdv)	17.70	35.40	64.460	82.160	64.031	81.731
PM (0.010 gr/dscf)	5.34	10.68	10.421	15.761	10.375	15 715
Cd (40 ug/dscm)	9.3e-03	1.86e-02	1.42e-02	2.35e-02	1.42e-02	2.35e-02
Pb (440 ug/dscm)	0.103	0.206	1.52e-01	2.55e-01	1.52e-01	2.55e-01
Hg (70 ug/dscm)	1.63e-02	3.26e-02	3.36e-02	4.99e-02	3.34e-02	4.97e-02
85% Control (162.4 ug/dscm)	3.79e-02	7.58e-02	8.05e-02	1.18e-01	8.01e-02	1.18e-01
Total PCDD/F (30 ng/dscm)	7.0e-06	1.4e-05	1.02e-05	1.72e-05	1.02e-05	1.72e-05
HF (5.0 ppmdv)	0.96	1.92	1.678	2.638	1.672	2.632
VOC (37 ppmdv)	5.80	11.60	10.736	16.536	10.690	16.490
Beryllium (0.16 ug/dscm)	3.70e-05	7.40e-05	7.65e-05	1.14e-04	7.61e-05	1.13e-04
Sulfuric Acid (10.35 ppmdv)	9.85	19.70	26.632	36.482	26.478	36.328
Arsenic (10.74 ug/dscm)	2.50e-03	5.00e-03	5.15e-03	7.65e-03	5.13e-03	7.63e-03
Ammonia (50 ppmdv)	8.235	16.47	16.954	25.189	16.874	25.109

TABLE 6-5
ISCST3 REFINED RESULTS FOR LEE COUNTY FACILITY

Facility Configuration	Existing Facility Only		Proposed Case 5 + Existing Facility		Proposed Case 6 + Existing Facility	
Number of Operating Units (Case)	1 (Case A)	2 (Case B)	2 (Case C)	3 (Case D)	2 (Case E)	3 (Case F)
"Unitized" Emissions (g/s)	1.000	1.000	1.000	1.000	1.000	1.000
ISCST3 REFINED RESULTS FOR "UNITIZED" FACILITY EMISSION RATE (ug/m^3)						
1-Hour Maximum	3.31027	2.96878	2.35895	1.48248	2.97061	1.48618
1-Hour High Second-High	2.29284	1.58058	1.48567	1.17293	1.58028	1.19054
3-Hour Maximum	1.57179	0.99821	0.99523	0.82491	1.00247	0.82994
3-Hour High Second-High	1.38477	0.87191	0.86257	0.69521	0.88086	0.70336
8-Hour Maximum	0.97361	0.64143	0.63554	0.53232	0.64899	0.53702
8-Hour High Second-High	0.84916	0.52055	0.51756	0.39811	0.52647	0.40546
24-Hour Maximum	0.44950	0.29177	0.28942	0.23134	0.29480	0.23494
24-Hour High Second-High	0.29721	0.23136	0.23003	0.14612	0.23274	0.14854
Annual Maximum	0.02993	0.01895	0.01883	0.01482	0.01924	0.01505
ISCST3 REFINED RESULTS BY POLLUTANT (ug/m^3)						
CO 1-Hour Maximum	11.345	20.349	16.624	15.528	20.836	15.518
CO 8-Hour Maximum	3.337	4.397	4.479	5.576	4.552	5.607
NO_x Annual Maximum	0.302	0.382	0.358	0.431	0.364	0.436
SO_2 3-Hour Maximum	8.120	10.314	13.382	15.354	13.404	15.384
SO_2 24-Hour Maximum	2.322	3.015	3.892	4.306	3.942	4.355
SO_2 Annual Maximum	0.155	0.196	0.253	0.276	0.257	0.279
HCl 1-Hour Maximum	7.383	13.242	19.159	15.347	23.967	15.305
HCl Annual Maximum	0.0667	0.0845	0.1529	0.1534	0.1552	0.1550
PM_{10} 24-Hour Maximum	0.302	0.393	0.380	0.459	0.385	0.465
PM_{10} Annual Maximum	0.020	0.026	0.025	0.029	0.025	0.030
Cd 1-Hour Maximum	3.88e-03	6.96e-03	4.23e-03	4.40e-03	5.31e-03	4.40e-03
Cd Annual Maximum	3.51e-05	4.44e-05	3.38e-05	4.40e-05	3.44e-05	4.45e-05
Pb 1-Hour Maximum	4.30e-02	7.71e-02	4.53e-02	4.77e-02	5.69e-02	4.77e-02
Pb Annual Maximum	3.88e-04	4.92e-04	3.62e-04	4.77e-04	3.68e-04	4.83e-04
Hg 1-Hour Maximum	1.58e-02	2.84e-02	2.39e-02	2.21e-02	3.00e-02	2.21e-02
Hg Annual Maximum	1.43e-04	1.81e-04	1.91e-04	2.21e-04	1.94e-04	2.24e-04
Total PCDD/F 1-Hour Max	2.92e-06	5.24e-06	3.03e-06	3.21e-06	3.81e-06	3.22e-06
Total PCDD/F Annual Max	2.64e-08	3.34e-08	2.42e-08	3.21e-08	2.47e-08	3.26e-08
HF 1-Hour Maximum	4.00e-01	7.18e-01	4.99e-01	4.93e-01	6.26e-01	4.93e-01
HF Annual Maximum	3.62e-03	4.58e-03	3.98e-03	4.93e-03	4.05e-03	4.99e-03
Be 1-Hour Maximum	1.54e-05	2.77e-05	2.27e-05	2.12e-05	2.85e-05	2.12e-05
Be Annual Maximum	1.40e-07	1.77e-07	1.82e-07	2.12e-07	1.84e-07	2.14e-07
H_2SO_4 1-Hour Maximum	4.108	7.369	7.916	6.815	9.911	6.803
H_2SO_4 Annual Maximum	0.037	0.047	0.063	0.068	0.064	0.069
As 1-Hour Maximum	1.04e-03	1.87e-03	1.53e-03	1.43e-03	1.92e-03	1.43e-03
As Annual Maximum	9.43e-06	1.19e-05	1.22e-05	1.43e-05	1.24e-05	1.45e-05
Ammonia 1-Hour Max	3.435	6.161	5.039	4.705	6.316	4.702
Ammonia Annual Max	0.031	0.039	0.040	0.047	0.041	0.048

TABLE 6-6
MAXIMUM CRITERIA POLLUTANT IMPACTS FOR THE LEE COUNTY FACILITY EXPANSION

MAXIMUM INCREASES (ug/m^3) DUE TO PROPOSED UNIT

Facility Configuration	Proposed Unit 3 Only		Proposed Case 5 + Existing Facility		Proposed Case 6 + Existing Facility	
Number of Operating Units (Case)	1 (Case 5)	1 (Case 6)	2 vs 1 (Case C)	3 vs 2 (Case D)	2 vs 1 (Case E)	3 vs 2 (Case F)
CO 1-hr Maximum	11.662	11.579	8.312	4.981	10.326	4.971
CO 1-hr High Second-High	6.566	6.754	5.038	3.867	5.494	3.841
CO 8-hr Maximum	2.862	2.888	1.649	1.410	1.721	1.434
CO 8-hr High Second-High	2.416	2.441	1.464	0.908	1.484	0.911
NO_x Annual Maximum	0.214	0.216	0.074	0.060	0.078	0.064
SO_2 3-hr Maximum	10.525	10.460	7.436	6.300	7.958	6.282
SO_2 3-hr High Second-High	9.057	9.061	5.696	4.525	6.062	4.573
SO_2 24-hr Maximum	2.980	3.004	1.797	1.405	1.838	1.438
SO_2 24-hr High Second-High	2.168	2.161	1.637	0.910	1.648	0.929
SO_2 Annual Maximum	0.198	0.200	0.105	0.084	0.109	0.087
PM_{10} 24-hr Maximum	0.230	0.232[a]	0.115	0.088	0.118	0.091
PM_{10} 24-hr High Second-High	0.168	0.167[a]	0.111	0.062	0.113	0.062
PM_{10} Annual Maximum	0.0153	0.0155[a]	0.006	0.005	0.006	0.005

MAXIMUM IMPACTS (ug/m^3) FOR COMBINED FACILITY

Number of Operating Units	One Unit		Two Units		Three Units
Facility Configuration	Proposed Unit Only	One Existing Unit	Both Existing Units	Existing (1) + Proposed (1)	Existing (2) + Proposed (1)
CO 1-hr Maximum	11.662	11.345	20.349	20.836	15.528
CO 1-hr High Second-High	6.754	7.858	10.834	11.084	12.431
CO 8-hr Maximum	2.888	3.337	4.397	4.552	5.607
CO 8-hr High Second-High	2.441	2.910	3.568	3.693	4.234
NO_x Annual Maximum	0.216	0.302	0.382	0.364	0.436
SO_2 3-hr Maximum	10.525	8.120	10.314	13.404	15.384
SO_2 3-hr High Second-High	9.061	7.154	9.009	11.778	13.038
SO_2 24-hr Maximum	3.004	2.322	3.015	3.942	4.355
SO_2 24-hr High Second-High	2.168	1.535	2.390	3.112	2.753
SO_2 Annual Maximum	0.200	0.155	0.196	0.257	0.279
PM_{10} 24-hr Maximum	0.232	0.302	0.393	0.385	0.465[b]
PM_{10} 24-hr High Second-High	0.168	0.200	0.311	0.304	0.294[b]
PM_{10} Annual Maximum	0.015	0.020	0.026	0.025	0.030[b]

[a] Impacts with minor particulate sources are 0.398, 0.276 and 0.054 ug/m^3 for 24-hour maximum, 24-hour high second-high, and annual maximum, respectively.

[b] Impacts with minor particulate sources are 1.177, 0.814 and 0.161 ug/m^3 for 24-hour maximum, 24-hour high second-high, and annual maximum, respectively.

impacts due to the new MWC unit when the existing units are operating as shown on the top of Table 6-6. This is done by modeling future conditions of two or three units with positive emissions and existing conditions with one or two units with negative emissions. ISCST3 then outputs the maximum increase in ambient impacts due to the additional new MWC unit. Accordingly, to determine the maximum increase for "2 vs 1" units, Cases C and E (two units) were modeled with positive emissions and Case A (one unit) was modeled concurrently with negative emissions. For determining maximum increases for "3 vs. 2" units, Cases D and F (three units) were modeled with positive emissions and Case B (two existing units) was modeled with negative emissions. For example, the top of Table 6-6 shows that the maximum annual increase in annual NOx impacts due to the additional MWC unit is 0.060 ug/m^3 for Case D. This maximum increase in modeled concentration was calculated by ISCST by modeling the impact for the future facility consisting of three MWC units (two existing and proposed Case 5) with an emission rate of 230.790 lbs/hr (Case D on Table 6-4). Concurrently, ISCST modeled the existing facility for two operating units with a negative emission rate of 160 lbs/hr (Case B on Table 6-4). The difference in emissions of 70.79 lbs/hr (230.790 lbs/hr-160 lbs/hr) that is modeled is therefore the proposed MWC unit Case 5 (see Table 6-2). When ISCST adds the resulting concentrations of 0.405 and -0.345 ug/m^3 for Case D and Case B, respectively (i.e., "3 vs. 2"), it obtains the resultant increase of 0.060 ug/m^3 at that receptor for that time period. Since the ratio of the mass emission rates (lb/hr) between the existing and proposed units vary for each pollutant, separate modeling analyses are required for each pollutant. Therefore, the netting analysis was restricted to the main criteria pollutants (CO, NO_X, SO_2, and PM_{10}).

Results of the netting analysis are shown on the top of Table 6-6. As expected, maximum impacts due to the new MWC unit operating alone are always greater than when either or both of the existing MWC units are operating. Maximum increases in facility impacts (i.e., the new MWC unit operating alone) are shown in Figures 6-4 and 6-5 for 1-hour and 8-hour CO concentrations, Figure 6-6 for annual NO_x concentrations, and Figures 6-7, 6-8, and 6-9 for 3-hour, 24-hour, and annual SO_2 concentrations. Concentrations shown in these figures are the maximum impacts for any of the five years of meteorological data and for either Case 5 or Case 6.

Since the existing MWC units now operate at more than 90% availability, operation of the new MWC unit by itself would be expected to be a relatively rare occurrence. As a practical matter, one of the LCERF's primary purposes is to reduce the volume of materials to be landfilled, so the most likely choice is between the new unit operating by itself versus one of the old units operating. Unit 3 will have emissions similar to or less than the existing MWC units. This case of one operating unit (i.e., the new MWC alone) would actually result in little change in modeled facility impacts.

Since compliance with PSD increments and ambient air quality standards is based on modeling high second-high short-term impacts, these impacts are included on Table 6-6. The bottom of Table 6-6 also includes a summary of the combined facility impacts for one, two, or three operating units from Tables 6-3 and 6-5 for the criteria pollutants. As can be seen, maximum impacts for the proposed unit are similar to maximum impacts for

FIGURE 6-4
MAXIMUM INCREASES IN FACILITY 1-HOUR CO IMPACTS (ug/m^3)

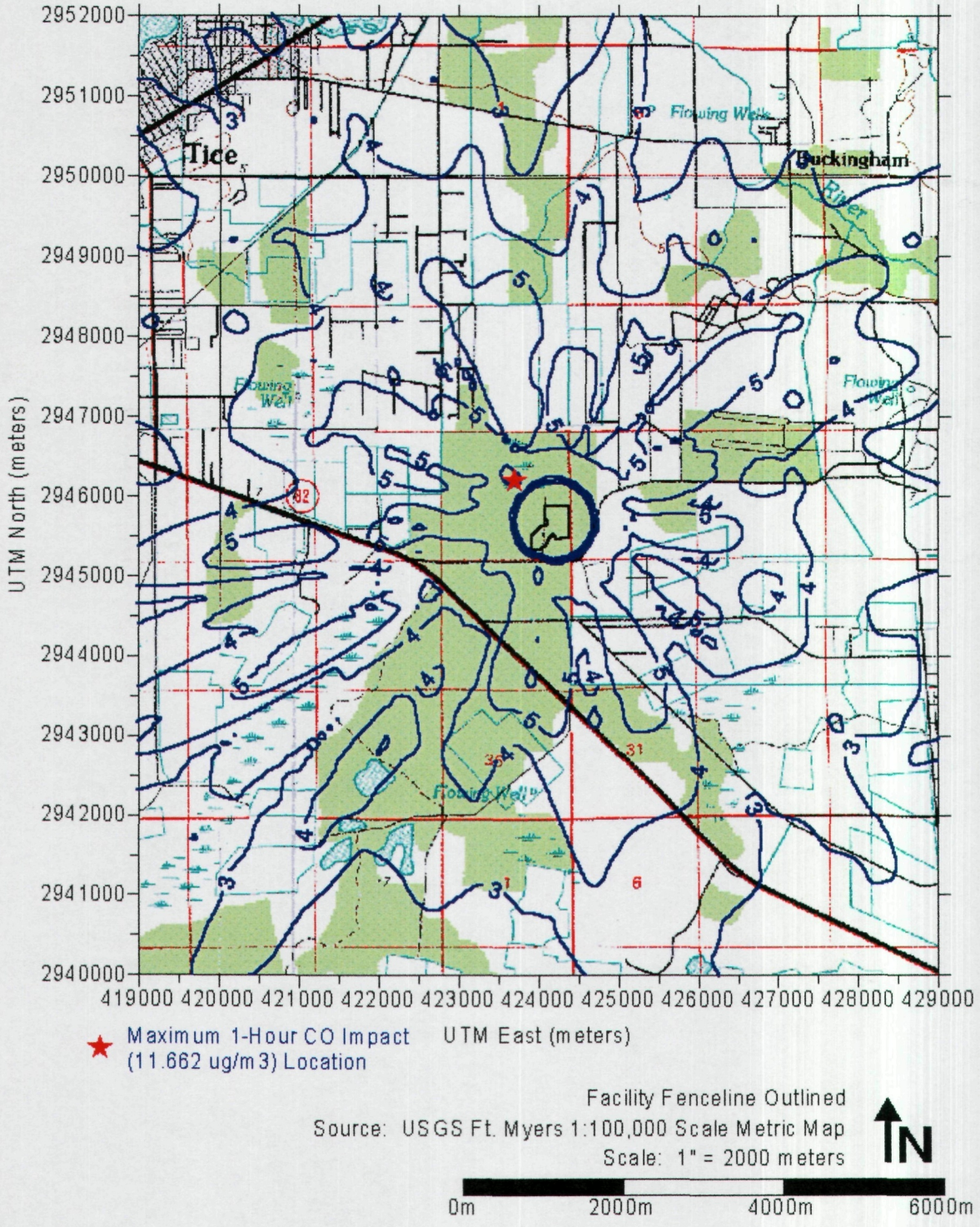


FIGURE 6-5
MAXIMUM INCREASES IN FACILITY 8-HOUR CO IMPACTS (ug/m^3)

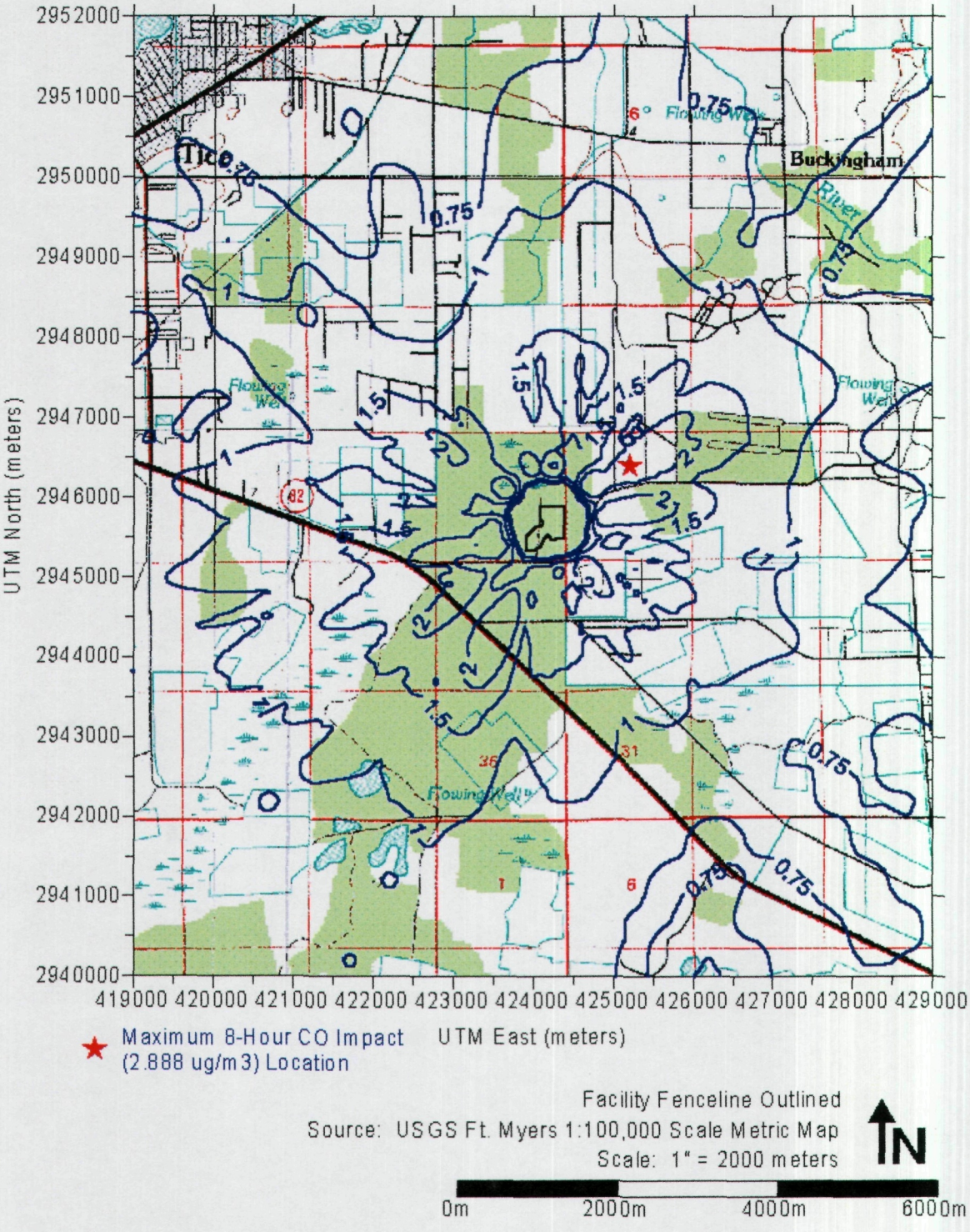
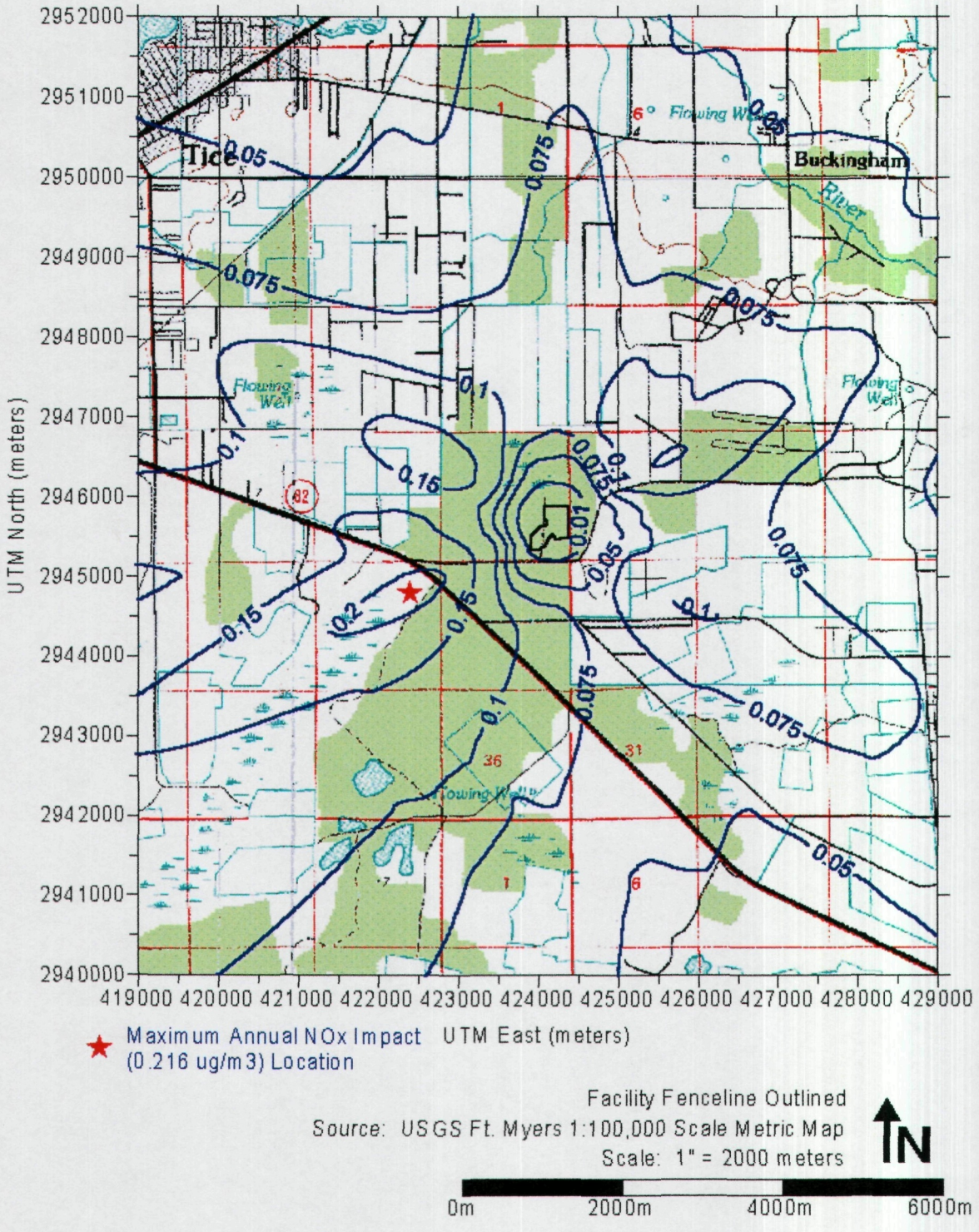
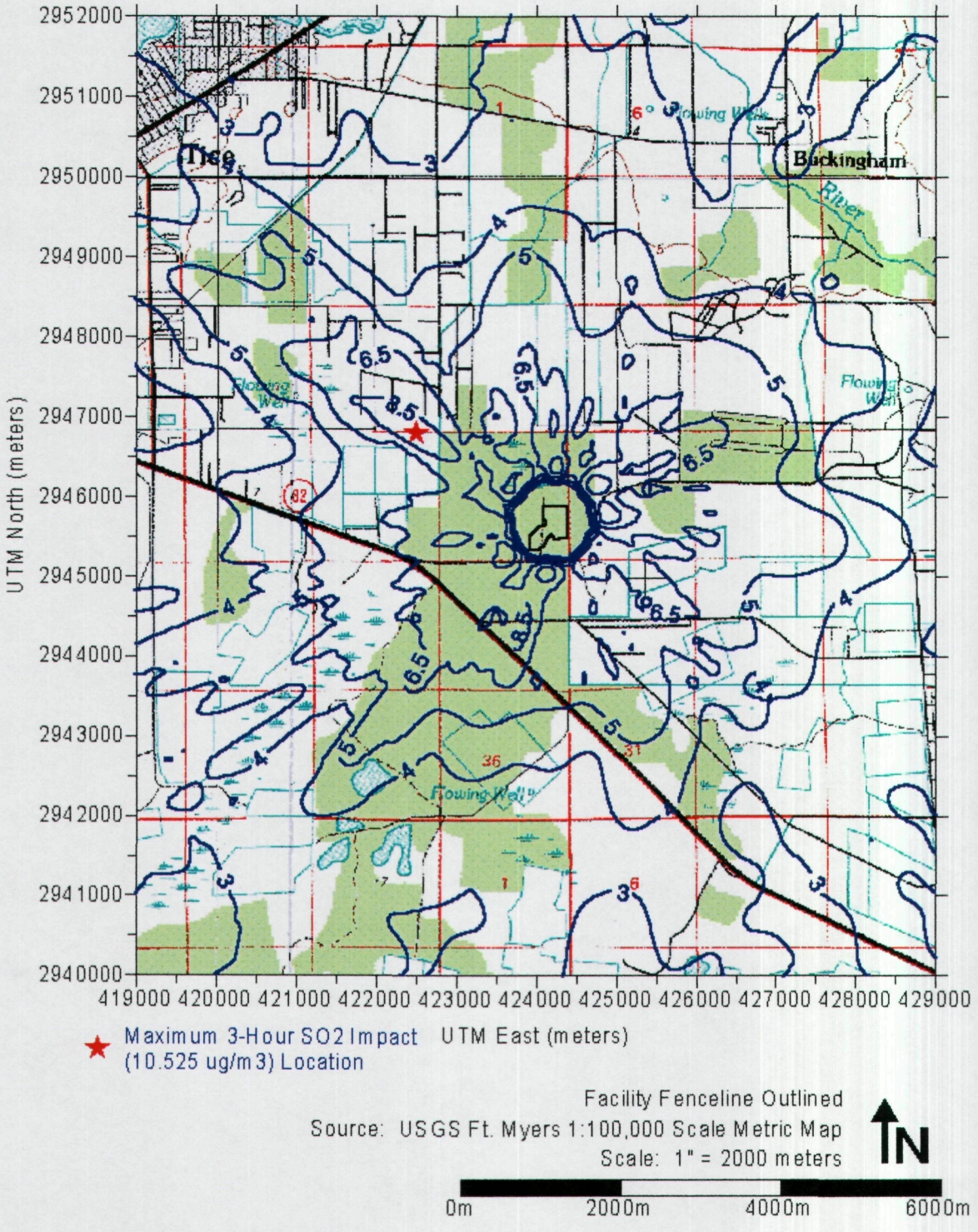


FIGURE 6-6
MAXIMUM INCREASES IN FACILITY ANNUAL NO_X IMPACTS (ug/m^3)



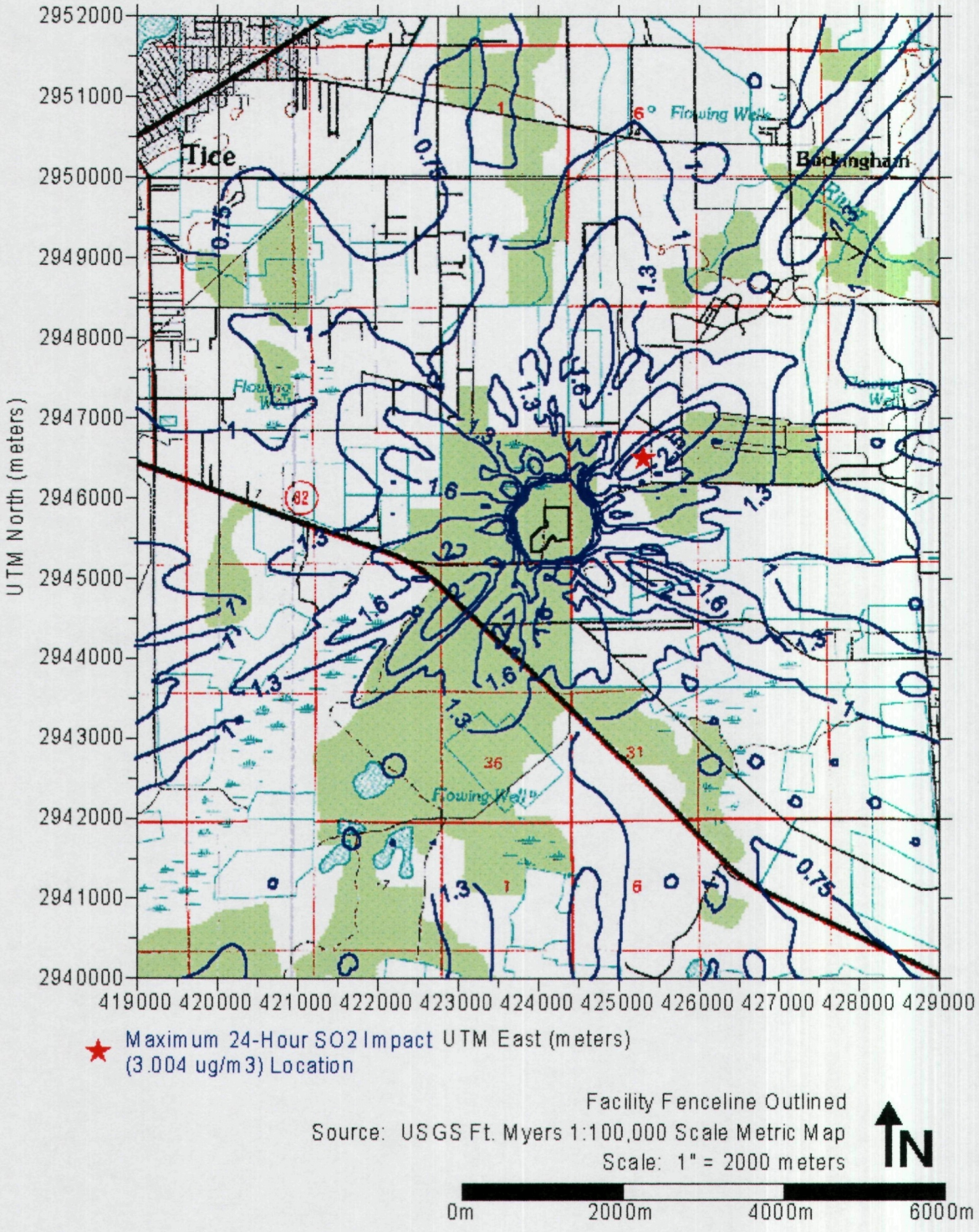
Prepared by:
RTP Environmental Associates, Inc.

FIGURE 6-7
MAXIMUM INCREASES IN FACILITY 3-HOUR SO_2 IMPACTS (ug/m^3)



Prepared by:
RTP Environmental Associates, Inc.

FIGURE 6-8
MAXIMUM INCREASES IN FACILITY 24-HOUR SO_2 IMPACTS (ug/m^3)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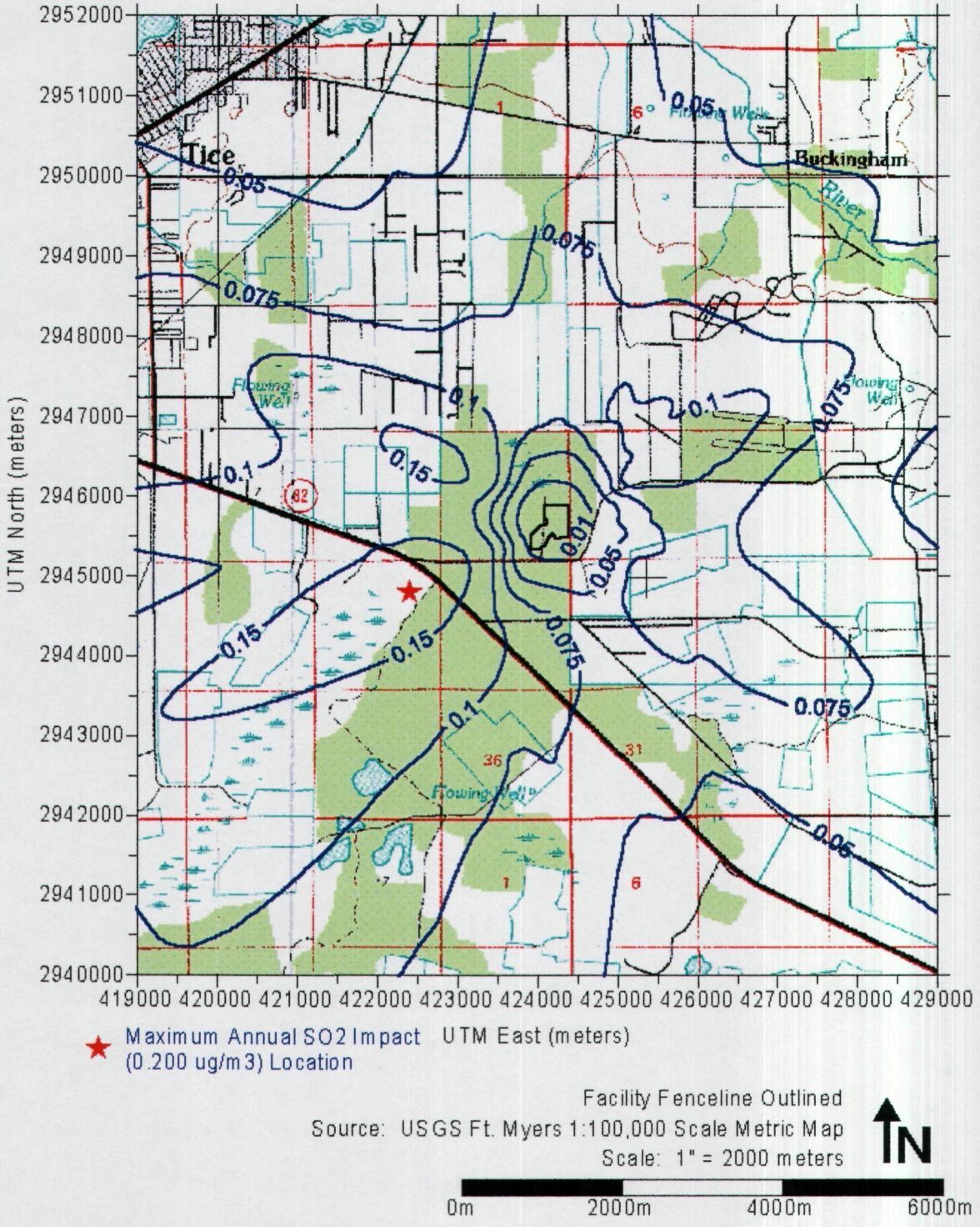
Buckingham
Flowing Well
Flowing Well
Flowing Well

FIGURE 6-9
MAXIMUM INCREASES IN FACILITY ANNUAL SO_2 IMPACTS (ug/m^3)



Prepared by:
RTP Environmental Associates, Inc.

a single existing unit. Similarly, maximum impacts for the two existing units are similar to impacts for one existing unit plus the proposed Unit 3. Included in the PM_{10} impacts for the worst-case scenarios are the minor PM sources. Maximum increases in 24-hour and annual facility PM_{10} impacts due to the new MWC unit (Case 6) including possible increases in minor PM source emissions are shown in Figures 6-10 and 6-11.

6.7 SIGNIFICANT IMPACT LEVELS

Maximum increases in facility impacts due to Unit 3 are compared on Table 6-7 to the USEPA SILs for Class II areas. Maximum increases in facility impacts are less than the Class II SILs for all criteria pollutants (PM_{10}, SO_2, NO_X, CO and Pb). Impacts are less than 10% of the SILs for CO, PM_{10} and Pb, about 20% of the SIL for NO_X, and 60% or less of the SILs for SO_2. Since SILs are concentrations below which impacts are indistinguishable from background concentrations, they are generally considered to be representative of insignificant or negligible impacts. Accordingly, the proposed modification would be considered insignificant with respect to local air quality (Class I impacts in the Everglades are addressed in Section 7). Therefore, no additional impact analyses are required under PSD regulations for any of these pollutants. Maximum combined facility impacts are also compared to the SILs on Table 6-7. Again, maximum impacts for the entire facility (i.e., existing and proposed MWC units) for all criteria pollutants are less than the SILs.

6.8 DE MINIMIS MONITORING LEVELS

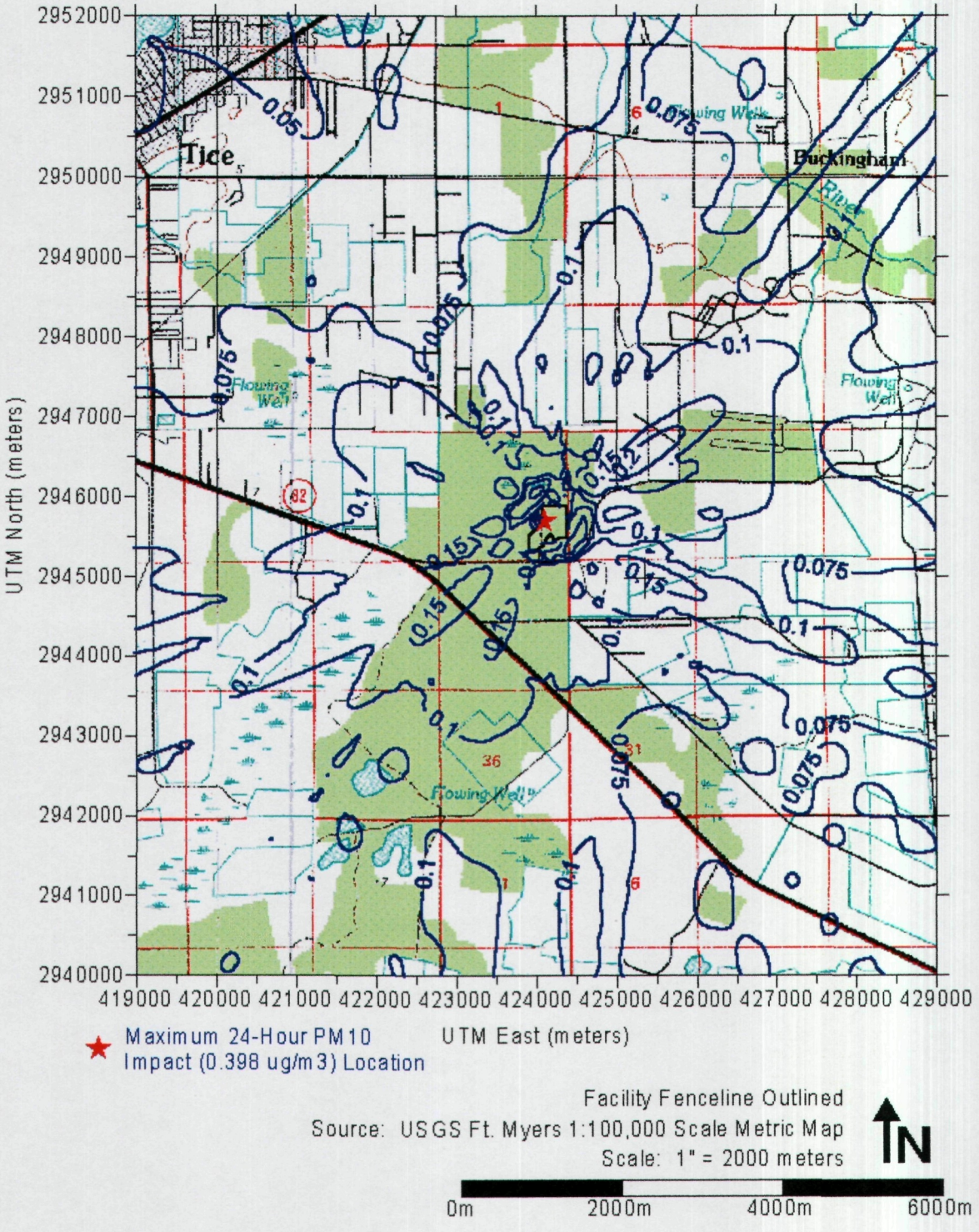
A proposed facility that is considered a major source under the PSD regulations is required to evaluate ambient air quality levels in the vicinity of the facility. One of the first assessments to be made is to evaluate whether ambient air quality monitoring will be required to define background air quality prior to submitting the air permit application.

Maximum increases in facility impacts due to the proposed MWC unit are compared on Table 6-8 to the USEPA de minimis monitoring levels. Maximum increases in facility impacts due to the new MWC are less than the de minimis monitoring levels for all applicable criteria and non-criteria pollutants. Since de minimis monitoring levels have been set near the lower detection limits for ambient monitoring equipment, preconstruction monitoring would not be useful because facility impacts would be difficult to detect. Therefore, no preconstruction monitoring would typically be required under PSD regulations and an exemption from ambient monitoring is requested. Maximum combined facility impacts are also compared to the de minimis monitoring levels on Table 6-8. Maximum impacts for the entire facility (i.e., existing and proposed MWC units) for all applicable pollutants are less than the de minimis monitoring levels.

6.9 PSD CLASS II INCREMENTS

Under the original 1970 Clean Air Act (CAA), major source growth was allowed as long as violations of the AAQS would not occur. In the CAA amendments of 1977, Congress included a detailed section on PSD, designed to preserve ambient air quality levels in

FIGURE 6-10
MAXIMUM INCREASES IN FACILITY 24-HOUR PM_{10} IMPACTS (ug/m^3)



Prepared by:
RTP Environmental Associates, Inc.

FIGURE 6-11
MAXIMUM INCREASES IN FACILITY ANNUAL PM_{10} IMPACTS (ug/m^3)

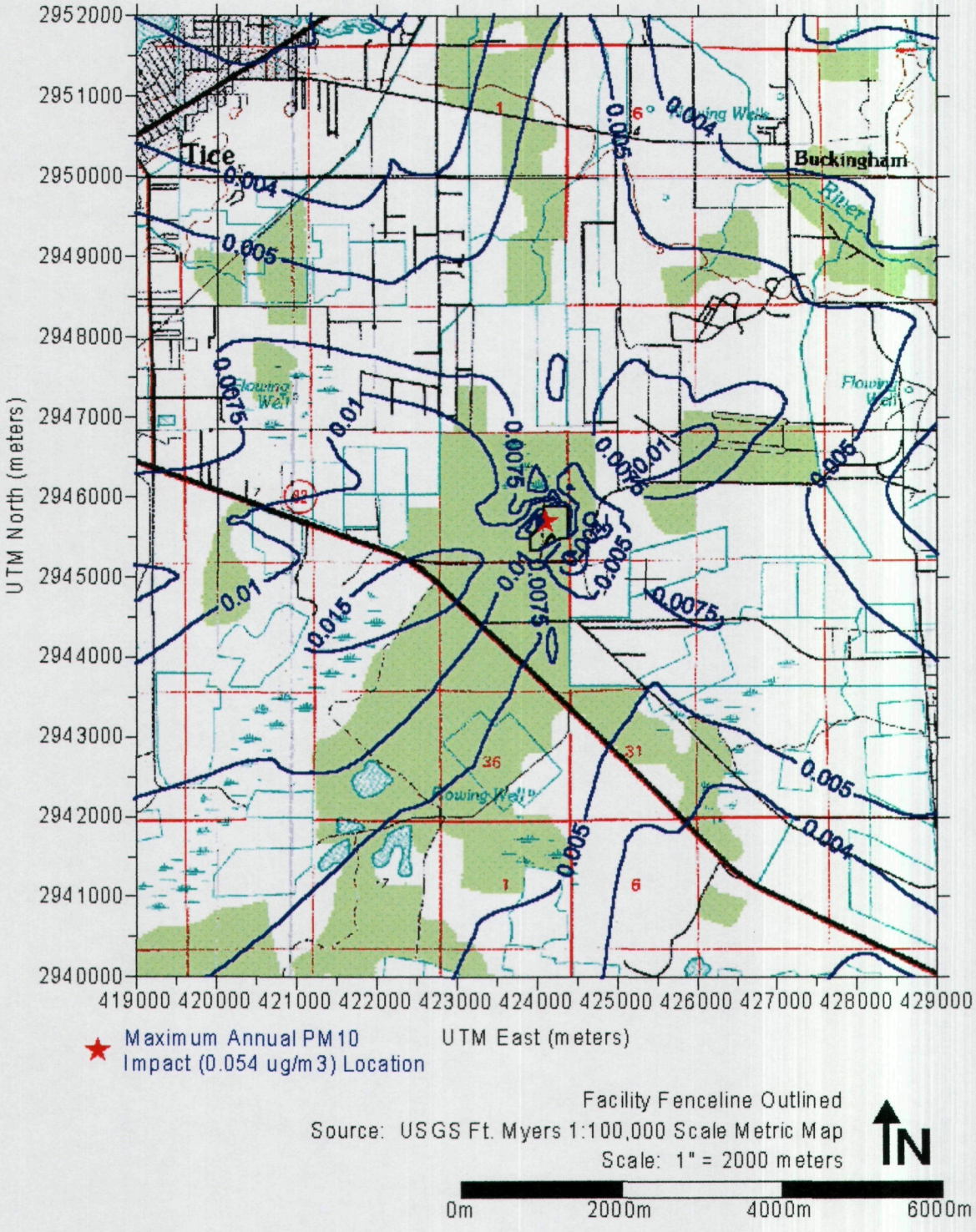


TABLE 6-7
COMPARISON OF MAXIMUM INCREASES AND FACILITY IMPACTS TO SIGNIFICANT IMPACT LEVELS

Pollutant	SILS[a] (ug/m^3)	Max Increase[b] for Proposed Unit (ug/m^3)	Percent of SIL	Max Impact[b] for Facility (ug/m^3)	Percent of SIL
CO 1-Hour	2000	11.662	0.6%	20.836	1.0%
CO 8-Hour	500	2.888	0.6%	5.607	1.1%
NO_x Annual	1	0.216	21.6%	0.436	43.6%
SO_2 3-Hour	25	10.525	42.1%	15.384	61.5%
SO_2 24-Hour	5	3.004	60.1%	4.355	87.1%
SO_2 Annual	1	0.200	20.0%	0.279	27.9%
PM_{10} 24-Hour	5	0.398	8.0%	1.177	23.5%
PM_{10} Annual	1	0.054	5.4%	0.161	16.1%
Pb Quarter[c]	0.03	0.0023	7.5%	0.0075	25.2%

[a] From Rules 62-204.200(29) (Definition of Significant Impact) and 62-210.200(232) (Definition of Significant Impact), F.A.C.
[b] Maximum short-term and long-term impacts.
[c] The maximum 24-hour modeled concentrations were used to conservatively determine compliance with quarterly value.

TABLE 6-8
COMPARISON OF MAXIMUM INCREASES AND FACILITY IMPACTS TO DE MINIMIS MONITORING LEVELS

Pollutant	De Minimis[a] Monitoring Level (ug/m^3)	Max Increase[b] for Proposed Unit (ug/m^3)	Percent of de Minimis	Max Impact[b] for Facility (ug/m^3)	Percent of de Minimis
CO 8-Hour	575	2.888	0.5%	5.607	1.0%
NO_x Annual	14	0.216	1.5%	0.436	3.1%
SO_2 24-Hour	13	3.004	23.1%	4.355	33.5%
PM_{10} 24-Hour	10	0.398	4.0%	1.177	11.8%
Pb Quarter[c]	0.1	0.0023	2.3%	0.0075	7.5%
Hg 24-Hour	0.25	0.0019	0.8%	0.0035	1.4%
HF 24-Hour	0.25	0.0328	13.1%	0.0779	31.2%
Be 24-Hour	0.001	1.8e-06	0.2%	3.35e-06	0.3%
Vinyl Chloride 24-Hour	15	No Vinyl Chloride Emissions are Expected from Existing or Proposed Units			
Total Reduced Sulfur 1-Hour	10	No Total Reduced Sulfur Emissions are Expected from Existing or Proposed Units			
Reduced Sulfur Compounds 1-Hour	10	No Reduced Sulfur Compounds Emissions are Expected from Existing or Proposed Units			
H_2S 1-Hour	0.2	No H_2S Emissions are Expected from Existing or Proposed Units			

[a] From Table 62-212.400-3, F.A.C. (De Minimis Ambient Impacts) and 40 CFR 51.166(i)(8)(i). No de minimis air quality level is provided for ozone. However, any net increase of 100 tons per year (tpy) or more of volatile organic compounds (VOCs) is subject to preconstruction review and would be required to perform an ambient impact analysis, including the gathering of ambient air quality data. Since the proposed net increase of VOC is 21.6 tpy, no preconstruction monitoring should be required.

[b] Maximum short-term and long-term impacts.

[c] The maximum 24-hour modeled concentrations were used to conservatively determine compliance with the lead quarterly value.

areas which were appreciably better (i.e., ambient concentrations considerably less) than the AAQS. The PSD increments established the maximum allowable increase in pollutant concentrations above some assumed baseline level. Increases in source emissions at all sources (whether major PSD sources or minor sources) permitted or installed after the "baseline date" consume increment. PSD increments are promulgated for SO_2, NO_2, and PM_{10}. Unlike AAQS, PSD increments are not uniform everywhere.

Three classes of PSD areas, each with specific increments, were established. Class I increments are designed to protect pristine areas such as national parks or wilderness areas. The nearest PSD Class I area to the LCERF is Everglades National Park. A discussion of Class I impacts and increments for this area is contained in Section 7. Most areas in the United States are regulated by Class II increments, designed for moderate growth. Class III increments were developed to allow concentrated industrial growth in limited areas. However, no Class III areas have been designated to date and the vast majority of the United States, including the project vicinity, is classified as a PSD Class II area. Therefore, PSD Class II increments will be considered here.

The refined modeling analyses demonstrated that maximum increases in facility impacts due to the third unit would be negligible. Although not required by PSD modeling guidelines, high second-high short-term and maximum annual impacts are compared to PSD increments in the project vicinity (both with respect to increases due to the proposed MWC unit as well as combined facility impacts). These impacts are compared on Table 6-9 to the PSD Class II increments (Class I increments are addressed in Section 7). As can be seen, maximum increases in facility impacts are 2.4% or less of the applicable Class II increments and maximum facility impacts are 3.4% or less of the same increments. Therefore, pollutant impacts for all three MWC units represent only a small percentage of the total Class II PSD increments available in the project vicinity.

6.10 AMBIENT AIR QUALITY STANDARDS

The CAA of 1970 mandated promulgation of AAQS to protect the public health and welfare. As a result, the USEPA defined AAQS for a set of criteria pollutants which have been demonstrated historically to have the ability to cause widespread, adverse health impacts. "National primary ambient air quality standards define levels of air quality which the Administrator [of the USEPA] judges are necessary, with an adequate margin of safety, to protect the public health [state of general health of a community or population]" (40 CFR 50.2(b)). "National secondary ambient air quality standards define levels of air quality which the Administrator judges necessary to protect the public welfare [non-human features and ecosystems associated with the human environment] from any known or anticipated adverse effects of a pollutant" (40 CFR 50.2(b)). To more fully address facility compliance with AAQS, maximum background values must be considered. Baseline air quality data for the study area is described in Section 5 along with discussions on the forms of the various AAQS.

Although not required by PSD regulations, overall high second-high short-term and maximum annual impacts of the facility after the addition of the third unit are compared

TABLE 6-9
COMPARISON OF MAXIMUM INCREASES AND FACILITY IMPACTS TO PSD CLASS II INCREMENTS

Pollutant	Class II Increment[a] (ug/m^3)	Max Increase[b] for Proposed Unit (ug/m^3)	Percent of PSD Class II Increment	Max Impact[b] for Facility (ug/m^3)	Percent of PSD Class II Increment
NO_x Annual	25	0.216	0.9%	0.436	1.7%
SO_2 3-hour	512	9.061	1.8%	13.038	2.5%
SO_2 24-hour	91	2.168	2.4%	3.112	3.4%
SO_2 Annual	20	0.200	1.0%	0.279	1.4%
PM_{10} 24-hour	30	0.276	0.9%	0.814	2.7%
PM_{10} Annual	17	0.054	0.3%	0.161	0.9%

[a] From Rule 62-204.260(2), F.A.C (Prevention of Significant Deterioration Increments).
[b] Based on high second-high short-term and maximum long-term impacts.

on Table 6-10 to AAQS. As shown on the top of Table 6-10, maximum increases in facility impacts are less than 1% of the AAQS for all modeled pollutants. Maximum facility impacts after construction of the third unit are less than 2% of the AAQS as shown on the bottom of Table 6-10. As is typical with most sources, background levels are much greater than maximum modeled impacts for the facility. However, even after appropriate maximum baseline concentrations determined in Section 5 are added to the facility's impacts, compliance with the AAQS is still indicated by a wide margin.

Maximum combined facility impacts (i.e., existing and proposed MWC units including background) range from 1% (quarterly Pb) to 64% (8-hour CO) of the applicable AAQS. Thus, no AAQS are in risk of contravention due to facility emissions combined with maximum measured baseline values. As discussed above, maximum impacts are predicted to be less than the SILs in all Class II areas. Therefore, the facility will not cause or significantly contribute to existing or potential AAQS violations, regardless of their location.

6.11 AMBIENT REFERENCE CONCENTRATIONS

Section 6.10 and Table 6-10 compare the maximum increases in facility impacts to AAQS promulgated by the USEPA and State of Florida. At the request of USEPA Region IV, maximum air quality impacts of the proposed modification were also addressed for pollutants without AAQS (termed "non-criteria pollutants). The Florida Air Toxics Working Group developed a list of ARCs for a large number of non-criteria pollutants based on a number of widely accepted reference sources. Ambient air concentrations less than the applicable ARC were deemed to pose no meaningful risk to human health. While the FDEP has ruled that the ARCs are not rules and hence do not have any statutory or legal authority (March 1, 2000 DARM-PER-28 guidance memo), they are still useful for evaluating the magnitude of non-criteria pollutant impacts.

Non-criteria pollutant impacts are compared to the latest available ARCs from the Florida Air Toxics Working Group on Table 6-11. Maximum increases in facility impacts due to the proposed unit were calculated using the equation presented in Section 6.5 with the Case 4 emissions on Table 6-2 and the maximum 8-hour, 24-hour, and annual "unitized" impacts on the top of Table 6-3 for all six cases (1-6). Maximum facility impacts including existing and proposed MWC units were calculated using the equation presented in Section 6.6 with the Case A through Case F emissions on Table 6-4 and the maximum 8-hour, 24-hour, and annual "unitized" impacts on the top of Table 6-5 for all six cases (A-F). The overall maxima for all six cases modeled (i.e., Cases 1 to 6 for the new MWC unit and Cases A to F for the overall facility) are shown in Table 6-11. Maximum increases in facility impacts due to the proposed MWC unit are less than one-third of the ARC for sulfuric acid mist (SAM or H_2SO_4) and less than 13% of the ARC for hydrochloric acid (hydrogen chloride or HCl). Maximum impacts for all other pollutants are less than 10% of the ARC. Maximum facility impacts after construction of Unit 3 are also less than one-half of the ARCs for all pollutants and averaging times. Since the ARCs were developed from a wide variety of references and include conservative safety factors when appropriate (e.g., occupational exposure levels), construction and operation

TABLE 6-10
COMPARISON OF MAXIMUM INCREASES AND FACILITY IMPACTS TO AMBIENT AIR QUALITY STANDARDS

MAXIMUM INCREASES (ug/m^3) DUE TO PROPOSED UNIT

Pollutant	AAQS[a] (ug/m^3)	Baseline (ug/m^3)	Max Increase[b] for Proposed Unit (ug/m^3)	Percent of AAQS	Increase + Baseline (ug/m^3)	Percent of AAQS
CO 1-Hour	40,000	12,535	6.754	0.02%	12,542	31.35%
CO 8-Hour	10,000	6,440	2.441	0.02%	6,442	64.42%
NO_x Annual	100	19	0.216	0.22%	19.2	19.22%
SO_2 3-Hour	1,300	149	9.061	0.70%	158	12.16%
SO_2 24-Hour	260	50	2.168	0.83%	52	20.06%
SO_2 Annual	60	8	0.200	0.33%	8.2	13.67%
PM_{10} 24-Hour	150	28	0.276	0.18%	28.3	18.87%
PM_{10} Annual	50	19	0.054	0.11%	19.1	38.20%
Pb Quarter[c]	1.5	0.01	0.0023	0.15%	0.012	0.82%

MAXIMUM IMPACTS (ug/m^3) FOR COMBINED FACILITY

Pollutant	AAQS[a] (ug/m^3)	Baseline (ug/m^3)	Max Impact[b] for Facility (ug/m^3)	Percent of AAQS	Facility + Baseline (ug/m^3)	Percent of AAQS
CO 1-Hour	40,000	12,535	12.431	0.03%	12,547	31.37%
CO 8-Hour	10,000	6,440	4.234	0.04%	6,444	64.44%
NO_x Annual	100	19	0.436	0.44%	19.4	19.40%
SO_2 3-Hour	1,300	149	13.038	1.00%	162	12.46%
SO_2 24-Hour	260	50	3.112	1.20%	53	20.38%
SO_2 Annual	60	8	0.279	0.47%	8.3	13.83%
PM_{10} 24-Hour	150	28	0.814	0.54%	28.8	19.20%
PM_{10} Annual	50	19	0.161	0.32%	19.2	38.40%
Pb Quarter[c]	1.5	0.01	0.0075	0.50%	0.018	1.20%

[a] The most restrictive AAQS between the Florida AAQS (Rule 62-204.240, F.A.C.) and National AAQS (40 CFR 50) are used.
[b] Based on high second-high short-term and maximum long-term impacts.
[c] The maximum 24-hour modeled concentrations were used to conservatively determine compliance with quarterly value.

TABLE 6-11
COMPARISON OF MAXIMUM INCREASES AND FACILITY IMPACTS TO AMBIENT REFERENCE CONCENTRATIONS

Pollutant	ARCs[a] (ug/m^3)	Max Increase[b] for Proposed Unit (ug/m^3)	Percent of ARC	Max Impact[b] for Facility (ug/m^3)	Percent of ARC
HCl 8-Hour	70	4.701	6.7%	5.530	7.9%
HCl 24-Hour	17	2.138	12.6%	2.419	14.2%
HCl Annual	7	0.142	2.0%	0.155	2.2%
Cd 8-Hour	0.02	4.97e-04	2.5%	1.59e-03	7.9%
Cd 24-Hour	0.005	2.26e-04	4.5%	6.95e-04	13.9%
Cd Annual	0.00056	1.50e-05	2.7%	4.45e-05	8.0%
Pb 8-Hour	0.5	4.97e-03	1.0%	1.72e-02	3.4%
Pb 24-Hour	0.1	2.26e-03	2.3%	7.55e-03	7.5%
Pb Annual	0.09	1.50e-04	0.2%	4.83e-04	0.5%
Hg 8-Hour	0.1	4.28e-03	4.3%	7.98e-03	8.0%
Hg 24-Hour	0.02	1.94e-03	9.7%	3.49e-03	17.5%
Hg Annual	0.3	1.30e-04	0.04%	2.24e-04	0.07%
TCDD[c] Annual	2.2e-08	1.96e-10	0.9%	6.52e-10	3.0%
HF 8-Hour	26	0.072	0.3%	0.178	0.7%
HF 24-Hour	6.2	0.033	0.5%	0.078	1.3%
Be 8-Hour	0.02	3.96e-06	0.02%	7.65e-06	0.04%
Be 24-Hour	0.005	1.80e-06	0.04%	3.35e-06	0.07%
Be Annual	0.00042	1.20e-07	0.03%	2.14e-07	0.05%
SAM 8-Hour	10	1.687	16.9%	2.458	24.6%
SAM 24-Hour	2.4	0.767	32.0%	1.075	44.8%
As 8-Hour	0.1	2.66e-04	0.3%	5.16e-04	0.5%
As 24-Hour	0.02	1.21e-04	0.6%	2.26e-04	1.1%
As Annual	0.00023	8.06e-06	3.5%	1.45e-05	6.3%
NH_3 8-Hour	170	0.877	0.5%	1.699	1.0%
NH_3 24-Hour	41	0.399	1.0%	0.743	1.8%
NH_3 Annual	100	0.027	0.03%	0.048	0.05%

[a] From Version 4.0 Ambient Reference Concentration (ARCs) (FDEP, 1995b) list developed by the Florida Air Toxics Working Group. The ARC list is based on occupational exposure levels developed by ACGIH and OSHA with appropriate safety factors, BIF levels, and USEPA IRIS risk factors and reference concentrations.

[b] Maximum short-term and long-term impacts.

[c] 2378-TCDD Toxic Equivalent (TEQ) emissions estimated as 2% of total PCDD/PCDF emissions based on the average of available stack test data for the two existing LCERF units.

of the new and existing units would not be expected to significantly impact human health in the project vicinity. A more detailed human health risk assessment which considers additional modes of exposure and other parameters is contained in the Power Plant Siting Act (PPSA) application for Unit 3. An ecological risk assessment of the impact of the LCERF on wildlife and other ecological values is also contained in the PPSA application.

LEE COUNTY ENERGY RECOVERY FACILITY
PREVENTION OF SIGNIFICANT DETERIORATION
APPLICATION FOR MUNICIPAL WASTE COMBUSTOR UNIT 3

SECTION 7
ADDITIONAL IMPACT ANALYSES

October 31, 2002

SECTION 7
ADDITIONAL IMPACT ANALYSES

In previous sections, the Lee County Energy Recovery Facility (LCERF) emissions increases and maximum impacts on local air quality concentrations were calculated in order to demonstrate that emissions from the proposed modification will comply with all applicable air quality and engineering standards (e.g., ambient air quality standards [AAQS], Prevention of Significant Deterioration [PSD] increments, Best Available Control Technology [BACT], etc.). The applicant is required to submit, as part of the PSD permit application, additional impact analyses for each PSD pollutant subject to preconstruction review. The additional analyses specified in 40 CFR 51.166(o) are to determine:

- An analysis of the impairment to visibility, soils, and vegetation having significant commercial or recreational value that would occur as a result of the modification and general commercial, residential, industrial, and other growth associated with the modification.
- An analysis of the air quality impact projected for the area as a result of general commercial, residential, industrial, and other growth associated with the modification.

These additional analyses of impacts from the proposed modification on air quality in the project vicinity are addressed in the next three sections. At the request of the Department, included is an assessment of minor source growth since August 7, 1977 as mentioned in 40 CFR 51.166(n)(3)(ii). In addition, an assessment of impacts during startup, shutdown, and malfunction conditions is addressed in Section 7.4. A summary of the ISCST3 modeling analyses of concentrations and deposition rates performed for the risk assessments in the Power Plant Siting Act (PPSA) application is given in Section 7.5.

Air Quality Related Values (AQRVs) for nearby Class I areas are addressed in Section 7.6 (PSD Class I Analysis). These include CALPUFF analyses to determine maximum impacts, deposition rates, and visibility impairment for comparison to Class I significance levels in the Everglades National Park.

7.1 LOCAL VISIBILITY IMPACTS

As discussed in Section 6 (Air Quality Impact Analyses), the proposed modification consists of adding Unit 3 to the two existing units. Pollutant emissions from the proposed unit will be exhausted from a third flue in the existing concrete stack shell which contains the two existing municipal waste combustor (MWC) flues. Particulate matter (PM) emissions from other existing Title V emission units at the LCERF (lime silo and ash building baghouse vent) are extremely small, as shown in Section 6, and would not be expected to cause visible emissions. Thus, local visibility issues are most likely to be due to MWC emissions and the associated 276-foot stack.

Pollutants have specific effects upon visibility within the atmosphere. The primary pollutants of concern for visibility are PM and nitrogen oxides (NO_X). PM can both scatter and absorb light, resulting in plumes which can be lighter or darker than the viewing background. Emissions of NO_X consist mostly of nitric oxide (NO) with smaller amounts (less than 10%) of nitrogen dioxide (NO_2) and other NO_X species. While NO is colorless, NO_2 can form a plume that is perceived of as yellow under certain viewing conditions. NO emissions eventually react to form NO_2 but at considerable distances. Thus, PM rather than NO_X is of primary concern when considering local visibility impacts.

In this case, visible PM emissions will not occur because Unit 3 will use a fabric filter (FF) baghouse and will comply with an emission limit of 0.009 gr/dscf corrected to 7% O_2. While bag failures can result in visible emissions, the air pollution control (APC) system is closely monitored and bag malfunctions are typically detected and corrected before visible emissions occur. Other emissions, such as acid gases, could possibly react with ammonia slip from the SNCR system and cause visible plumes in the immediate vicinity of the stack.

The addition of a third flue to the stack shell would increase the amount of emissions by roughly 50% but not the pollutant concentration in the plume (because emission limits based on stack gas concentrations are similar for proposed and existing units). Thus, potential increases in plume visibility would be due only to a slightly greater plume depth and not increases in pollutant concentrations.

Operation of the current units shows that a visible plume due to pollutant emissions occurs very rarely. Continuous opacity measurements (COM) greater than 5% opacity (based on six-minute averages) occur about 0.0057% of the time, which translates to about 5 hours per year. Thus, the chance of observing a visible plume due to primary pollutant emissions of PM or NO_2 is small. The addition of a third MWC unit would not be expected to appreciably increase the severity or frequency of a visible plume in the project vicinity.

A visible plume due to condensed water vapor is seen more frequently, based on visual observations of the stack during the past eight years of operation. A vapor plume may appear 100 days per year, typically in the winter and on mornings between 6 and 9 a.m. The vapor plume appears within 50 feet of the stack and causes a short water vapor plume which extends from 100 to 500 feet downwind and then rapidly dissipates. The vapor plume is caused by the moisture content, or humidity, of the flue gas. The flue gas moisture is from three sources: 1) MSW, 2) combustion air, and 3) water evaporated from the spray dry absorber (SDA). The SDA is essential in controlling not only acid gases (e.g., 80% and 95% reduction of SO_2 and HCl, respectively), but the water in the slurry spray also rapidly cools the exhaust gases helping to minimize dioxin/furan formation and aiding in the capture and control of mercury. For these reasons, the use of water is an integral part of the APC system to significantly reduce pollutant emissions.

In the original PPSA application, field analyses were performed using a hovering helicopter (CDM, 1990a) which showed that a 400-foot stack would be visible for up to 2.5 miles from the LCERF, depending on the direction and in the absence of vegetation and other obstructions. When considering vegetation and other obstructions, the stack would not be visible in some directions past 1.5 miles. Given that the actual stack built is 276-feet high, the area where the stack and small water vapor plume would be visible is limited to the immediate facility vicinity (probably less than 1.5 miles). Impacts of the proposed modification on visibility in nearby Class I areas are described later.

7.2 MINOR SOURCE GROWTH

Minor source growth for the project was assessed in two ways. The secondary impacts of the proposed source on local air quality is assessed as required in 40 CFR 51.166(o). An analysis of population growth and other factors is also considered to qualitatively assess the amount of PSD increment consumption by minor sources since August 7, 1977 as mentioned in 40 CFR 51.166(n)(3)(ii).

Secondary impacts of the proposed source on local air quality are related to the increase in population due to facility employment and the attraction of support industries. The LCERF currently employs about 50 persons. An additional nine persons will be required when construction of the new unit is completed. This increase of nine persons represents only 0.002% of the current Lee County population of 440,888 (U.S. Census Bureau, 2002). Since many of the new workers will likely be hired from the surrounding community, any increase in local population would be insignificant to local air quality. Construction of the new unit will take approximately 24 months and require an additional 50 to 70 persons onsite on average with a maximum number of about 100 additional persons onsite at any one time (only 0.02% of Lee County's population). Any impacts on local population, if any, would be temporary.

Waste disposal rates for Lee and Hendry Counties currently exceed existing facility capacity on average. In addition, future increases in population are likely to increase the need for additional capacity. Therefore, a third unit is proposed to meet current and future capacity requirements in an environmentally sound manner. Given that Lee County has one of the highest recycling rates in Florida, it is unlikely that increases in recycling rates alone would eliminate the need for additional capacity. These issues are discussed in more detail in the LCERF Materials Separation Plan. Municipal solid waste (MSW) generation rates in the two counties will be unaffected by whether a new unit is built or not. Therefore, no significant expansion of industry or secondary support services is expected for operation of Unit 3.

Currently, approximately 250 trucks per day visit the LCERF to dispose of MSW. As noted above, MSW generation rates will be unaffected by the new unit. If a new MWC unit is not constructed, excess MSW will need to be transported to regional landfills. In that event, a transfer station would likely be constructed at the facility site. Thus, there would be no change in inbound trucks. However, there would be an increase in outbound trucks (MSW vs. ash). Therefore, the new unit will actually decrease truck traffic and

truck-related emissions in the general project area. For these reasons, it is unlikely that the new unit will cause any appreciable deterioration of local air quality due to secondary sources or minor source growth and may actually improve local air quality.

At the request of the Florida Department of Environmental Protection (FDEP), a qualitative analysis has been performed of minor source growth and PSD increment consumption since the August 7, 1977 (effective date of PSD program and increments). The PSD minor source baseline dates in Florida are December 27, 1977 for PM and SO_2 and March 28, 1988 for NO_2 (Rule 62-204.360, F.A.C.). Since the baseline dates, any increases in ambient pollutant concentrations due to major or minor sources consume PSD increment. Conversely, any decreases in ambient pollutant concentrations would expand PSD increments. Since PSD increments are less than the AAQS, PSD increments typically restrict air quality deterioration in areas with baseline air quality considerably better (i.e., appreciably smaller) than the AAQS.

Lee County population[a] during 1977, 1988, and 2000 was 175251, 309144, and 440888 persons, respectively. Thus, there were large increases in Lee County's population of about 150% and 45% since the PM/SO_2 and NO_2 baseline dates, respectively. Lee County manufacturing employment[b] during the same years was 3207, 5771, and 7181 persons, respectively -- a 125% increase since the PM/SO_2 baseline dates and a 25% increase since the NO_2 baseline date. As a percentage of population, manufacturing employment has dropped from around 1.85% in 1977 and 1988 to 1.6% in 2000.

Based on population and manufacturing figures alone, it would appear that consumption of the Class II PSD increments by minor PSD sources is about 1.5 and 0.5 times the original baseline concentrations in 1977 for PM/SO_2 and in 1988 for NO_2. However, this does not consider other factors that affect emissions and air quality impacts. First, transportation emissions from automobiles and trucks have decreased sharply since 1977. These decreases in mobile source emissions generally offset any increases due to nationwide increases in vehicle-miles traveled. Also, manufacturing employment as a percentage of population has also decreased. Since industrial emissions are usually second overall to transportation emissions, this would suggest little Class II PSD increment consumption by major sources. Further, air quality regulations such as PSD, maximum achievable control technology (MACT), Title IV, and the Emission Guidelines have decreased permitted emission rates for many major PSD sources (both existing sources such as the LCERF and PSD modifications such as the Florida Power & Light Company's Fort Myers Repowering Project) and possibly expanded Class II PSD increments.

Ambient air quality monitoring data available since the baseline dates also support the conclusion that the Class II PSD increments has remained the same or expanded since the baseline dates. Due to the cost of monitoring, the length of time since the baseline dates, and the change in PM measurement methods from TSP to PM_{10}, it is difficult to obtain a complete record between 1977/1988 and 2000. However, some limited monitoring data

[a] Linear interpolation of 1970, 1980, 1990, and 2000 census data.
[b] Florida Labor Market Statistics (Corbin, 2002b).

representative of Lee County are available for some period of time at the same location for the three PSD increment pollutants. Available historic monitoring data (high second-high short-term and maximum annual ambient concentrations in ug/m^3 over three calendar years, if available) are compared below:

TSP 24-Hour High Second-High Concentration (ug/m^3)

Charlotte County (3760-002)	48(94-96)-59(84-86) = -10 ug/m^3/10 yrs
Lee County (1300-005)	80(92-94)-70(84-86) = +10 ug/m^3/8 yrs

TSP Annual Maximum Geometric Mean Concentration (ug/m^3)

Charlotte County (3760-002)	20(94-96)-27(84-86) = -7 ug/m^3/10 yrs
Lee County (1300-005)	26(92-94)-30(84-86) = -4 ug/m^3/8 yrs

SO_2 3-Hour High Second-High Concentration (ug/m^3)

Sarasota County (4100-010)	242(90-92)-208(84-86) = +34 ug/m^3/6 yrs
Sarasota County (4100-012)	291(90-92)-278(84-86) = +13 ug/m^3/6 yrs

SO_2 24-Hour High Second-High Concentration (ug/m^3)

Sarasota County (4100-010)	101(90-92)-137(84-86) = -36 ug/m^3/6 yrs
Sarasota County (4100-012)	62(90-92)- 85(84-86) = -23 ug/m^3/6 yrs

SO_2 Annual Maximum Arithmetic Mean Concentration (ug/m^3)

Sarasota County (4100-010)	7(90-92)-11(84-86) = -4 ug/m^3/6 yrs
Sarasota County (4100-012)	8(90-92)- 5(84-86) = +3 ug/m^3/6 yrs

NO_2 Annual Maximum Arithmetic Mean Concentration (ug/m^3)

Pinellas County (3980-018)	30(98-00)-30(84-85) = +0 ug/m^3/14 yrs

Hence, while population and manufacturing employment increases would suggest that PSD increment consumption has occurred since the baseline date, trends in mobile and point source emissions and ambient air quality data suggest little PSD increment consumption since the baseline dates.

As shown in Section 6.9, maximum increases in facility impacts in the project vicinity due to the proposed modification are less than 2.5% of the PSD Class II increments for all pollutants and averaging times. Total facility impacts for both existing and proposed units are less than 3.5% of the PSD Class II increments. Since maximum increases in facility impacts were less than the significant impact levels (SILs) for all pollutants and averaging times, no additional multisource modeling analyses for major sources were required to show overall compliance with AAQS or PSD increments.

7.3 SOILS AND VEGETATION

PSD regulations require analysis of the impact to soils and vegetation having significant commercial or recreational value that would occur due to emissions from the proposed PSD modification. Atmospheric pollutants emitted in PSD significant emission rates

from the proposed modification include NOx, sulfur dioxide (SO_2), PM, and carbon monoxide (CO). At extreme levels, these contaminants may cause direct damage to plant tissue and may result in deposition of chemicals into surrounding soils.

The significance of the impacts to soils and vegetation depends primarily on the atmospheric concentration levels of these pollutants as well as on the types of plants grown and the land use patterns in the surrounding area. Since maximum increases in facility impacts for the proposed modification occur in the immediate project vicinity, agricultural statistics and other information were summarized for Lee County (U.S. Department of Agriculture, 1997). Approximately 25% of the land in Lee County is devoted to agricultural production. Approximately 500 farms make up a total of 129,000 acres in the county, producing agricultural products with an annual market value in excess of $116 million.

There are approximately 25,000 acres of harvested cropland, 75,000 acres of pasture land for livestock, 13,000 acres of woodland, and 14,000 acres in orchards. Major crops grown in the county include vegetables, sweet corn, and melons (47% of the total market value of Lee County agricultural products sold, ranking as the eighth county in Florida); nursery and greenhouse crops (31% of the total Lee County market value, ranking tenth in the state); and fruits, nuts, and berries (16% of the total Lee County market value, for a county ranking of 18th in the state). Despite the number of acres devoted to pasture land, the market value of livestock is only 2% of the total market value of Lee County agricultural products sold (ranking 43rd in the state). Other uses of the land which could potentially experience significant impacts include parkland and other open areas within the County of recreational value that contain significant amounts of vegetation and exposed soils.

Historically, the majority of vegetative impacts due to air contaminants have resulted from elevated atmospheric concentrations of SO_2. At extreme levels, emissions of this contaminant can cause direct damage to plant tissue. The maximum 3-hour SO_2 impact due to facility emissions after the proposed modification is 15.4 ug/m^3 (Cases C through F on Table 6-5), well below the level at which plant damage has been observed. Therefore, no significant adverse impacts to vegetation due to SO_2 emissions from the modification are expected to occur.

Two additional pollutants which could potentially have harmful impacts on area vegetation include NO_X and CO. Neither of these gases is toxic to plants except in very high concentrations. The literature on NO_2 suggests the following injury threshold doses of NO_2 on plants (Dames & Moore, 1981):

- No effect for concentrations less than 10 ppm (18,800 ug/m^3) and exposures of 1 to 600 hours.
- Leaf symptoms for concentrations between 10 and 300 ppm (18,800 to 564,000 ug/m^3) and exposures of ½ to 600 hours.
- Death for concentrations between 300 and 500 ppm (564,000 to 940,000 ug/m^3) and exposures of 3/4 to 2 hours.

The threshold concentration for visible effects of NO_2 on vegetation is therefore about 335 times higher than the maximum 1-hour NO_X facility impact of 56 ug/m^3 predicted for the facility after the proposed modification (calculated for Cases C through F using the equation in Section 6.6, the NOx emission rates on Table 6-4, and the 1-hour maximum "unitized" impacts on the top of Table 6-5).

CO requires even higher concentrations to elicit injury in plants. According to Dames & Moore (1981), the following injury threshold levels apply:

- No effect for concentrations less than 100 ppm (115,000 ug/m^3) and exposures for 1 to 3 weeks.
- Epinasty at levels greater than 500 ppm (575,000 ug/m^3).
- Chlorosis and leaf abscission occur at 10,000 ppm (11,500,000 ug/m^3) in sensitive plants, but tolerant plants require more than 10 times this concentration to produce the same symptoms.

Thus, the threshold concentration for visible effects is 5,500 times greater than the maximum 1-hour CO impact of 20.8 ug/m^3 predicted for the facility after the proposed modifications (Cases C through F on Table 6-5).

The impact of emission levels on soils is also not expected to cause any harmful effects. The potential for changes in rainfall pH due to the formation of sulfuric and nitric acid in the atmosphere from facility emissions of SO_2 and NO_X is minor given the expected maximum annual ambient air concentrations of SO_2 and NO_x due to facility emissions of 0.3 and 0.4 ug/m^3, respectively. According to the literature, there is no evidence of any significant impacts of gaseous NO_X on soil microorganisms. Negative impacts of CO on soil microorganisms have only been observed at levels significantly greater than those being emitted by this facility. These effects include inhibition of nitrogen fixation by soil microorganisms and increased utilization of CO by soil microorganisms (Dames & Moore, 1981). Inhibition of nitrogen fixation has been observed only when CO concentrations are in excess of 2,000,000 ug/m^3, a level more than 96,000 times the maximum 1-hour facility impact of 20.8 ug/m^3 (Cases C through F on Table 6-5). Soils function as a major sink for atmospheric CO, primarily due to uptake and metabolism of CO by soil fungi. At the levels expected, facility emissions of CO are not expected to result in any significant changes to local soils or the productivity of these microorganisms. Therefore, no significant impacts from the modification are anticipated on soils.

The impacts of PM and heavy metals including lead (Pb) on soils and vegetation are also expected to be insignificant due to the low predicted concentrations of these air contaminants. Studies have shown that urban areas with higher Pb soil concentrations than those likely to occur in Lee County have observed no detectable effect on produce or on human consumers of these foods (RTP Environmental Associates, Inc., 1986).

Potential impacts on soils and vegetation have been evaluated due to facility emissions of both criteria and non-criteria (trace element) pollutants. Proposed emissions for the new unit as well as combined (proposed + existing) emissions for the entire future facility have been shown in Section 6.10 of this permit application not to interfere with the maintenance of AAQS. Since one of the factors used in developing the secondary AAQS was the prevention of significant adverse impacts on soils and vegetation, facility compliance with the AAQS also indicates that no significant adverse impact on soils and vegetation will occur. A more detailed ecological risk assessment of the proposed modification is also contained in the PPSA application.

7.4 STARTUP, SHUTDOWN, AND MALFUNCTION CONDITIONS

The U.S. Environmental Protection Agency (USEPA) has recognized that the New Source Performance Standard (NSPS) emission standards for MWCs can only be met under steady state conditions and by employing "Good Combustion Practices (GCP)." During periods of startup, shutdown, and malfunction (S/S/M) conditions, the NSPS emission limits do not apply as follows (40 CFR Part 60.58b(a) and November 16, 2001 Federal Register at 66 FR 57824):

- The NSPS emission "standards under this subpart apply at all times except during periods of startup, shutdown, or malfunction. Duration of startup, shutdown, or malfunction periods are limited to 3 hours per occurrence, except as provided" next.

- "For the purpose of compliance with the [NSPS] CO emission limits, if a loss of boiler water level control (e.g., boiler waterwall tube failure) or a loss of combustion air control (e.g., loss of combustion air fan, induced draft fan, combustion grate bar failure) is determined to be a malfunction, the duration of the malfunction period is limited to 15 hours per occurrence."

- "The startup period commences when the affected facility begins the continuous burning of municipal solid waste and does not include any warm-up period when the affected facility is combusting fossil fuel or other non-municipal solid waste fuel, and no municipal solid waste is being fed to the combustor."

- "Continuous burning is the continuous, semicontinuous, or batch feeding of municipal solid waste for purposes of waste disposal, energy production, or providing heat to the combustion system in preparation for waste disposal or energy production. The use of municipal solid waste solely to provide thermal protection of the grate or hearth during the startup period when municipal solid waste is being fed to the grate is not considered to be continuous burning."

These exclusionary periods were included in the MWC standards and guidelines since operation during these periods is unstable, transitory in nature, and outside the normal control range of the equipment. However, the NSPS language does not relieve the owner

or operator from the requirement at 40 CFR 60.11(d) of the NSPS general provisions which require:

- "At all times, including periods of startup, shutdown, and malfunction, owners and operators shall, to the maximum extent practicable, maintain and operate any affected facility including associated air pollution control equipment in a manner consistent with good air pollution control practice for minimizing emissions."

The NSPS language also does not alter the definition of malfunction included in 40 CFR 60.2 (Definitions) of the NSPS general provisions which is:

- "...any sudden, infrequent, and not reasonably preventable failure of air pollution control equipment, process equipment, or a process to operate in a normal or usual manner. Failures that are caused in part by poor maintenance or careless operation are not malfunctions."

While malfunctions do occur at MWCs due to the complexity of the MWC and air pollution control (APC) equipment (i.e., spray dry absorber, fabric filter baghouse, selective non-catalytic reduction (SNCR), and activated carbon injection), every precaution must be taken to minimize the frequency and severity of malfunctions. The LCERF has standard procedures to maintain the integrity and reliability of capital equipment and processes including: 1) a preventative maintenance program; 2) inspections of key components on each shift; and 3) scheduled outages for internal inspection of equipment. Each of these tasks are designed to maintain the integrity of the LCERF and thereby avoid unnecessary S/S/M.

The following analyses are provided to document that the facility will continue to comply with the AAQS even during S/S/M periods. Short-term AAQS would be of concern, which requires that CO, SO_2, and PM be addressed (NO_2 has an annual standard only).

Specific startup practices for Unit 3 will vary depending whether it is initiated from a "cold" start (i.e., the furnace and associated equipment are at ambient temperature) or a "hot" start, better defined as a "restart." All startup procedures, however, include the use of MSW and residue to cover the grates to prevent the grates from overheating whenever auxiliary fuel firing is necessary. During startup, auxiliary fuel is initially combusted to preheat the furnace if necessary. After proper conditions are achieved, continuous MSW feeding is initiated and MSW throughput is ramped until full load is reached. The shutdown sequence basically involves halting the MSW feed and then firing natural or propane gas when necessary until the grates are clear (i.e., the same sequence as startup except in reverse). The auxiliary burners aid in reducing shutdown CO and VOC emissions.

During combustion of natural or propane gas only, emissions are very much less than when firing MSW due to the clean nature of these fuels and the significantly smaller size of the auxiliary burners as compared to the gross heat input capacity of the MWCs. Therefore, impacts would be less during initial startup and final shutdown conditions than

the maximum normal facility impacts shown in Section 6 (Air Quality Impact Analyses). Operating conditions during startup or shutdown operations when a combination of auxiliary fuel and MSW is combusted would be similar to conditions of reduced load. These reduced load operating conditions were modeled in Section 6 as part of the screening analyses and impacts were found to be less than under conditions of maximum load. Emissions monitored during the startup and shutdown of the Marion County, Oregon facility indicated no significant increase in flue gas concentrations of dioxins and furans (a measure of organics in general) or of metals. There was an approximate 40% increase in emissions of acid gases above average (i.e., considerably less than the 400% increase analyzed below when considering malfunctions) (USEPA, 1987b, 1987c).

While emissions and impacts during startups and scheduled shutdowns will be the same or less than for normal operations, emissions and impacts during some types of malfunctions can be greater than for normal conditions. Malfunctions can be grouped into three general categories - boiler malfunctions, miscellaneous malfunctions, and APC equipment malfunctions. These malfunctions are considered routine and are the reason for the USEPA exclusionary policy regarding malfunctions. Except for excess CO emissions associated with loss of boiler water level control as noted earlier, excess emissions during malfunctions are limited to three hours, consistent with the NSPS exemption rules. Catastrophic failure of the APC system which cannot be repaired in three hours would require the combustion unit to be taken into a shutdown sequence.

Boiler malfunctions include boiler tube ruptures (typically the single largest contributor to lost boiler availability due to repair times) and ash discharger pluggages (more frequent than tube failures but only require the temporary cessation of MSW feed until the discharger is drained and cleared). Miscellaneous malfunctions consist of site power losses, control system malfunctions, and auxiliary burner failures. Loss of the electrical connection would cause combustion instabilities resulting in shutdown. Auxiliary burner failures (mis-starts) can cause short-duration low temperatures and elevated CO and VOC concentrations. All of these malfunctions can result in elevated CO and VOC emissions until the unit is returned to normal operation or shutdown is complete. Malfunction CO emissions of 600 ppmdv corrected to 7% O_2 for all three units (i.e., a facility malfunction and shutdown including all three units) were assumed for a 15-hour period allowed for in the NSPS for certain malfunctions. This would result in high second-high 1-hour and 8-hour facility concentrations during malfunction conditions of 75 and 25 ug/m^3, respectively. Added to maximum representative background concentrations of 12535 and 6440 ug/m^3, respectively, gives total concentrations that are 32% and 65% of the respective AAQS (almost totally due to background). Thus, excess CO emissions would not be expected to cause or contribute to exceedances of the CO AAQS in the extremely unlikely event of simultaneous malfunction of all three units and emissions six times greater than NSPS limits. Again, most malfunction conditions do not result in emissions greater than permit limits.

APC equipment malfunctions consist of scrubber or carbon injection malfunctions (i.e., pluggage of the lime or carbon slurry systems and atomizer failures), baghouse failures, and SNCR system failures. Short-term impacts for SNCR failures were not considered

since NO_2 has no short-term AAQS. For annual emissions and impacts as described later, SNCR failures were assumed to yield uncontrolled NO_X emissions of 350 ppmdv corrected to 7% O_2.

Scrubber malfunctions may be accompanied by normal flue gas temperatures (loss of lime feed only) or elevated flue gas temperatures (loss of both lime feed and water slurry). Acid gas emissions for either scenario would be similar. Since elevated temperatures result in higher plume rise and decreased impacts, impacts for normal stack gas temperatures were considered. Uncontrolled emissions during the malfunction would be five times greater than the proposed permit limits for normal conditions since the NSPS requires SO_2 control of 80%. Assuming a single 3-hour malfunction of all three units simultaneously in one 24-hour period would give 3-hour and 24-hour high second-high facility impacts of 65 and 4.7 ug/m^3, respectively. Added to maximum representative background concentrations of 149 and 50 ug/m^3, respectively, gives total concentrations that are 16% and 21% of the respective AAQS (mostly due to background). Thus, excess SO_2 emissions greater than the proposed permit levels as allowed in the NSPS would not be expected to cause or contribute to exceedances of the SO_2 AAQS even in the extremely unlikely event of simultaneous malfunction of all three units during periods when inlet SO2 concentrations are at the maximum expected levels. Again, emissions during most malfunction events will comply with the proposed permit levels.

Baghouse failures may occur periodically but to a lesser extent than other APC system problems. Bag ruptures, a potential failure mode, can be detected as elevated opacity readings at the stack. In most cases, bag ruptures do not cause an opacity exceedance and can be repaired without a combustion unit shutdown. Baghouse failures resulting in emissions greater than the proposed permit limit are infrequent. The duration of excess emissions resulting from a bag failure would be expected to be limited to less than 30 minutes as the offending baghouse module would be quickly isolated. However, assuming excess emissions twice the proposed permit limits (0.018 gr/dscf) averaged over 24-hours and a complete failure of the baghouse system for all three MWC units simultaneously for a 3-hour period allowed in the NSPS would result in a high second-high 24-hour facility impact of 0.588 ug/m^3. Adding the maximum 24-hour representative background value of 28 ug/m^3 gives a total PM_{10} impact that is 19% of the AAQS (again, mostly due to background). Therefore, excess PM_{10} emissions greater than the proposed permit levels as allowed in the NSPS would not be expected to cause or contribute to exceedances of the PM_{10} AAQS. Again, emissions during most malfunction events will comply with the proposed permit levels.

Maximum facility impacts for short-term averaging times (i.e., 24-hours or less) during S/S/M periods were shown to comply with AAQS for all criteria pollutants above. The effect of S/S/M periods on annual emissions and impacts was also considered. Recent facility operations indicate 14 scheduled startups, nine scheduled shutdown periods, and five unscheduled malfunction shutdowns per unit during a 12-month period. The number of S/S/M events presented above is provided to allow an assessment of the impact from these type of operations, based on prior operations. These values should not be included

as a permit condition as the actual number of S/S/M events will vary year to year. Startup/scheduled shutdown emissions before and after normal operations would be less than normal facility emissions as noted above due to the size and fuel used in the auxiliary burners and the reduced amount of MSW combusted. Therefore, these periods (about 0.8% of the year at three hours per occurrence) were not considered since they are expected to decrease rather than increase annual impacts. While excess emissions would not be expected to occur for all of the malfunction periods, five malfunction shutdowns (15 hours) only equals 0.17% of the year. During 1998-2000, excess emissions stated in the quarterly reports averaged 8 hours/year/unit for CO and 1 min/yr/unit for opacity (no excess emissions were reported for SO_2 or NO_X). Even if excess emissions occurred 1% of the year (88 hours), annual emissions increases would only be 5% for CO, 4% for SO_2, and 1% for NO_X and PM_{10} (with the maximum proposed or permitted emission rates during the remaining 99% of the year).

None of the increases in annual emissions due to S/S/M conditions would appreciably change the air quality modeling results or the fact that annual impacts are less than all regulatory-defined significant impact levels, de minimis monitoring levels, AAQS, PSD increments, etc. Since the units will operate on average at less than 100% availability and less than 110% of nominal load, average annual emissions will be less than the permit limits (i.e., maximum annual emissions for the proposed MWC unit and the existing MWC units are already considerably overstated). Further, if reduced emissions during shutdown periods and periods of unit downtime for repairs associated with the malfunctions were considered, annual emissions would also likely be less than those conservatively presented in this permit application for normal operations.

7.5 RISK ASSESSMENT ANALYSES

In Section 6.10 (Ambient Air Quality Standards), maximum facility impacts were compared to AAQS and background pollutant levels. It was shown that facility emissions would not cause or significantly contribute to ambient concentrations greater than the USEPA and Florida AAQS, which are designed to protect human health or public welfare for the PSD criteria pollutants (CO, SO_2, NO_2, PM_{10}, and Pb). In Section 6.11, a comparison of maximum non-criteria pollutant concentrations to Florida Ambient Reference Concentrations (ARCs) was provided. Maximum concentration impacts less than the ARCs are generally assumed to demonstrate that facility emissions would not cause conditions injurious to human health.

While these analyses are generally considered to conservatively estimate facility impacts on public health, they do not consider non-inhalation routes of exposure and other factors which are considered in more detailed risk assessments. Therefore, a human health risk assessment is contained in the PPSA application. An ecological risk assessment of the impact of the facility emissions on wildlife and other ecological values is also included in the PPSA application.

Since additional routes of exposure are considered in the risk assessments, modeling analyses of wet and dry deposition rates are required. Also averages of concentrations

and deposition rates across particular land features are also needed (the PSD analyses focus on maximum impact locations). A summary of the ISCST3 modeling analyses performed for the risk assessments is included here.

ISCST3 was used with the same receptor grids as described in Section 6 -- the 100-meter spaced "fine" receptor grid within two kilometers of the main facility stack, the 500-meter spaced "coarse" receptor grids from two to ten kilometers from the main facility stack, and an additional 100-meter spaced "fine" receptor grid west-southwest of the source (to determine overall maximum annual concentrations). These modeled receptors are collectively referred to as the "modeling domain." In the PSD modeling analyses, the area inside the fence immediately surrounding the LCERF was excluded from the modeling domain. However, in the risk assessment modeling analyses, the area inside the property boundary, which is also fenced, was excluded from the long-term analyses. Public access is deterred by the property boundary fence, so activities related to indirect exposure pathways, such as livestock grazing and vegetable gardening, would not occur within the property boundary.

The modeling domain was sufficient in size to determine maximum impact locations. Area-averaged long-term impacts in the modeling domain were calculated for the Caloosahatchee River, and the associated watershed, and in the area of typical ponds found south of the facility (defined as that portion of the modeling domain area bounded by Interstate 75 on the west and State Route 82 on the north). Area-averaged long-term impacts were also determined for the right-of-way area used to graze cattle along the western property boundary.

All five years of Fort Myers (1990 through 1994 from Page Field) meteorological data as described in Section 6 were used. Average 5-year concentrations and deposition rates were determined (both anywhere in the modeling domain outside the property boundary and in the areas described above). Maximum 1-hour concentrations were also calculated for the overall modeling domain outside the LCERF fenceline.

Maximum 1-hour and 5-year gaseous concentrations were modeled by assuming no deposition, depletion, or gravitational settling. Since no firm guidance yet exists for using ISCST3 algorithms to estimate wet deposition rates for gaseous pollutants, 5-year wet gaseous deposition was estimated by modeling gases as 0.01 micron (um) particles with liquid and ice wet scavenging coefficients of 1.65E-4 (considering the effects of wet depletion but not gravitational settling on modeling impacts) based on the procedures in the USEPA Region VI Risk Assessment Protocols for Hazardous Waste Combustion Facilities (USEPA, 1998b and 1999d). Dry gaseous deposition rates were estimated later in the risk assessments by multiplying the modeled annual gaseous concentrations by an appropriate deposition velocity.

Concentrations and deposition rates were also modeled assuming the pollutants were evenly distributed across the surfaces of the particulate matter emissions. The effects of plume depletion (due to wet and dry deposition) and gravitational settling were also considered. The modeled particulate distribution was based on data from the Wurzburg,

Germany facility (Hahn and Sussman, 1986). The mean diameter and surface area percentages, based on the USEPA Region VI Risk Assessment Protocols for Hazardous Waste Combustion Facilities (USEPA, 1998b and 1999d), are:

Particle Class	Mean Diameter	% By Mass	% By Surface Area
< 0.6 um	0.38 um	53%	90.0%
0.6 - 1.0 um	0.82 um	4%	3.1%
1.0 - 1.6 um	1.32 um	3%	1.5%
1.6 - 3.2 um	2.49 um	10%	2.6%
3.2 - 5.0 um	4.16 um	8%	1.2%
5.0 - 7.3 um	6.22 um	8%	0.8%
7.3 - 10.8 um	9.16 um	6%	0.4%
10.8 - 17.4 um	14.35 um	8%	0.4%

A mean particle density of 1.0 g/cm^3 was assumed in the ISCST3 modeling since the PM distribution data were likely derived from Cascade impactor data. Wet scavenging coefficients are the ISCST3 recommended values (i.e., 0.6E-4, 0.4E-4, 0.8E-4, 1.8E-4, 3.2E-4, 4.2E-4, 5.8E-4, and 6.6E-4 calculated for the mean particle class diameters from 0.38 um to 14.35 um, respectively, and assuming identical values for liquid and ice precipitation).

Facility impacts were modeled for the new MWC unit operating with the two existing MWCs (i.e., future combined facility impacts for both proposed and existing MWCs). Impacts were predicted for both gaseous and particulate pollutants using a "unitized" facility emission rate of 1.0 grams/second for all conditions. The worst-case 1-hour and 5-year source configurations determined by the screening analyses in Section 6 were considered. For the combined facility, worst-case impacts occur under Case 6 conditions for the proposed facility as shown in Table 6-5. Maximum long-term impacts occur for three operating units (Case F). Maximum 1-hour impacts occur surprisingly for two operating units (Case E), probably due to the interaction between plume height and mixing height. Therefore, for the risk assessments, these cases were remodeled with an emission rate of 1 g/s and these results are shown on Table 7-1.

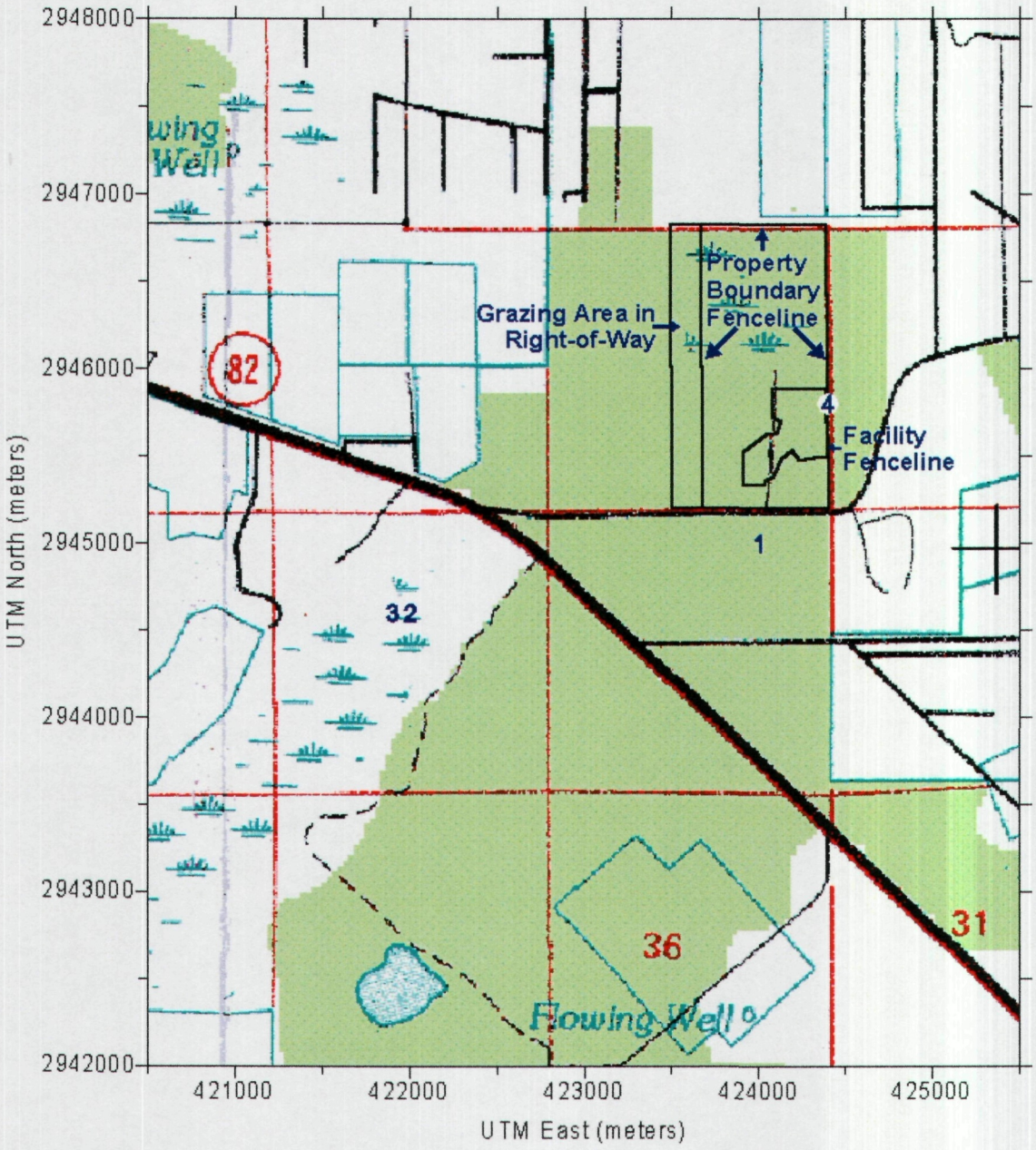
Because of depletion, 5-year particulate pollutant concentrations are slightly less than gaseous pollutant concentrations. Maximum 5-year wet deposition rates for both gaseous and particulate emissions decrease rapidly with increasing distance from the facility. Maximum 5-year dry deposition rates for particulate pollutants are less than maximum wet deposition rates. Finally, area-averaged maximum 5-year concentrations and deposition rates are similar for the areas considered. The locations of the maximum concentrations and deposition rates in the modeling domain are shown in Figure 7-1 for three operating units. Maximum wet and total deposition rates and 1-hour concentrations occur in the facility vicinity. Maximum 5-year concentrations and dry deposition rates occur 2.5 kilometers west-southwest of the stack.

TABLE 7-1
MODELING RESULTS FOR LEE COUNTY ENERGY RECOVERY FACILITY
RISK ASSESSMENT FOR COMBINED (PROPOSED AND EXISTING) MWC UNITS

ENTIRE FUTURE FACILITY	Overall Maximum for Modeling Domain		Modeling Domain Area-Average			
Pollutant Type and Modeled Parameter	**Maximum Modeled Impact**	**Location UTM (km)**	**Watershed for Typical Ponds**	**Caloosahatchee River**	**Caloosahatchee River Watershed**	**Right-of-Way Grazing Area**
Average Long-Term[a] Gaseous Pollutant Impacts for Case F (1 g/s emissions)						
Concentration (ug/m^3)	0.01289	422.0, 2944.6	0.00412	0.00340	0.00385	0.00284
Wet Deposition (g/m^2/yr)	0.08295	424.402,2945.8	0.00092	0.00038	0.00111	0.02848
Average Long-Term[a] Particulate Surface-Area Pollutant Impacts for Case F (1 g/s emissions)						
Concentration (ug/m^3)	0.01278	422.0, 2944.6	0.00406	0.00332	0.00378	0.00283
Total Deposition (g/m^2/yr)	0.03811	424.402, 2945.8	0.00072	0.00039	0.00082	0.01431
Dry Deposition (g/m^2/yr)	0.00027	421.9, 2944.6	0.000086	0.000058	0.000079	0.000048
Wet Deposition (g/m^2/yr)	0.03811	424.402,2945.8	0.00063	0.00033	0.00074	0.01426
Maximum Short-Term[b] Gaseous Pollutant Impacts for Case E (1 g/s emissions)						
1-Hour Concentration (ug/m^3)	2.97061	424.0, 2945.0	N/A	N/A	N/A	N/A

[a] Long-term impacts averaged over the five years of meteorological data modeled (1990-94 for Fort Myers Airport) for all areas outside the property boundary.
[b] Maximum 1-hour impact from all five years of meteorological data modeled (1990-94 for Fort Myers Airport) for all areas outside the facility fenceline.

FIGURE 7-1
MAXIMUM IMPACT LOCATIONS FOR RISK ASSESSMENTS



1 = Maximum 1-Hour Concentration
2 = Maximum Long-term Concentrations (Gases & Particulates)
3 = Maximum Long-term Dry Deposition Rate (Particulates)
4 = Maximum Long-term Wet Deposition Rates (Gases & Particulates) and Maximum Long-term Total Deposition Rate (Particulates)

Property Boundary and Facility Fencelines Shown
Source: USGS Ft. Myers 1:100,000 Scale Metric Map
Scale: 1" = 1000 meters

N

0m 1000m 2000m 3000m

Prepared by:
RTP Environmental Associates, Inc.

7.6 PSD CLASS I ANALYSIS

As part of the PSD permit application, air quality modeling analyses of increment consumption and impacts of PSD significant increases in pollutant emissions to other AQRVs in nearby Class I areas are required. The nearest PSD Class I area to the LCERF is Everglades National Park, located approximately 90 kilometers (km) south to southeast of the LCERF. The next closest Class I area, Chassahowitzka National Wildlife Refuge, is located nearly 250 km north of the LCERF. Impacts and AQRVs were therefore evaluated for the Everglades National Park only. Impacts in Everglades National Park were quantified using the CALPUFF Modeling System operated in a screening mode.

The modeling followed guidance provided by the Federal Land Managers' Air Quality Related Values Workgroup (FLAG) Phase I report (U.S. Forest Service et al., 2000), the Interagency Workgroup on Air Quality Modeling (IWAQM) Phase 2 Summary Report, and the Guidance on Nitrogen Deposition Analysis Thresholds criteria document. Details of the modeling approach were submitted to the National Park Service (NPS) in a modeling protocol, which was approved with some changes and additional guidance by Mr. John Notar of the NPS on November 8, 2001 (Graw, 2001).

CALPUFF was used to assess the potential impacts of the proposed modification on PSD Class I increments, regional haze, and deposition rates for nitrogen- and sulfur-containing species in the Everglades National Park. When CALPUFF is operated in a screening mode, a homogeneous wind-field is assumed for the entire modeling domain. Three receptor rings centered on the LCERF (424.2 km East and 2945.7 km North in UTM Zone 17) were created to quantify impacts: one ring representing the nearest Class I area boundary (88 km), another ring for the middle of the Class I area (146 km), and the third ring at the distance to the furthest Class I area boundary (205 km). Each receptor ring consists of 360 receptors equally spaced 1 degree apart. Due to the flat nature of southern Florida, no receptor elevations were considered. Reported concentrations are the maximum model-predicted impacts anywhere within the modeling domain, regardless if pollutants are predicted to be transported in a direction away from the Class I area.

CALPUFF was used in screening mode with five years of single station meteorology. The surface data required by CALPUFF for screening analyses includes pressure, relative humidity, precipitation, and horizontal global radiation data. The latest readily available five year period with horizontal global radiation data is 1986 through 1990 from the National Climatic Data Center (NCDC) Solar and Meteorological Surface Observation Network (SAMSON) CD. The nearest National Weather Service (NWS) surface station to the LCERF, Fort Myers Airport (Page Field), is not available on the SAMSON CD. The nearest SAMSON stations with solar radiation data are West Palm Beach (164 km from LCERF), Tampa (167 km), Miami (173 km), and Vero Beach (175 km). Based on conversations between Richard Graw of RTP Environmental Associates, Inc. (RTP) and Mr. John Notar of the NPS on September 26, 2001 (Graw, 2001), the Tampa surface station located at 27° 58' North latitude and 82° 32' West longitude in Time Zone 5 (EST) was selected for the Class I area screening analyses based on its similar exposure along Florida's Gulf Coast and expected sea breeze influences. The nearest NWS upper

air stations are West Palm Beach (164 km from LCERF) and Tampa (167 km). Due to its similar exposure along Florida's Gulf Coast, the Tampa upper air station was selected to determine representative mixing heights for the modeling analyses. PCRAMMET was used to generate the extended ISCST3 meteorological dataset using wet deposition and precipitation data options. Other PCRAMMET options were based on summer values for open agricultural and cultivated areas and are the same as those used to generate the Fort Myers ISCST3 modeling dataset as described in Section 6. The Tampa anemometer height is 22 feet.

CALPUFF is capable of simulating the chemical transformation of pollutants which contribute to regional haze and atmospheric deposition such as the transformation of sulfur dioxide to ammonium sulfate – a fine particle which effectively scatters light, thereby increasing haze. CALPUFF requires the user to provide background concentrations of other pollutants (e.g., ozone and ammonia) which participate in the chemical reactions in order to accurately quantify the impacts. For ozone (O_3), an average concentration of 24 ppb (based on nearby 7 am to 7 pm ozone season measurements) was used and, for ammonia (NH_3), a domain average value of 10.0 ppb was used (grassland regions) as suggested by Mr. John Notar of NPS on September 26, 2001 (Graw, 2001).

A CALPUFF control file was used which included IWAQM recommended defaults for the model options. This included rural dispersion coefficients, default wind speed profile exponents, default vertical potential temperature gradient and default surface characteristics for irrigated agricultural land. A brief summary of the options used in the modeling analysis are listed below:

- Number of X grid cells = 2
- Number of Y grid cells = 2
- Number of vertical layers = 1
- Grid Origin = 169.2 km East and 2690.7 km North in UTM Zone 17
- Grid spacing = 255 km
- Cell face heights = 0 and 5000 meters
- Minimum mixing height = 20 meters
- Maximum mixing height = 5000 meters (based on observational data)
- Minimum windspeed for non-calm conditions = 0.5 m/s
- Vertical distribution used in the near field = Gaussian
- Terrain adjustment method = partial plume path adjustment
- No puff splitting allowed
- Chemical mechanism = MESOPUFF-II
- Wet and dry removal modeled
- Dispersion coefficients = PG dispersion coefficients
- PG sigma-y and sigma-z not adjusted for roughness
- Partial plume penetration of elevated inversion allowed
- Lateral turbulence not used

The computational grid used extended 50 kilometers beyond the furthest receptor point. The maximum concentration for each pollutant averaging time modeled was compared with the appropriate AQRV. CALPOST options include the formation of hygroscopic species based on seasonal relative humidity [f(rh)] values and background concentrations of hygroscopic and non-hygroscopic species as presented for Everglades National Park in the FLAG Phase I report (U.S. Forest Service et al., 2000). Maximum hourly relative humidity was limited to 98%. CALPUFF values of light extinction were calculated for a 24-hour averaging period while CALPUFF predicted values of deposition were calculated for annual periods (8760 hours). CALPUFF predicted concentrations of PSD criteria pollutants SO_2, NO_2, and PM_{10} were calculated using the applicable averaging time (SO_2 = 3, 24, and 8760 hours; NO_2 = 8760 hours; and PM_{10} = 24 and 8760 hours). Other options used in the POSTUTIL and CALPOST post-processing programs are described below for the appropriate AQRV.

Maximum emission rates for the proposed modification (i.e., the new MWC unit) and the associated stack parameters used in the Class I analysis are shown on Tables 6-1 and 6-2 for Case 5. Sulfuric acid (H_2SO_4) emissions were modeled as sulfate (SO_4) by multiplying the sulfuric acid emission rate by the ratio of molecular weights (96/98).

7.6.1 PSD CLASS I INCREMENT ANALYSIS

Maximum concentrations predicted by CALPUFF for Unit 3 are shown on Table 7-2 for the PSD increment pollutants. USEPA has established PSD Class I increments for three pollutants: PM_{10}, SO_2, and NO_2. In addition, USEPA proposed Class I significant impact levels (SILs; 61 FR 38292, July 23, 1996) for these same pollutants. The maximum predicted concentrations are less than 3% of the PSD Class I increments for all pollutants. Since the maximum impacts are less than the proposed USEPA Class I SILs, no additional multisource modeling analyses (i.e., including other PSD sources) are typically required to demonstrate compliance with the PSD Class I increments.

7.6.2 PSD CLASS I AIR QUALITY RELATED VALUES

In addition to an analysis of PSD Class I increments, the applicant must also demonstrate that AQRVs in PSD Class I areas such as scenic vistas (i.e., based on CALPUFF modeled visibility impairment) and sensitive plants and ecosystems (i.e., based on CALPUFF modeled deposition rates of nitrogen- and sulfur-containing species) will not be threatened as a result of the proposed modification. The Federal Land Managers have established AQRV screening thresholds. If the applicant demonstrates that the maximum impacts are less than these screening thresholds, than further analyses would typically not be required. However, should the impacts exceed the screening thresholds, then more refined analysis may be required, depending upon the magnitude and frequency of occurrence, as evaluated on a case-by-case basis by the Federal Land Manager.

The CALPUFF-predicted change in light extinction is compared with the FLAG threshold of 5%, below which the proposed change is considered insignificant. Additionally, model-predicted nitrogen- and sulfur-containing species deposition rates

TABLE 7-2
COMPARISON OF MAXIMUM CLASS I IMPACTS TO USEPA
PROPOSED SIGNIFICANT IMPACT LEVELS AND CLASS I INCREMENTS

Pollutant Name	Averaging Time	Maximum Unit 3 Impacts (ug/m^3)	Proposed Class I SILs (ug/m^3)[a]	Percent of Proposed Class I SILs	PSD Class I Increments (ug/m^3)	Percent of PSD Class I Increments
PM_{10}	24-Hour	0.01404	0.3	4.68%	8	0.18%
PM_{10}	Annual	0.00110	0.2	0.55%	4	0.03%
SO_2	3-Hour	0.48556	1.0	48.56%	25	1.94%
SO_2	24-Hour	0.14901	0.2	74.51%	5	2.98%
SO_2	Annual	0.01294	0.1	12.94%	2	0.65%
NO_x	Annual	0.01171	0.1	11.71%	2.5	0.47%

[a] 61 Federal Register 38250, 1996 (specifically 61 FR 38292).

are compared with the FLAG threshold of 0.01 kilograms per hectare per year (kg/ha-yr), below which the proposed change is considered insignificant.

Model-predicted impacts on air quality related values were quantified using the same model, input data, and model options, as in the PSD Class I increment analysis. Two post-processing utilities, POSTUTIL and CALPOST, were also used as discussed below.

7.6.2.1 ACID DEPOSITION ANALYSES

Acid deposition is quantified by modeling the deposition rates of nitrogen- and sulfur-containing species. Emission rates of NO_X, SO_2, and SO_4 were input into CALPUFF, which in turn calculates the deposition rates of secondary species. Table 7-3 presents the species modeled in the CALPUFF program. Dry and wet flux output files created by CALPUFF were processed in POSTUTIL to obtain a combined total flux output file. In POSTUTIL, nitrogen and sulfur deposition fluxes were computed using a weighted sum of the deposition fluxes of all of the species computed and stored from the CALPUFF model run. Table 7-3 includes the weight of nitrogen or sulfur contained in each species modeled in the POSTUTIL program. All of the following contribute to the total nitrogen mass: SO_4 in the form of ammonium sulfate $[(NH_4)_2SO_4]$; NO_X as NO_2; HNO_3; and NO_3 in the form of ammonium nitrate $[(NH_4)NO_3]$. Only SO_2 and SO_4 contribute to the total sulfur mass. The total amount of nitrogen or sulfur contained in one gram of each of the species modeled was calculated using molecular weight ratios.

The resulting output file from the POSTUTIL program was processed in the CALPOST program to obtain total nitrogen and total sulfur deposition rates. A scaling factor was employed which converted the deposition rates from grams per square meter per second (g/m^2-sec) to kg/ha-yr. Table 7-4 presents the maximum model-predicted nitrogen and sulfur flux for Everglades National Park. The model-predicted nitrogen and sulfur deposition rates were lower than the FLAG thresholds of 0.01 kg/ha-yr for each compound, applicable in the Eastern United States. Therefore, the deposition impacts from the proposed modification are not considered significant and additional refined analyses are unnecessary.

7.6.2.2 REGIONAL HAZE ANALYSIS

The CALPOST post-processor was used to quantify the percent change in light extinction from the proposed modification. Since ammonium nitrate and ammonium sulfate particles form as a function of relative humidity (rh), seasonal values of this factor (f(rh)) are provided into CALPOST to account for this phenomenon. Seasonal f(rh) values documented in the FLAG report for Everglades National Park were used as input. Background concentrations of light scattering and absorbing species must also be provided in order for CALPOST to calculate the change in light extinction. The FLAG document provides seasonal values of hygroscopic and non-hygroscopic species for Everglades National Park, which were also used as input into CALPOST. Light extinction is calculated as a 24-hour averaged value.

TABLE 7-3
MODELING INPUTS FOR CALPUFF DEPOSITION ANALYSES

CHEMICAL SPECIES MODELED FOR DEPOSITION

Nitrogen Containing Species	Deposition Mechanism
HNO_3	Dry and Wet
NO_3	Dry and Wet
NO_x	Dry
Sulfur Containing Species	**Deposition Mechanism**
SO_2	Dry and Wet
SO_4	Dry and Wet

WEIGHT OF CHEMICAL SPECIES MODELED FOR DEPOSITION IN POSTUTIL

Species Contributing to Total Nitrogen	Weight[a]
$(NH_4)_2(SO_4)$ as SO_4	(2 x 14) / (32 + 4 x 16) = 0.291667
NO_x as NO_2	14 / (14 + 2 x 16) = 0.304348
HNO_3	14 / (1 + 14 + 3 x 16) = 0.222222
$(NH_4)NO_3$ as NO_3	(2 x 14) / (14 + 3 x 16) = 0.451623
Species Contributing to Total Sulfur	**Weight[a]**
SO_2	32 / (32 + 2 x 16) = 0.500000
SO_4	32 / (32 + 4 x 16) = 0.333333

[a] Number of grams of nitrogen or sulfur in one gram of species modeled, calculated from the molecular weights for nitrogen (14), sulfur (32), oxygen (16) and hydrogen (1) as shown above.

TABLE 7-4
MAXIMUM MODEL-PREDICTED NITROGEN AND SULFUR DEPOSITION RATES

Chemical Species	Deposition Rate (kg/ha-yr)	Screening Threshold (kg/ha-yr)	Percent of Screening Threshold
Total Nitrogen	0.00358	0.010	35.8%
Total Sulfur	0.00669	0.010	66.9%

The maximum model-predicted light extinction (B_{ext}), background light extinction, and percent change in light extinction are presented in Table 7-5. The maximum predicted change in light extinction is slightly greater than 5%, which is predicted to occur for one day out of the five years (1826 days) modeled at five of the 1080 receptors. The results are based upon the maximum 3-hour emission rates for SO_2 and sulfuric acid (H_2SO_4) and the 24-hour averaged concentration of light scattering and absorbing species.

The analysis was refined by using the 24-hour SO_2 and sulfuric acid emission rates to be consistent with the averaging period of the light scattering and absorbing species calculated in CALPUFF. The maximum 24-hour emission rate of these species (SO_2 and sulfuric acid) is 66% of the 3-hour emission rates reported on Table 6-2 for Case 5 (i.e., outlet SO_2 concentrations of 100 and 66 ppmdv corrected to 7% O_2 for 3-hour and 24-hour averaging times, respectively, with H_2SO_4 equal to 24% of SO_2 emission rate on a lb/hr or g/s basis). The results from the revised analysis with 24-hour emission rates are included on Table 7-5. For the 24-hour emission rates of SO_2 and H_2SO_4, the model-predicted change in light extinction is 4.01%, which is less than the 5% screening threshold. This is nevertheless a very conservative assessment. Therefore, the proposed modification does not pose a threat to regional haze at Everglades National Park.

TABLE 7-5
MODEL-PREDICTED CHANGE IN LIGHT EXTINCTION IN EVERGLADES NATIONAL PARK

Emission Source	Model-Predicted B_{ext} (Mm^{-1})	Background B_{ext} (Mm^{-1})	Percent Change in B_{ext}
Unit 3 With 3-Hour Emission Rates	1.168	21.83	5.35%
Unit 3 With 24-Hour Emission Rates	0.875	21.83	4.01%

LEE COUNTY ENERGY RECOVERY FACILITY
PREVENTION OF SIGNIFICANT DETERIORATION
APPLICATION FOR MUNICIPAL WASTE COMBUSTOR UNIT 3

SECTION 8
REFERENCES

October 31, 2002

SECTION 8
REFERENCES

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LEE COUNTY ENERGY RECOVERY FACILITY
PREVENTION OF SIGNIFICANT DETERIORATION
APPLICATION FOR MUNICIPAL WASTE COMBUSTOR UNIT 3

SECTION 9
ATTACHMENTS

October 31, 2002

LEE COUNTY ENERGY RECOVERY FACILITY
PREVENTION OF SIGNIFICANT DETERIORATION
APPLICATION FOR MUNICIPAL WASTE COMBUSTOR UNIT 3

ATTACHMENT A

FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION AIR PERMIT APPLICATION FORMS

October 31, 2002

Department of Environmental Protection

Division of Air Resources Management

APPLICATION FOR AIR PERMIT - TITLE V SOURCE

See Instructions for Form No. 62-210.900(1)

I. APPLICATION INFORMATION

Identification of Facility

1. Facility Owner/Company Name: Lee County Board of County Commissioners	
2. Site Name: Lee County Energy Recovery Facility	
3. Facility Identification Number: 0710119 [ ] Unknown	
4. Facility Location: Street Address or Other Locator: 10500 Buckingham Road City: Fort Myers County: Lee Zip Code: 33905	
5. Relocatable Facility? [ ] Yes [X] No	6. Existing Permitted Facility? [X] Yes [ ] No

Application Contact

1. Name and Title of Application Contact: Mr. Samuel M. Rosania, R.E.M./Project Scientist
2. Application Contact Mailing Address: Organization/Firm: Malcolm Pirnie, Inc. Street Address: 1715 East 9th Avenue City: Tampa State: FL Zip Code: 33605
3. Application Contact Telephone Numbers: Telephone: (813) 248 - 6900 Fax: (813) 248 - 8085

Application Processing Information (DEP Use)

1. Date of Receipt of Application:	
2. Permit Number:	
3. PSD Number (if applicable):	
4. Siting Number (if applicable):	

Purpose of Application

Air Operation Permit Application

This Application for Air Permit is submitted to obtain: (Check one)

[ ] Initial Title V air operation permit for an existing facility which is classified as a Title V source.

[ ] Initial Title V air operation permit for a facility which, upon start up of one or more newly constructed or modified emissions units addressed in this application, would become classified as a Title V source.

Current construction permit number:_____

[ ] Title V air operation permit revision to address one or more newly constructed or modified emissions units addressed in this application.

Current construction permit number:_____

Operation permit number to be revised:_____

[ ] Title V air operation permit revision or administrative correction to address one or more proposed new or modified emissions units and to be processed concurrently with the air construction permit application. (Also check Air Construction Permit Application below.)

Operation permit number to be revised/corrected:_____

[ ] Title V air operation permit revision for reasons other than construction or modification of an emissions unit. Give reason for the revision; e.g., to comply with a new applicable requirement or to request approval of an "Early Reductions" proposal.

Operation permit number to be revised:_____

Reason for revision:_____

Air Construction Permit Application

This Application for Air Permit is submitted to obtain: (Check one)

[X] Air construction permit to construct or modify one or more emissions units.

[ ] Air construction permit to make federally enforceable an assumed restriction on the potential emissions of one or more existing, permitted emissions units.

[ ] Air construction permit for one or more existing, but unpermitted, emissions units.

Owner/Authorized Representative or Responsible Official

1. Name and Title of Owner/Authorized Representative or Responsible Official:
   Mr. Lindsey Sampson

2. Owner/Authorized Representative or Responsible Official Mailing Address:
   Organization/Firm: Lee County Solid Waste Division
   Street Address: 10500 Buckingham Road
   City: Fort Myers State: FL Zip Code: 33905

3. Owner/Authorized Representative or Responsible Official Telephone Numbers:
   Telephone: (239) 338 - 3302 Fax: (239) 461 - 5871

4. Owner/Authorized Representative or Responsible Official Statement:

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

Lindsey J Sampson — Signature

11/7/02 — Date

* Attach letter of authorization if not currently on file.

Professional Engineer Certification

1. Professional Engineer Name: Amit Chattopadhay, P.E.
   Registration Number: 52823

2. Professional Engineer Mailing Address:
   Organization/Firm: Malcolm Pirnie, Inc.
   Street Address: 17-17 Route 208 North
   City: Fair Lawn State: NJ Zip Code: 07410

3. Professional Engineer Telephone Numbers:
   Telephone: (201) 797 - 7400 Fax: (201) 797 - 4558

4. Professional Engineer Statement:

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

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

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

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

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

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

Amit Chattopadhyay — Signature

11/7/2002 — Date

(seal)

* Attach any exception to certification statement.

Scope of Application

Emissions Unit ID	Description of Emissions Unit	Permit Type	Processing Fee
	Municipal Waste Combustion Unit No. 3	AC1A	
	Lime Silo II	AC1F	

Application Processing Fee

Check one: [ ] Attached - Amount: $_____ [X] Not Applicable

Construction/Modification Information

1. Description of Proposed Project or Alterations:

The Lee County Solid Waste Division operates the Lee County Energy Recovery Facility (LCERF) at 10500 Buckingham Road east of Fort Myers, Florida. The current facility consists of two Martin GmbH mass-burn traveling grate combustors each rated at a capacity of 660 tons/day (tpd) per unit for a total of 1,320 tons per day of solid waste fuel with a nominal HHV of 5,000 Btu/lb. Due to a growth in population since the facility came online in 1994, Lee County has decided to expand their current facility through the addition of a third 660-tpd combustion unit (Unit 3) that is a separate source. This facility expansion is not a modification of the existing two municipal waste combustors (Units 1 and 2).

2. Projected or Actual Date of Commencement of Construction: January 1, 2003

3. Projected Date of Completion of Construction: To Be Provided Later.

Application Comment

Application fees for this Prevention of Significant Deterioration application are covered by the LCERF's Power Plant Siting Act (PPSA) fees. The LCERF currently operates under the PPSA Conditions of Certification Case Number PA90-30.

II. FACILITY INFORMATION

A. GENERAL FACILITY INFORMATION

Facility Location and Type

1. Facility UTM Coordinates: Zone: 17	East (km): 424.21	North (km): 2945.70	
2. Facility Latitude/Longitude: Latitude (DD/MM/SS): 26/37/54	Longitude (DD/MM/SS): -81/45/41		
3. Governmental Facility Code: 3	4. Facility Status Code: A	5. Facility Major Group SIC Code: 49	6. Facility SIC(s): 4953
7. Facility Comment (limit to 500 characters): LCERF Operator is: Covanta Lee, Inc. (Formerly Ogden-Martin Systems of Lee, Inc.) 10500 Buckingham Road, Suite 400 Fort Myers, FL 33905 Tel: (941) 337-2200/Fax: (941) 337-2510 The Facility's two existing MWC units currently operate under the following air permits: PPSA Conditions of Certification PA90-30 FDEP Permit 0710119-001-AV PSD-FL-151 PSD-FL-151A PSD-FL-151B			

Facility Contact

1. Name and Title of Facility Contact: Tom Eriksen, Facility Manager			
2. Facility Contact Mailing Address: Organization/Firm: Covanta Lee, Inc. Street Address: 10500 Buckingham Road, Suite 400 City: Fort Myers	State: FL	Zip Code: 33905	
3. Facility Contact Telephone Numbers: Telephone: (941) 337 - 2200	Fax: (941) 337 - 2510		

Facility Regulatory Classifications

Check all that apply:

1. [ ] Small Business Stationary Source? [ ] Unknown
2. [X] Major Source of Pollutants Other than Hazardous Air Pollutants (HAPs)?
3. [ ] Synthetic Minor Source of Pollutants Other than HAPs?
4. [X] Major Source of Hazardous Air Pollutants (HAPs)?
5. [ ] Synthetic Minor Source of HAPs?
6. [X] One or More Emissions Units Subject to NSPS?
7. [ ] One or More Emission Units Subject to NESHAP?
8. [X] Title V Source by EPA Designation?
9. Facility Regulatory Classifications Comment (limit to 200 characters):

List of Applicable Regulations

40 CFR Part 50	40 CFR Part 52.21
40 CFR Part 60, Subpart Eb	40 CFR Part 60, Appendix A
40 CFR Part 60, Appendix B	
40 CFR Part 64	
Rule 62-204, F.A.C.	
Rule 62-210, F.A.C.	
Rule 62-212, F.A.C.	
Rule 62-296.416, F.A.C.	
Rule 62-297, F.A.C.	

B. FACILITY POLLUTANTS

List of Pollutants Emitted

1. Pollutant Emitted	2. Pollutant Classif.	3. Requested Emissions Cap		4. Basis for Emissions Cap	5. Pollutant Comment
		lb/hour	tons/year		
PM	B	5.08	22.26	Rule	USEPA NSPS
PM10	B	5.08	22.26	Rule	USEPA NSPS
CO	A	28.73	125.8	Rule	USEPA NSPS
SO2	A	65.72	287.8	Rule	USEPA NSPS
NOX	A	70.79	310.1	Rule	USEPA NSPS
PB	B	4.94 E-2	0.216	Rule	USEPA NSPS
VOC	B	4.936	21.62	ESCPSD	
H027	B	4.94 E-3	0.0216	Rule	USEPA NSPS (Cadmium)
DIOX	B	3.21 E-6	1.406 E-5	Rule	USEPA NSPS
H107	B	0.718	3.145	Rule	40 CFR 52.21 (HF)
H106	A	46.76	204.8	Rule	USEPA NSPS (HCl)
H114	B	4.26 E-2	0.187	Rule	USEPA NSPS (Mercury)
SAM	B	16.78	73.51	Rule	40 CFR 52.21
H021	B	3.95 E-5	1.73 E-4	ESCPSD	(Beryllium)
H015	B	2.65 E-3	0.0116	Other	Units 1 and 2 operation (Arsenic)
Ammonia	B	8.72	38.190	Other	Based on operation of Units 1 and 2.
HAPS	A	47.58	208.4	Rule	40 CFR 52.21

C. FACILITY SUPPLEMENTAL INFORMATION

Supplemental Requirements

1. Area Map Showing Facility Location: [X] Attached, Document ID: Fig. 1-1 [ ] Not Applicable [ ] Waiver Requested
2. Facility Plot Plan: [X] Attached, Document ID: Fig. 6-2 [ ] Not Applicable [ ] Waiver Requested
3. Process Flow Diagram(s): [X] Attached, Document ID: Below [ ] Not Applicable [ ] Waiver Requested
4. Precautions to Prevent Emissions of Unconfined Particulate Matter: [X] Attached, Document ID: Below [ ] Not Applicable [ ] Waiver Requested
5. Fugitive Emissions Identification: [X] Attached, Document ID: Below [ ] Not Applicable [ ] Waiver Requested
6. Supplemental Information for Construction Permit Application: [X] Attached, Document ID: See PSD Application Write-up [ ] Not Applicable
7. Supplemental Requirements Comment: The map showing facility location is Figure 1-1 of the PSD application. The facility plot plan is Figure 6-2 of the PSD application. The process flow diagram is provided in the PSD application write-up. Precautions to Prevent Emissions of Unconfined Particulate Matter are provided in the PSD application write-up in Section 6. Fugitive Emissions Identification is provided in the PSD application write-up in Section 6.4 (Source Data). Proposed Insignificant Activities are listed in the PSD application write-up in Section 6.4 (Source Data). The identification of additional applicable requirements is provided in the PSD application write-up.

Additional Supplemental Requirements for Title V Air Operation Permit Applications

8. List of Proposed Insignificant Activities:
   [X] Attached, Document ID: See field 7 above [ ] Not Applicable

9. List of Equipment/Activities Regulated under Title VI:
   [ ] Attached, Document ID:_____
   [ ] Equipment/Activities On site but Not Required to be Individually Listed
   [X] Not Applicable

10. Alternative Methods of Operation:
    [ ] Attached, Document ID:_____ [X] Not Applicable

11. Alternative Modes of Operation (Emissions Trading):
    [ ] Attached, Document ID:_____ [X] Not Applicable

12. Identification of Additional Applicable Requirements:
    [X] Attached, Document ID: See field 7 above [ ] Not Applicable

13. Risk Management Plan Verification:
    [X] Plan previously submitted to Chemical Emergency Preparedness and Prevention Office (CEPPO). Verification of submittal attached (Document ID: Attachment G) or previously submitted to DEP (Date and DEP Office:_____)
    [ ] Plan to be submitted to CEPPO (Date required:_____)
    [ ] Not Applicable

14. Compliance Report and Plan:
    [ ] Attached, Document ID:_____ [X] Not Applicable

15. Compliance Certification (Hard-copy Required):
    [ ] Attached, Document ID:_____ [X] Not Applicable

III. EMISSIONS UNIT INFORMATION

A separate Emissions Unit Information Section (including subsections A through J as required) must be completed for each emissions unit addressed in this Application for Air Permit. If submitting the application form in hard copy, indicate, in the space provided at the top of each page, the number of this Emissions Unit Information Section and the total number of Emissions Unit Information Sections submitted as part of this application.

A. GENERAL EMISSIONS UNIT INFORMATION (All Emissions Units)

Emissions Unit Description and Status

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

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

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

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

2. Regulated or Unregulated Emissions Unit? (Check one)

[X] The emissions unit addressed in this Emissions Unit Information Section is a regulated emissions unit.

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

3. Description of Emissions Unit Addressed in This Section (limit to 60 characters):

Municipal waste combustor unit rated at 660 tons of municipal solid waste per day.

4. Emissions Unit Identification Number: [X] No ID
ID: [ ] ID Unknown

5. Emissions Unit Status Code:	6. Initial Startup Date:	7. Emissions Unit Major Group SIC Code:	8. Acid Rain Unit?
C		49	[ ]

9. Emissions Unit Comment: (Limit to 500 Characters)

Emissions Unit Control Equipment

1. Control Equipment/Method Description (Limit to 200 characters per device or method):

Air Pollution Control (APC) equipment for the third unit will be similar to APC equipment for the two existing units; namely, a spray dry absorber, fabric filter baghouse, activated carbon injection system, and selective non-catalytic reduction system.

2. Control Device or Method Code(s): 016, 025, 048, 067, 107

Emissions Unit Details

1. Package Unit: Manufacturer:	To Be Determined	Model Number: To Be Determined
2. Generator Nameplate Rating:	+- 20	MW (Nominal)
3. Incinerator Information:	To Be Determined	
Dwell Temperature:		°F
Dwell Time:		seconds
Incinerator Afterburner Temperature:		°F

B. EMISSIONS UNIT CAPACITY INFORMATION
(Regulated Emissions Units Only)

Emissions Unit Operating Capacity and Schedule

1. Maximum Heat Input Rate:	275			mmBtu/hr
2. Maximum Incineration Rate:	55,000	lb/hr	660	tons/day
3. Maximum Process or Throughput Rate:	660 tons per day (annual basis)			
4. Maximum Production Rate:				
5. Requested Maximum Operating Schedule:				
	24	hours/day	7	days/week
	52	weeks/year	8,760	hours/year

6. Operating Capacity/Schedule Comment (limit to 200 characters):

Municipal Waste Combustor unit 3 is rated at 660 tons per day at a reference higher heating value (HHV)of 5,000 Btu per pound of waste on an annual basis. The Lee County Energy Recovery Facility is permitted to burn waste under their Power Plant Siting Act Conditions of Certification for Case Number PA90-30.

C. EMISSIONS UNIT REGULATIONS
(Regulated Emissions Units Only)

List of Applicable Regulations

40 CFR Part 50	National Primary and Secondary Ambient Air Quality Standards
40 CFR Part 52.21	Prevention of Significant Deterioration of Air Quality
40 CFR Part 60, Subpart Eb	New Source Performance Standards for Large Municipal Waste Combustors
40 CFR Part 60, Appendix A	Test Methods
40 CFR Part 60, Appendix B	Performance Specifications
40 CFR Part 64	Compliance Assurance Monitoring
Rule 62-204 F.A.C.	Air Pollution Control - General Provisions
Rule 62-210 F.A.C.	Stationary Sources - General Requirements
Rule 62-212 F.A.C.	Stationary Sources - Preconstruction Review
Rule 62-296.416 F.A.C.	Stationary Sources – Emission Standards for Waste-to-Energy Facilities
Rule 62-297 F.A.C.	Stationary Sources - Emissions Monitoring

D. EMISSION POINT (STACK/VENT) INFORMATION
(Regulated Emissions Units Only)

Emission Point Description and Type

1. Identification of Point on Plot Plan or Flow Diagram? See Field 14 Below.	2. Emission Point Type Code: 1
3. Descriptions of Emission Points Comprising this Emissions Unit for VE Tracking (limit to 100 characters per point):	
4. ID Numbers or Descriptions of Emission Units with this Emission Point in Common:	

5. Discharge Type Code: V	6. Stack Height: 276 feet	7. Exit Diameter: 6.17 feet
8. Exit Temperature: 270 °F	9. Actual Volumetric Flow Rate: 80,000-155,800 acfm	10. Water Vapor: 14.73 %

11. Maximum Dry Standard Flow Rate: 35800-65,900	12. Nonstack Emission Point Height: feet

13. Emission Point UTM Coordinates:

Zone: 17 East (km): 424.20 North (km): 2945.70

14. Emission Point Comment (limit to 200 characters):
From Field 1 Above: Emission Point is located in the upper right area of Figure 6-2 of the PSD Application. The emission point is located at an elevation of 276 feet above grade (271 feet for structural stack plus 5 feet for flue).

The stack contains space three separate flues, one for each combustor unit. Flues for Units 1 and 2 currently are in the facility stack. The flue for Unit 3 will be installed during this project.

The maximum dry standard flow rate in field 11 above is corrected to 7% oxygen. Flow ranges above correspond to operation of unit over the operating window. See Section 6 of the PSD application documentation for further information on this operating window, specifically Figure 6-1.

E. SEGMENT (PROCESS/FUEL) INFORMATION
(All Emissions Units)

Segment Description and Rate: Segment 1 of 1.

1. Segment Description (Process/Fuel Type) (limit to 500 characters): Municipal solid waste (MSW) generated in the Lee County area is combusted by the facility to generate thermal energy and heat water producing steam. This steam is used to power an electrical generator and produce electricity that is sold to the power grid. The MSW is rated at 5,000 Btu/pound under the PPSA Conditions of Certification Case Number PA90-30.		
2. Source Classification Code (SCC): 50100105	3. SCC Units: Tons Burned	
4. Maximum Hourly Rate: 27.5	5. Maximum Annual Rate: 240,900	6. Estimated Annual Activity Factor:
7. Maximum % Sulfur:	8. Maximum % Ash:	9. Million Btu per SCC Unit: 10
10. Segment Comment (limit to 200 characters):		

Segment Description and Rate: Segment _____ of _____

1. Segment Description (Process/Fuel Type) (limit to 500 characters):		
2. Source Classification Code (SCC):	3. SCC Units:	
4. Maximum Hourly Rate:	5. Maximum Annual Rate:	6. Estimated Annual Activity Factor:
7. Maximum % Sulfur:	8. Maximum % Ash:	9. Million Btu per SCC Unit:
10. Segment Comment (limit to 200 characters):		

F. EMISSIONS UNIT POLLUTANTS
(All Emissions Units)

1. Pollutant Emitted	2. Primary Control Device Code	3. Secondary Control Device Code	4. Pollutant Regulatory Code
PM	016		EL
PM10	016		EL
CO	025		EL
SO2	067	016	EL
NOX	107		EL
PB	016		EL
VOC	025		EL
H027	016		EL
DIOX	025	067	EL
H107	067	016	EL
H106	067	016	EL
H114	048	016	EL
SAM	067	016	EL
H021	016		EL
H015	016		EL
Ammonia			EL
HAPS	016	025	EL

G. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION
(Regulated Emissions Units -
Emissions-Limited and Preconstruction Review Pollutants Only)

Potential/Fugitive Emissions

1. Pollutant Emitted: PM	2. Total Percent Efficiency of Control:
3. Potential Emissions: 5.08 lb/hour 22.26 tons/year	4. Synthetically Limited? [ ]
5. Range of Estimated Fugitive Emissions: [ ] 1 [ ] 2 [ ] 3 _____ to _____ tons/year	
6. Emission Factor: 0.009 grains/dscf @ 7% O_2 Reference: Past operation of units 1 and 2 at facility	7. Emissions Method Code: 0
8. Calculation of Emissions (limit to 600 characters): $\frac{0.009 \text{ grains @ 7\% } O_2}{\text{dscf}} x \frac{\text{lb}}{7{,}000 \text{ grains}} x \frac{65{,}868 \text{ dscf @ 7\% } O_2}{\text{minute}} x \frac{60 \text{ minute}}{\text{hour}}$	
9. Pollutant Potential/Fugitive Emissions Comment (limit to 200 characters):	

Allowable Emissions Allowable Emissions 1 of 1.

1. Basis for Allowable Emissions Code: OTHER	2. Future Effective Date of Allowable Emissions:
3. Requested Allowable Emissions and Units: 0.009 grains/dscf @ 7% O_2	4. Equivalent Allowable Emissions: 5.08 lb/hour 22.26 tons/year
5. Method of Compliance (limit to 60 characters): USEPA Method 5 [as per 40 CFR 60.58b(c)]	
6. Allowable Emissions Comment (Desc. of Operating Method) (limit to 200 characters): Emission factor is based on an analysis of past operation of units 1 and 2 at the facility in addition to other available data for municipal waste combustion facilities.	

G. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION
(Regulated Emissions Units -
Emissions-Limited and Preconstruction Review Pollutants Only)

Potential/Fugitive Emissions

1. Pollutant Emitted: PM10	2. Total Percent Efficiency of Control:
3. Potential Emissions: 5.08 lb/hour 22.26 tons/year	4. Synthetically Limited? [ ]
5. Range of Estimated Fugitive Emissions: [ ] 1 [ ] 2 [ ] 3 _____ to _____ tons/year	
6. Emission Factor: 0.009 grains/dscf @ 7% O_2 Reference: Past operation of units 1 and 2 at facility	7. Emissions Method Code: 0
8. Calculation of Emissions (limit to 600 characters): $\frac{0.009 \text{ grains @ 7\% } O_2}{\text{dscf}} x \frac{\text{lb}}{7{,}000 \text{ grains}} x \frac{65{,}868 \text{ dscf @ 7\% } O_2}{\text{minute}} x \frac{60 \text{ minute}}{\text{hour}}$	
9. Pollutant Potential/Fugitive Emissions Comment (limit to 200 characters):	

Allowable Emissions Allowable Emissions 1 of 1

1. Basis for Allowable Emissions Code: OTHER	2. Future Effective Date of Allowable Emissions:
3. Requested Allowable Emissions and Units: 0.009 grains/dscf @ 7% O_2	4. Equivalent Allowable Emissions: 5.08 lb/hour 22.26 tons/year
5. Method of Compliance (limit to 60 characters): USEPA Method 5 [as per 40 CFR 60.58b(c)]	
6. Allowable Emissions Comment (Desc. of Operating Method) (limit to 200 characters): Emission factor is based on an analysis of past operation of units 1 and 2 at the facility in addition to other available data for municipal waste combustion facilities.	

G. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION
(Regulated Emissions Units - Emissions-Limited and Preconstruction Review Pollutants Only)

Potential/Fugitive Emissions

1. Pollutant Emitted: CO	2. Total Percent Efficiency of Control:
3. Potential Emissions: 28.73 lb/hour 125.8 tons/year	4. Synthetically Limited? [ ]
5. Range of Estimated Fugitive Emissions: [ ] 1 [ ] 2 [ ] 3 _____ to _____ tons/year	
6. Emission Factor: 100 ppmdv @7% O_2 Reference: 40 CFR 60, Subpart Eb	7. Emissions Method Code: 0

8. Calculation of Emissions (limit to 600 characters):

$$\frac{100\ \text{ppmdv @ 7\% O}_2}{1 \times 10^6} \times \frac{28.01\ \text{lb}}{\text{lb mole}} \times \frac{65{,}868\ \text{dscf @ 7\% O}_2}{\text{minute}} \times \frac{60\ \text{minute}}{\text{hour}} \times \frac{\text{mole}}{385.3\ \text{dscf}}$$

9. Pollutant Potential/Fugitive Emissions Comment (limit to 200 characters):

Allowable Emissions Allowable Emissions 1 of 1

1. Basis for Allowable Emissions Code: RULE	2. Future Effective Date of Allowable Emissions:
3. Requested Allowable Emissions and Units: 100 ppmdv @ 7% O_2	4. Equivalent Allowable Emissions: 28.73 lb/hour 125.8 tons/year
5. Method of Compliance (limit to 60 characters): CEM [as per 40 CFR 60.58b(i)]	
6. Allowable Emissions Comment (Desc. of Operating Method) (limit to 200 characters): Emission source is applicable to 40 CFR 60, Subpart Eb.	

G. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION
(Regulated Emissions Units - Emissions-Limited and Preconstruction Review Pollutants Only)

Potential/Fugitive Emissions

1. Pollutant Emitted: SO2	2. Total Percent Efficiency of Control: 80%
3. Potential Emissions: 65.72 lb/hour 287.8 tons/year	4. Synthetically Limited? [ ]
5. Range of Estimated Fugitive Emissions: [ ] 1 [ ] 2 [ ] 3 _____ to _____ tons/year	
6. Emission Factor: 100 ppmdv @ 7% O_2 Reference: 40 CFR 60, Subpart Eb	7. Emissions Method Code: 0

8. Calculation of Emissions (limit to 600 characters):

$$\frac{100\ \text{ppmdv @ 7\% O}_2}{1 \times 10^6} \times \frac{64.07\ \text{lb}}{\text{lb mole}} \times \frac{65{,}868\ \text{dscf @ 7\% O}_2}{\text{minute}} \times \frac{60\ \text{minute}}{\text{hour}} \times \frac{\text{mole}}{385.3\ \text{dscf}}$$

9. Pollutant Potential/Fugitive Emissions Comment (limit to 200 characters):

40 CFR 60.52b(b) limits SO_2 emissions to 30 ppmdv (at 7% O_2) or 20% (by weight or volume) of potential SO2 emissions concentration, whichever is less stringent (20% of uncontrolled SO_2 emissions is conservatively estimated to be 100 ppmdv at 7% O_2).

Allowable Emissions Allowable Emissions 1 of 1

1. Basis for Allowable Emissions Code: RULE	2. Future Effective Date of Allowable Emissions:
3. Requested Allowable Emissions and Units: 100 ppmdv @ 7% O_2	4. Equivalent Allowable Emissions: 65.72 lb/hour 287.8 tons/year
5. Method of Compliance (limit to 60 characters): CEM [as per 40 CFR 60.58b(e)]	

6. Allowable Emissions Comment (Desc. of Operating Method) (limit to 200 characters):

40 CFR 60.52b(b) limits SO_2 emissions to 30 ppmdv (at 7% O_2) or 20% (by weight or volume) of potential SO2 emissions concentration, whichever is less stringent (20% of uncontrolled SO_2 emissions is conservatively estimated to be 100 ppmdv at 7% O_2).

G. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION
(Regulated Emissions Units - Emissions-Limited and Preconstruction Review Pollutants Only)

Potential/Fugitive Emissions

1. Pollutant Emitted: NOX	2. Total Percent Efficiency of Control: Approx. 40%
3. Potential Emissions: 70.79 lb/hour 310.1 tons/year	4. Synthetically Limited? [ ]
5. Range of Estimated Fugitive Emissions: [ ] 1 [ ] 2 [ ] 3 _____ to _____ tons/year	
6. Emission Factor: 150 ppmdv @ 7% O_2 Reference: 40 CFR 60, Subpart Eb	7. Emissions Method Code: 0

8. Calculation of Emissions (limit to 600 characters):

$$\frac{150\ \text{ppmdv @ 7\% O}_2}{1 \times 10^6} \times \frac{46.01\ \text{lb}}{\text{lb mole}} \times \frac{65{,}868\ \text{dscf @ 7\% O}_2}{\text{minute}} \times \frac{60\ \text{minute}}{\text{hour}} \times \frac{\text{mole}}{385.3\ \text{dscf}}$$

9. Pollutant Potential/Fugitive Emissions Comment (limit to 200 characters):

180 ppmdv at 7% O_2 for the first year of operation, thereafter 150 ppmdv at 7% O_2.

Allowable Emissions Allowable Emissions 1 of 1

1. Basis for Allowable Emissions Code: RULE	2. Future Effective Date of Allowable Emissions:
3. Requested Allowable Emissions and Units: 150 ppmdv @ 7% O_2	4. Equivalent Allowable Emissions: 70.79 lb/hour 310.1 tons/year
5. Method of Compliance (limit to 60 characters): CEM [as per 40 CFR 60.58b(h)]	

6. Allowable Emissions Comment (Desc. of Operating Method) (limit to 200 characters):

40 CFR 60, Subpart Eb establishes a NOx limit of 180 ppmdv at 7% O_2 for the first year of operation, thereafter the limit is 150 ppmdv at 7% O_2.

G. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION
(Regulated Emissions Units - Emissions-Limited and Preconstruction Review Pollutants Only)

Potential/Fugitive Emissions

1. Pollutant Emitted: Pb	2. Total Percent Efficiency of Control:
3. Potential Emissions: 4.94 E-2 lb/hour 0.216 tons/year	4. Synthetically Limited? [ ]
5. Range of Estimated Fugitive Emissions: [ ] 1 [ ] 2 [ ] 3 _____ to _____ tons/year	
6. Emission Factor: 0.200 mg/dscm @ 7% O_2 Reference: 40 CFR 60, Subpart Eb	7. Emissions Method Code: 0

8. Calculation of Emissions (limit to 600 characters):

$$\frac{0.2\ \text{mg @ 7\% O}_2}{\text{dscm}} \times \frac{\text{gram}}{1000\ \text{mg}} \times \frac{\text{dscm}}{35.31\ \text{dscf}} \times \frac{65{,}868\ \text{dscf @ 7\% O}_2}{\text{minute}} \times \frac{60\ \text{minute}}{\text{hour}} \times \frac{\text{lb}}{453.59\ \text{gram}}$$

9. Pollutant Potential/Fugitive Emissions Comment (limit to 200 characters):

Allowable Emissions Allowable Emissions 1 of 1

1. Basis for Allowable Emissions Code: RULE	2. Future Effective Date of Allowable Emissions:
3. Requested Allowable Emissions and Units: 0.200 mg/dscm @ 7% O_2	4. Equivalent Allowable Emissions: 4.94 E-2 lb/hour 0.216 tons/year

5. Method of Compliance (limit to 60 characters):

USEPA Method 29 [as per 40 CFR 60.58b(d)]

6. Allowable Emissions Comment (Desc. of Operating Method) (limit to 200 characters):

Emission source is applicable to 40 CFR 60.58b(a)(4).

Emissions Unit Information Section 1 of 2.

Pollutant Detail Information Page 7 of 17.

G. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION
(Regulated Emissions Units - Emissions-Limited and Preconstruction Review Pollutants Only)

Potential/Fugitive Emissions

1. Pollutant Emitted: VOC	2. Total Percent Efficiency of Control:
3. Potential Emissions: 4.936 lb/hour 21.62 tons/year	4. Synthetically Limited? [ ]
5. Range of Estimated Fugitive Emissions: [ ] 1 [ ] 2 [ ] 3 _____ to _____ tons/year	
6. Emission Factor: 30 ppmdv @7% O_2 Reference: Past operation of units 1 and 2 at facility	7. Emissions Method Code: 0
8. Calculation of Emissions (limit to 600 characters):	
$\frac{30\ \text{ppmdv @ 7\% O}_2}{1 \times 10^6} \times \frac{16.04\ \text{lb}}{\text{lb mole}} \times \frac{65{,}868\ \text{dscf @ 7\% O}_2}{\text{minute}} \times \frac{60\ \text{minute}}{\text{hour}} \times \frac{\text{mole}}{385.3\ \text{dscf}}$	
9. Pollutant Potential/Fugitive Emissions Comment (limit to 200 characters):	

Allowable Emissions Allowable Emissions 1 of 1

1. Basis for Allowable Emissions Code: OTHER	2. Future Effective Date of Allowable Emissions:
3. Requested Allowable Emissions and Units: 30 ppmdv @ 7% O_2	4. Equivalent Allowable Emissions: 4.936 lb/hour 21.62 tons/year
5. Method of Compliance (limit to 60 characters): Proposed as initial stack test only using USEPA Method 18 or 25A.	
6. Allowable Emissions Comment (Desc. of Operating Method) (limit to 200 characters): Emission factor is based on an analysis of past operation of units 1 and 2 at the facility in addition to other available data for municipal waste combustion facilities.	

G. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION
(Regulated Emissions Units - Emissions-Limited and Preconstruction Review Pollutants Only)

Potential/Fugitive Emissions

1. Pollutant Emitted: H027 (Cadmium)	2. Total Percent Efficiency of Control:
3. Potential Emissions: 4.94 E-3 lb/hour 0.0216 tons/year	4. Synthetically Limited? [ ]
5. Range of Estimated Fugitive Emissions: [ ] 1 [ ] 2 [ ] 3 _____ to _____ tons/year	
6. Emission Factor: 0.020 mg/dscm @ 7% O_2 Reference: 40 CFR 60, Subpart Eb	7. Emissions Method Code: 0
8. Calculation of Emissions (limit to 600 characters): $\frac{0.02\text{ mg @ 7\% O}_2}{\text{dscm}} x \frac{\text{gram}}{1000\text{ mg}} x \frac{\text{dscm}}{35.31\text{ dscf}} x \frac{65{,}868\text{ dscf @ 7\% O}_2}{\text{minute}} x \frac{60\text{ minute}}{\text{hour}} x \frac{\text{lb}}{453.59\text{ gram}}$	
9. Pollutant Potential/Fugitive Emissions Comment (limit to 200 characters):	

Allowable Emissions Allowable Emissions 1 of 1

1. Basis for Allowable Emissions Code: RULE	2. Future Effective Date of Allowable Emissions:
3. Requested Allowable Emissions and Units: 0.020 mg/dscm @ 7% O_2	4. Equivalent Allowable Emissions: 4.94 E-3 lb/hour 0.0216 tons/year
5. Method of Compliance (limit to 60 characters): USEPA Method 29 [as per 40 CFR 60.58b(d)]	
6. Allowable Emissions Comment (Desc. of Operating Method) (limit to 200 characters): Emission source is applicable to 40 CFR 60.52b(a)(3).	

G. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION
(Regulated Emissions Units - Emissions-Limited and Preconstruction Review Pollutants Only)

Potential/Fugitive Emissions

1. Pollutant Emitted: DIOX	2. Total Percent Efficiency of Control:
3. Potential Emissions: 3.21 E-6 lb/hour 1.406 E-5 tons/year	4. Synthetically Limited? [ ]
5. Range of Estimated Fugitive Emissions: [ ] 1 [ ] 2 [ ] 3 _____ to _____ tons/year	
6. Emission Factor: 13 ng/dscm @ 7% O_2 Reference: 40 CFR 60, Subpart Eb	7. Emissions Method Code: 0
8. Calculation of Emissions (limit to 600 characters): $\frac{13\text{ ng @ 7\% O}_2}{\text{dscm}} \times \frac{\text{gram}}{1\text{E9 ng}} \times \frac{\text{dscm}}{35.31\text{ dscf}} \times \frac{65{,}868\text{ dscf @ 7\% O}_2}{\text{minute}} \times \frac{60\text{ minute}}{\text{hour}} \times \frac{\text{lb}}{453.59\text{ gram}}$	
9. Pollutant Potential/Fugitive Emissions Comment (limit to 200 characters):	

Allowable Emissions Allowable Emissions 1 of 1

1. Basis for Allowable Emissions Code: RULE	2. Future Effective Date of Allowable Emissions:
3. Requested Allowable Emissions and Units: 13 ng/dscm @ 7% O_2	4. Equivalent Allowable Emissions: 3.21 E-6 lb/hour 1.406 E-5 tons/year
5. Method of Compliance (limit to 60 characters): USEPA Method 23 [as per 40 CFR 60.58b(g)]	
6. Allowable Emissions Comment (Desc. of Operating Method) (limit to 200 characters): Emission source is applicable to 40 CFR 60.52b(c).	

G. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION
(Regulated Emissions Units - Emissions-Limited and Preconstruction Review Pollutants Only)

Potential/Fugitive Emissions

1. Pollutant Emitted: H107 (Fluorides)	2. Total Percent Efficiency of Control:
3. Potential Emissions: 0.718 lb/hour 3.145 tons/year	4. Synthetically Limited? [ ]
5. Range of Estimated Fugitive Emissions: [ ] 1 [ ] 2 [ ] 3 _____ to _____ tons/year	
6. Emission Factor: 3.5 ppmdv @ 7% O_2 Reference: Past operation of units 1 and 2 at facility	7. Emissions Method Code: 0
8. Calculation of Emissions (limit to 600 characters): $\frac{3.5\ \text{ppmdv @ 7\% O}_2}{1 \times 10^6} \times \frac{20.01\ \text{lb}}{\text{lb mole}} \times \frac{65{,}868\ \text{dscf @ 7\% O}_2}{\text{minute}} \times \frac{60\ \text{minute}}{\text{hour}} \times \frac{\text{mole}}{385.3\ \text{dscf}}$	
9. Pollutant Potential/Fugitive Emissions Comment (limit to 200 characters):	

Allowable Emissions Allowable Emissions 1 of 1

1. Basis for Allowable Emissions Code: OTHER	2. Future Effective Date of Allowable Emissions:
3. Requested Allowable Emissions and Units: 3.5 ppmdv @ 7% O_2	4. Equivalent Allowable Emissions: 0.718 lb/hour 3.145 tons/year
5. Method of Compliance (limit to 60 characters): Proposed as initial stack test only using USEPA Method 13A or 13B.	
6. Allowable Emissions Comment (Desc. of Operating Method) (limit to 200 characters): Emission factor is based on an analysis of past operation of units 1 and 2 at the facility in addition to other available data for municipal waste combustion facilities.	

G. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION
(Regulated Emissions Units - Emissions-Limited and Preconstruction Review Pollutants Only)

Potential/Fugitive Emissions

1. Pollutant Emitted: H106 (HCl)	2. Total Percent Efficiency of Control: 95%
3. Potential Emissions: 46.76 lb/hour 204.8 tons/year	4. Synthetically Limited? [ ]
5. Range of Estimated Fugitive Emissions: [ ] 1 [ ] 2 [ ] 3 _____ to _____ tons/year	
6. Emission Factor: 125 ppmdv @ 7% O_2 Reference: 40 CFR 60, Subpart Eb	7. Emissions Method Code: 0

8. Calculation of Emissions (limit to 600 characters):

$$\frac{125\ \text{ppmdv @ 7\% O}_2}{1 \times 10^6} \times \frac{36.47\ \text{lb}}{\text{lb mole}} \times \frac{65{,}868\ \text{dscf @ 7\% O}_2}{\text{minute}} \times \frac{60\ \text{minute}}{\text{hour}} \times \frac{\text{mole}}{385.3\ \text{dscf}}$$

9. Pollutant Potential/Fugitive Emissions Comment (limit to 200 characters):

40 CFR 60.52b(b) limits HCl emissions to 25 ppmdv (at 7% O_2) or 5% (by weight or volume) of potential HCl emissions concentration, whichever is less stringent (5% of uncontrolled HCl emissions is conservatively estimated to be 125 ppmdv at 7% O_2).

Allowable Emissions Allowable Emissions 1 of 1

1. Basis for Allowable Emissions Code: RULE	2. Future Effective Date of Allowable Emissions:
3. Requested Allowable Emissions and Units: 125 ppmdv @ 7% O_2	4. Equivalent Allowable Emissions: 46.76 lb/hour 204.8 tons/year

5. Method of Compliance (limit to 60 characters):

USEPA Method 26 or 26A [as per 40 CFR 60.58b(f)]

6. Allowable Emissions Comment (Desc. of Operating Method) (limit to 200 characters):

40 CFR 60.52b(b) limits HCl emissions to 25 ppmdv (at 7% O_2) or 5% (by weight or volume) of potential HCl emissions concentration, whichever is less stringent (5% of uncontrolled HCl emissions is conservatively estimated to be 125 ppmdv at 7% O_2).

G. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION
(Regulated Emissions Units - Emissions-Limited and Preconstruction Review Pollutants Only)

Potential/Fugitive Emissions

1. Pollutant Emitted: H114 (Mercury)	2. Total Percent Efficiency of Control: 85%
3. Potential Emissions: 4.26 E-2 lb/hour 0.187 tons/year	4. Synthetically Limited? [ ]
5. Range of Estimated Fugitive Emissions: [ ] 1 [ ] 2 [ ] 3 _____ to _____ tons/year	
6. Emission Factor: 0.1725 mg/dscm @ 7% O_2 Reference: 40 CFR 60, Subpart Eb	7. Emissions Method Code: 0

8. Calculation of Emissions (limit to 600 characters):

$$\frac{0.1725\ \text{mg @ 7\% O}_2}{\text{dscm}} \times \frac{\text{gram}}{1000\ \text{mg}} \times \frac{\text{dscm}}{35.31\ \text{dscf}} \times \frac{65{,}868\ \text{dscf @ 7\% O}_2}{\text{minute}} \times \frac{60\ \text{minute}}{\text{hour}} \times \frac{\text{lb}}{453.59\ \text{gram}}$$

9. Pollutant Potential/Fugitive Emissions Comment (limit to 200 characters):
Rule 62-296.416, F.A.C. and 40 CFR 60.52b(a) limit mercury emissions to 0.070 milligrams per dry standard cubic meter (mg/dscm) (at 7% O_2) or removed 85% (by weight or volume) of uncontrolled mercury emissions, whichever is less stringent (15% of uncontrolled mercury emissions is conservatively estimated to be 0.1725 mg/dscm at 7% O_2).

Allowable Emissions Allowable Emissions 1 of 1

1. Basis for Allowable Emissions Code: RULE	2. Future Effective Date of Allowable Emissions:
3. Requested Allowable Emissions and Units: 0.1725 mg/dscm @ 7% O_2	4. Equivalent Allowable Emissions: 4.26 E-2 lb/hour 0.187 tons/year
5. Method of Compliance (limit to 60 characters): USEPA Method 29 [as per 40 CFR 60.58b(d)]	
6. Allowable Emissions Comment (Desc. of Operating Method) (limit to 200 characters): Rule 62-296.416, F.A.C. and 40 CFR 60.52b(a) limit mercury emissions to 0.070 milligrams per dry standard cubic meter (mg/dscm) (at 7% O_2) or removed 85% (by weight or volume) of uncontrolled mercury emissions, whichever is less stringent (15% of uncontrolled mercury emissions is conservatively estimated to be 0.1725 mg/dscm at 7% O_2).	

Emissions Unit Information Section 1 of 2.

Pollutant Detail Information Page 13 of 17.

G. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION
(Regulated Emissions Units - Emissions-Limited and Preconstruction Review Pollutants Only)

Potential/Fugitive Emissions

1. Pollutant Emitted: SAM (Sulfuric Acid Mist)	2. Total Percent Efficiency of Control:
3. Potential Emissions: 16.78 lb/hour 73.51 tons/year	4. Synthetically Limited? [ ]
5. Range of Estimated Fugitive Emissions: [ ] 1 [ ] 2 [ ] 3 _____ to _____ tons/year	
6. Emission Factor: 16.68 ppmdv at 7% O_2 Reference: Past operation of units 1 and 2 at facility	7. Emissions Method Code: 0
8. Calculation of Emissions (limit to 600 characters): $\frac{16.68\ \text{ppmdv @ 7\% } O_2}{1 \times 10^6} \times \frac{98.09\ \text{lb}}{\text{lb mole}} \times \frac{65{,}868\ \text{dscf @ 7\% } O_2}{\text{minute}} \times \frac{60\ \text{minute}}{\text{hour}} \times \frac{\text{mole}}{385.3\ \text{dscf}}$	
9. Pollutant Potential/Fugitive Emissions Comment (limit to 200 characters):	

Allowable Emissions Allowable Emissions 1 of 1

1. Basis for Allowable Emissions Code: OTHER	2. Future Effective Date of Allowable Emissions:
3. Requested Allowable Emissions and Units: 16.68 ppmdv at 7% O_2	4. Equivalent Allowable Emissions: 16.78 lb/hour 73.51 tons/year
5. Method of Compliance (limit to 60 characters): Proposed as initial stack test only using USEPA Method 8.	
6. Allowable Emissions Comment (Desc. of Operating Method) (limit to 200 characters): Emission factor is based on an analysis of past operation of units 1 and 2 at the facility in addition to other available data for municipal waste combustion facilities.	

G. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION
(Regulated Emissions Units - Emissions-Limited and Preconstruction Review Pollutants Only)

Potential/Fugitive Emissions

1. Pollutant Emitted: H021 (Beryllium)	2. Total Percent Efficiency of Control:
3. Potential Emissions: 3.95 E-5 lb/hour 1.730 E-4	4. Synthetically Limited? [ ]
5. Range of Estimated Fugitive Emissions: [ ] 1 [ ] 2 [ ] 3 _____ to _____ tons/year	
6. Emission Factor: 0.16 ug/dscm @ 7% O_2 Reference: Past operation of units 1 and 2 at facility	7. Emissions Method Code: 0
8. Calculation of Emissions (limit to 600 characters): $\frac{0.16\,ug\,@\,7\%\,O_2}{dscm} x \frac{gram}{1E6\,ug} x \frac{dscm}{35.31\,dscf} x \frac{65{,}868\,dscf\,@\,7\%\,O_2}{minute} x \frac{60\,minute}{hour} x \frac{lb}{453.59\,gram}$	
9. Pollutant Potential/Fugitive Emissions Comment (limit to 200 characters):	

Allowable Emissions Allowable Emissions 1 of 1

1. Basis for Allowable Emissions Code: OTHER	2. Future Effective Date of Allowable Emissions:
3. Requested Allowable Emissions and Units: 0.16 ug/dscm @ 7% O_2	4. Equivalent Allowable Emissions: 3.95 E-5 lb/hour 1.730 E-4 tons/year
5. Method of Compliance (limit to 60 characters): Proposed as initial stack test only using USEPA Method 29.	
6. Allowable Emissions Comment (Desc. of Operating Method) (limit to 200 characters): Emission factor is based on an analysis of past operation of units 1 and 2 at the facility in addition to other available data for municipal waste combustion facilities.	

G. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION
(Regulated Emissions Units - Emissions-Limited and Preconstruction Review Pollutants Only)

Potential/Fugitive Emissions

1. Pollutant Emitted: H015 (Arsenic)	2. Total Percent Efficiency of Control:
3. Potential Emissions: 2.65 E-3 lb/hour 0.0116 tons/year	4. Synthetically Limited? [ ]
5. Range of Estimated Fugitive Emissions: [ ] 1 [ ] 2 [ ] 3 _____ to _____ tons/year	
6. Emission Factor: 10.74 ug/dscm @ 7% O_2 Reference: Past operation of units 1 and 2 at facility	7. Emissions Method Code: 0
8. Calculation of Emissions (limit to 600 characters): $\frac{10.74\,ug\,@\,7\%\,O_2}{dscm} x \frac{gram}{1E6\,ug} x \frac{dscm}{35.31\,dscf} x \frac{65{,}868\,dscf\,@\,7\%\,O_2}{minute} x \frac{60\,minute}{hour} x \frac{lb}{453.59\,gram}$	
9. Pollutant Potential/Fugitive Emissions Comment (limit to 200 characters):	

Allowable Emissions Allowable Emissions 1 of 1

1. Basis for Allowable Emissions Code: OTHER	2. Future Effective Date of Allowable Emissions:
3. Requested Allowable Emissions and Units: 10.74 ug/dscm @ 7% O_2	4. Equivalent Allowable Emissions: 2.65 E-3 lb/hour 0.0116 tons/year
5. Method of Compliance (limit to 60 characters): Proposed as initial stack test only using USEPA Method 29.	
6. Allowable Emissions Comment (Desc. of Operating Method) (limit to 200 characters): Emission factor is based on an analysis of past operation of units 1 and 2 at the facility in addition to other available data for municipal waste combustion facilities.	

G. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION
(Regulated Emissions Units - Emissions-Limited and Preconstruction Review Pollutants Only)

Potential/Fugitive Emissions

1. Pollutant Emitted: Ammonia	2. Total Percent Efficiency of Control:
3. Potential Emissions: 8.72 lb/hour 38.19 tons/year	4. Synthetically Limited? [ ]
5. Range of Estimated Fugitive Emissions: [ ] 1 [ ] 2 [ ] 3 _____ to _____ tons/year	
6. Emission Factor: 50 ppmdv @ 7% O_2 Reference: Past operation of units 1 and 2 at facility	7. Emissions Method Code: 0
8. Calculation of Emissions (limit to 600 characters): $\frac{50\ \text{ppmdv @ 7\% O}_2}{1 \times 10^6} \times \frac{17.0\ \text{lb}}{\text{lb mole}} \times \frac{65{,}868\ \text{dscf @ 7\% O}_2}{\text{minute}} \times \frac{60\ \text{minute}}{\text{hour}} \times \frac{\text{mole}}{385.3\ \text{dscf}}$	
9. Pollutant Potential/Fugitive Emissions Comment (limit to 200 characters):	

Allowable Emissions Allowable Emissions 1 of 1

1. Basis for Allowable Emissions Code: OTHER	2. Future Effective Date of Allowable Emissions:
3. Requested Allowable Emissions and Units: 50 ppmdv @ 7% O_2	4. Equivalent Allowable Emissions: 8.72 lb/hour 38.19 tons/year
5. Method of Compliance (limit to 60 characters): Proposed as initial stack test only using USEPA Method CTM-027 (Conditional Test Method).	
6. Allowable Emissions Comment (Desc. of Operating Method) (limit to 200 characters): Emission factor is based on an analysis of past operation of units 1 and 2 at the facility in addition to other available data for municipal waste combustion facilities.	

G. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION
(Regulated Emissions Units - Emissions-Limited and Preconstruction Review Pollutants Only)

Potential/Fugitive Emissions

1. Pollutant Emitted: HAPS (Total HAPs)	2. Total Percent Efficiency of Control:
3. Potential Emissions: 47.58 lb/hour 208.4 tons/year	4. Synthetically Limited? [ ]
5. Range of Estimated Fugitive Emissions: [ ] 1 [ ] 2 [ ] 3 _____ to _____ tons/year	
6. Emission Factor: 47.58 lb/hour Reference: Summation of Individual HAPs	7. Emissions Method Code: 0
8. Calculation of Emissions (limit to 600 characters): Summation of Individual HAPs: arsenic, beryllium, cadmium, dioxins, fluorides (HF), hydrochloric acid (HCl), lead, and mercury.	
9. Pollutant Potential/Fugitive Emissions Comment (limit to 200 characters):	

Allowable Emissions Allowable Emissions 1 of 1

1. Basis for Allowable Emissions Code: OTHER	2. Future Effective Date of Allowable Emissions:
3. Requested Allowable Emissions and Units: 47.58 lb/hour	4. Equivalent Allowable Emissions: 47.58 lb/hour 208.4 tons/year
5. Method of Compliance (limit to 60 characters): Not Applicable	
6. Allowable Emissions Comment (Desc. of Operating Method) (limit to 200 characters): Requested emission limit is summation of arsenic, beryllium, cadmium, dioxins, fluorides (HF), hydrochloric acid (HCl), lead, and mercury.	

H. VISIBLE EMISSIONS INFORMATION
(Only Regulated Emissions Units Subject to a VE Limitation)

Visible Emissions Limitation: Visible Emissions Limitation ___1___ of ___1___

1. Visible Emissions Subtype: VE10	2. Basis for Allowable Opacity: [X] Rule [ ] Other
3. Requested Allowable Opacity: Normal Conditions: 10 % Exceptional Conditions: 10 % Maximum Period of Excess Opacity Allowed: 6 min/hour	
4. Method of Compliance: USEPA Method 9 and continuous opacity monitoring system [as per 40 CFR 60.58b(c)]	
5. Visible Emissions Comment (limit to 200 characters): Visible Emission is regulated under 40 CFR 60, Subpart Eb. Opacity is defined as a 6-minute average. Unit 3 will utilize a continuous opacity monitoring system (COMS).	

I. CONTINUOUS MONITOR INFORMATION
(Only Regulated Emissions Units Subject to Continuous Monitoring)

Continuous Monitoring System: Continuous Monitor __1___ of __7___

1. Parameter Code: O2	2. Pollutant(s):
3. CMS Requirement:	[X] Rule [ ] Other
4. Monitor Information: To Be Provided Later. Manufacturer: Model Number: Serial Number:	
5. Installation Date: To Be Provided Later.	6. Performance Specification Test Date: To Be Provided Later.
7. Continuous Monitor Comment (limit to 200 characters): 40 CFR 60.58b(b) requires installation and operation of Continuous Emissions Monitoring System (CEMs) at each location where CO, SO_2, and NO_x emissions are monitored (i.e., before SDA and after FF).	

I. CONTINUOUS MONITOR INFORMATION
(Only Regulated Emissions Units Subject to Continuous Monitoring)

Continuous Monitoring System: Continuous Monitor __2___ of __7___

1. Parameter Code: EM	2. Pollutant(s): CO
3. CMS Requirement:	[X] Rule [ ] Other
4. Monitor Information: To Be Provided Later. Manufacturer: Model Number: Serial Number:	
5. Installation Date: To Be Provided Later.	6. Performance Specification Test Date: To Be Provided Later.
7. Continuous Monitor Comment (limit to 200 characters): 40 CFR 60.58b(i) requires installation and operation of CO CEM.	

I. CONTINUOUS MONITOR INFORMATION
(Only Regulated Emissions Units Subject to Continuous Monitoring)

Continuous Monitoring System: Continuous Monitor __3___ of __7___

1. Parameter Code: VE	2. Pollutant(s):
3. CMS Requirement:	[X] Rule [ ] Other
4. Monitor Information: To Be Provided Later. Manufacturer: Model Number: Serial Number:	
5. Installation Date: To Be Provided Later.	6. Performance Specification Test Date: To Be Provided Later.
7. Continuous Monitor Comment (limit to 200 characters): 40 CFR 60.58b(c) requires installation and operation of a continuous opacity monitoring system.	

I. CONTINUOUS MONITOR INFORMATION
(Only Regulated Emissions Units Subject to Continuous Monitoring)

Continuous Monitoring System: Continuous Monitor __4___ of __7___

1. Parameter Code: EM	2. Pollutant(s): SO2
3. CMS Requirement:	[X] Rule [ ] Other
4. Monitor Information: To Be Provided Later. Manufacturer: Model Number: Serial Number:	
5. Installation Date: To Be Provided Later.	6. Performance Specification Test Date: To Be Provided Later.
7. Continuous Monitor Comment (limit to 200 characters): 40 CFR 60.58b(e) requires installation and operation of inlet and outlet CEM systems (i.e., before the SDA and after the FF).	

I. CONTINUOUS MONITOR INFORMATION
(Only Regulated Emissions Units Subject to Continuous Monitoring)

Continuous Monitoring System: Continuous Monitor __5___ of __7___

1. Parameter Code: TEMP	2. Pollutant(s):
3. CMS Requirement:	[X] Rule [ ] Other
4. Monitor Information: To Be Provided Later. Manufacturer: Model Number: Serial Number:	
5. Installation Date: To Be Provided Later.	6. Performance Specification Test Date: To Be Provided Later.
7. Continuous Monitor Comment (limit to 200 characters): A continuous monitoring system is required under 40 CFR 60.58b(i) to monitor the temperature of the flue gas stream at the inlet of the fabric filter control device.	

I. CONTINUOUS MONITOR INFORMATION
(Only Regulated Emissions Units Subject to Continuous Monitoring)

Continuous Monitoring System: Continuous Monitor __6___ of __7___

1. Parameter Code: FLOW (Steam)	2. Pollutant(s):
3. CMS Requirement:	[X] Rule [ ] Other
4. Monitor Information: To Be Provided Later. Manufacturer: Model Number: Serial Number:	
5. Installation Date: To Be Provided Later.	6. Performance Specification Test Date: To Be Provided Later.
7. Continuous Monitor Comment (limit to 200 characters): A continuous monitoring system is required under 40 CFR 60.58b(i) to monitor steam flow.	

I. CONTINUOUS MONITOR INFORMATION
(Only Regulated Emissions Units Subject to Continuous Monitoring)

Continuous Monitoring System: Continuous Monitor __7___ of __7___

1. Parameter Code: EM	2. Pollutant(s): NOx
3. CMS Requirement:	[X] Rule [ ] Other
4. Monitor Information: To Be Provided Later. Manufacturer: Model Number: Serial Number:	
5. Installation Date: To Be Provided Later.	6. Performance Specification Test Date: To Be Provided Later.
7. Continuous Monitor Comment (limit to 200 characters): 40 CFR 60.58b(h) requires the installation and operation of a NOx CEM system.	

J. EMISSIONS UNIT SUPPLEMENTAL INFORMATION
(Regulated Emissions Units Only)

Supplemental Requirements

1. Process Flow Diagram [X] Attached, Document ID: Below [ ] Not Applicable [ ] Waiver Requested
2. Fuel Analysis or Specification [X] Attached, Document ID: Below [ ] Not Applicable [ ] Waiver Requested
3. Detailed Description of Control Equipment [X] Attached, Document ID: Below [ ] Not Applicable [ ] Waiver Requested
4. Description of Stack Sampling Facilities [X] Attached, Document ID: Below [ ] Not Applicable [ ] Waiver Requested
5. Compliance Test Report [ ] Attached, Document ID:_____ [ ] Previously submitted, Date:_____ [X] Not Applicable
6. Procedures for Startup and Shutdown [X] Attached, Document ID: Below [ ] Not Applicable [ ] Waiver Requested
7. Operation and Maintenance Plan [X] Attached, Document ID: Below [ ] Not Applicable [ ] Waiver Requested
8. Supplemental Information for Construction Permit Application [X] Attached, Document ID: Below [ ] Not Applicable
9. Other Information Required by Rule or Statute [X] Attached, Document ID: Below [ ] Not Applicable
10. Supplemental Requirements Comment: The following items are provided in the PSD application write-up: Process flow diagram; fuel analysis or specification; detailed description of control equipment (Section 4); supplemental information for construction permit application; other information required by rule or statute; and identification of additional applicable requirements. A description of stack sampling facilities; procedures for startup and shutdown; and operation and maintenance plan will be provided later.

Additional Supplemental Requirements for Title V Air Operation Permit Applications

11. Alternative Methods of Operation
[ ] Attached, Document ID:_____ [X] Not Applicable

12. Alternative Modes of Operation (Emissions Trading)
[ ] Attached, Document ID:_____ [X] Not Applicable

13. Identification of Additional Applicable Requirements
[X] Attached, Document ID: See field 10 above [ ] Not Applicable

14. Compliance Assurance Monitoring Plan
[ ] Attached, Document ID:_____ [X] Not Applicable

15. Acid Rain Part Application (Hard-copy Required)

[ ] Acid Rain Part - Phase II (Form No. 62-210.900(1)(a))
Attached, Document ID:_____

[ ] Repowering Extension Plan (Form No. 62-210.900(1)(a)1.)
Attached, Document ID:_____

[ ] New Unit Exemption (Form No. 62-210.900(1)(a)2.)
Attached, Document ID:_____

[ ] Retired Unit Exemption (Form No. 62-210.900(1)(a)3.)
Attached, Document ID:_____

[ ] Phase II NOx Compliance Plan (Form No. 62-210.900(1)(a)4.)
Attached, Document ID:_____

[ ] Phase NOx Averaging Plan (Form No. 62-210.900(1)(a)5.)
Attached, Document ID:_____

[X] Not Applicable

III. EMISSIONS UNIT INFORMATION

A separate Emissions Unit Information Section (including subsections A through J as required) must be completed for each emissions unit addressed in this Application for Air Permit. If submitting the application form in hard copy, indicate, in the space provided at the top of each page, the number of this Emissions Unit Information Section and the total number of Emissions Unit Information Sections submitted as part of this application.

A. GENERAL EMISSIONS UNIT INFORMATION
(All Emissions Units)

Emissions Unit Description and Status

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

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

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

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

2. Regulated or Unregulated Emissions Unit? (Check one)

[X] The emissions unit addressed in this Emissions Unit Information Section is a regulated emissions unit.

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

3. Description of Emissions Unit Addressed in This Section (limit to 60 characters):
Operation of a limo storage silo for the air pollution control equipment associated with Municipal Waste Combustor Unit 3 at the facility. Particulate emissions will be controlled with a baghouse.

4. Emissions Unit Identification Number:
ID:
[X] No ID
[ ] ID Unknown

5. Emissions Unit Status Code:	6. Initial Startup Date:	7. Emissions Unit Major Group SIC Code:	8. Acid Rain Unit?
C		49	[ ]

9. Emissions Unit Comment: (Limit to 500 Characters)

Emissions Unit Control Equipment

1. Control Equipment/Method Description (Limit to 200 characters per device or method):

Particulate emissions from filling operations of the lime storage silo will be controlled using a fabric filter baghouse. Emissions occur during filling operations only.

2. Control Device or Method Code(s): 018

Emissions Unit Details

1. Package Unit:
   Manufacturer: To Be Provided Model Number: To Be Provided
2. Generator Nameplate Rating: MW
3. Incinerator Information:
   Dwell Temperature: °F
   Dwell Time: seconds
   Incinerator Afterburner Temperature: °F

B. EMISSIONS UNIT CAPACITY INFORMATION
(Regulated Emissions Units Only)

Emissions Unit Operating Capacity and Schedule

1. Maximum Heat Input Rate:		mmBtu/hr
2. Maximum Incineration Rate:	lb/hr	tons/day
3. Maximum Process or Throughput Rate:		
4. Maximum Production Rate:		
5. Requested Maximum Operating Schedule:		
	24 hours/day	7 days/week
	52 weeks/year	8760 hours/year
6. Operating Capacity/Schedule Comment (limit to 200 characters):		

C. EMISSIONS UNIT REGULATIONS
(Regulated Emissions Units Only)

List of Applicable Regulations

Rule 62-297.620(4), F.A.C.	Exceptions and Approval of Alternate Procedures and Requirements

D. EMISSION POINT (STACK/VENT) INFORMATION
(Regulated Emissions Units Only)

Emission Point Description and Type

1. Identification of Point on Plot Plan or Flow Diagram?	2. Emission Point Type Code: 1	
3. Descriptions of Emission Points Comprising this Emissions Unit for VE Tracking (limit to 100 characters per point):		
4. ID Numbers or Descriptions of Emission Units with this Emission Point in Common:		
5. Discharge Type Code: D	6. Stack Height: 85 feet	7. Exit Diameter: 0.67 feet
8. Exit Temperature: Ambient °F	9. Actual Volumetric Flow Rate: 1200 acfm	10. Water Vapor: %
11. Maximum Dry Standard Flow Rate: 1200 dscfm	12. Nonstack Emission Point Height: feet	
13. Emission Point UTM Coordinates: Zone: 17 East (km): 424.249 North (km): 2945.717		
14. Emission Point Comment (limit to 200 characters):		

E. SEGMENT (PROCESS/FUEL) INFORMATION
(All Emissions Units)

Segment Description and Rate: Segment __1__ of __1__

1. Segment Description (Process/Fuel Type) (limit to 500 characters): Lime Silo Loading Operations		
2. Source Classification Code (SCC):	3. SCC Units:	
4. Maximum Hourly Rate:	5. Maximum Annual Rate:	6. Estimated Annual Activity Factor:
7. Maximum % Sulfur:	8. Maximum % Ash:	9. Million Btu per SCC Unit:
10. Segment Comment (limit to 200 characters):		

Segment Description and Rate: Segment _____ of _____

1. Segment Description (Process/Fuel Type) (limit to 500 characters):		
2. Source Classification Code (SCC):	3. SCC Units:	
4. Maximum Hourly Rate:	5. Maximum Annual Rate:	6. Estimated Annual Activity Factor:
7. Maximum % Sulfur:	8. Maximum % Ash:	9. Million Btu per SCC Unit:
10. Segment Comment (limit to 200 characters):		

F. EMISSIONS UNIT POLLUTANTS
(All Emissions Units)

1. Pollutant Emitted	2. Primary Control Device Code	3. Secondary Control Device Code	4. Pollutant Regulatory Code
PM	018		NS
PM10	018		NS

G. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION
(Regulated Emissions Units -
Emissions-Limited and Preconstruction Review Pollutants Only)

Potential/Fugitive Emissions

1. Pollutant Emitted: PM	2. Total Percent Efficiency of Control: 99%
3. Potential Emissions: 0.154 lb/hour 0.0281 tons/year	4. Synthetically Limited? [ ]
5. Range of Estimated Fugitive Emissions: [ ] 1 [ ] 2 [ ] 3 _____ to _____ tons/year	
6. Emission Factor: 0.015 gr/dscf Reference: Engineering Estimate	7. Emissions Method Code:
8. Calculation of Emissions (limit to 600 characters): $\frac{0.015\ \text{grains}}{\text{dscf}} \times \frac{1{,}200\ \text{dscf}}{\text{minute}} \times \frac{60\ \text{minutes}}{\text{fill}} \times \frac{\text{lb}}{7{,}000\ \text{grains}} = \frac{0.154\ \text{lb}}{\text{hour}}$	
9. Pollutant Potential/Fugitive Emissions Comment (limit to 200 characters):	

Allowable Emissions Allowable Emissions _____ of _____

1. Basis for Allowable Emissions Code:	2. Future Effective Date of Allowable Emissions:
3. Requested Allowable Emissions and Units:	4. Equivalent Allowable Emissions: lb/hour tons/year
5. Method of Compliance (limit to 60 characters):	
6. Allowable Emissions Comment (Desc. of Operating Method) (limit to 200 characters):	

G. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION
(Regulated Emissions Units - Emissions-Limited and Preconstruction Review Pollutants Only)

Potential/Fugitive Emissions

1. Pollutant Emitted: PM10	2. Total Percent Efficiency of Control: 99%
3. Potential Emissions: 0.154 lb/hour 0.0281 tons/year	4. Synthetically Limited? [ ]
5. Range of Estimated Fugitive Emissions: [ ] 1 [ ] 2 [ ] 3 _____ to _____ tons/year	
6. Emission Factor: 0.015 grains/dscf Reference: Engineering Estimate	7. Emissions Method Code:
8. Calculation of Emissions (limit to 600 characters): $\frac{0.015\ \text{grains}}{\text{dscf}} \times \frac{1{,}200\ \text{dscf}}{\text{minute}} \times \frac{60\ \text{minutes}}{\text{fill}} \times \frac{\text{lb}}{7{,}000\ \text{grains}} = \frac{0.154\ \text{lb}}{\text{hour}}$	
9. Pollutant Potential/Fugitive Emissions Comment (limit to 200 characters):	

Allowable Emissions Allowable Emissions _____ of _____

1. Basis for Allowable Emissions Code:	2. Future Effective Date of Allowable Emissions:
3. Requested Allowable Emissions and Units:	4. Equivalent Allowable Emissions: lb/hour tons/year
5. Method of Compliance (limit to 60 characters):	
6. Allowable Emissions Comment (Desc. of Operating Method) (limit to 200 characters):	

H. VISIBLE EMISSIONS INFORMATION
(Only Regulated Emissions Units Subject to a VE Limitation)

Visible Emissions Limitation: Visible Emissions Limitation 1 of 1

1. Visible Emissions Subtype: 05	2. Basis for Allowable Opacity: [X] Rule [ ] Other
3. Requested Allowable Opacity: Normal Conditions: 5 % Exceptional Conditions: 5 % Maximum Period of Excess Opacity Allowed: min/hour	
4. Method of Compliance: USEPA Method 9	
5. Visible Emissions Comment (limit to 200 characters): Lee County proposes to demonstrate compliance under Rule 62-297.620(4), F.A.C. (Exceptions and Approval of Alternate Procedures and Requirements), which allows the Secretary of the Florida Department of Environmental Protection to waive particulate compliance test requirements when potential particulate emissions are less than 100 tons per year and the emission unit is equipped with a baghouse. An alternative compliance standard of 5% opacity can be included in the permit under this rule.	

I. CONTINUOUS MONITOR INFORMATION
(Only Regulated Emissions Units Subject to Continuous Monitoring)

Continuous Monitoring System: Continuous Monitor _____ of _____

1. Parameter Code:	2. Pollutant(s):
3. CMS Requirement:	[ ] Rule [ ] Other
4. Monitor Information: Manufacturer: Model Number: Serial Number:	
5. Installation Date:	6. Performance Specification Test Date:
7. Continuous Monitor Comment (limit to 200 characters):	

J. EMISSIONS UNIT SUPPLEMENTAL INFORMATION
(Regulated Emissions Units Only)

Supplemental Requirements

1. Process Flow Diagram [X] Attached, Document ID: Below [ ] Not Applicable [ ] Waiver Requested
2. Fuel Analysis or Specification [ ] Attached, Document ID:_____ [X] Not Applicable [ ] Waiver Requested
3. Detailed Description of Control Equipment [X] Attached, Document ID: Below [ ] Not Applicable [ ] Waiver Requested
4. Description of Stack Sampling Facilities [X] Attached, Document ID: Below [ ] Not Applicable [ ] Waiver Requested
5. Compliance Test Report [ ] Attached, Document ID:_____ [ ] Previously submitted, Date:_____ [X] Not Applicable
6. Procedures for Startup and Shutdown [X] Attached, Document ID: Below [ ] Not Applicable [ ] Waiver Requested
7. Operation and Maintenance Plan [X] Attached, Document ID: Below [ ] Not Applicable [ ] Waiver Requested
8. Supplemental Information for Construction Permit Application [X] Attached, Document ID: See PSD Application Write-up [ ] Not Applicable
9. Other Information Required by Rule or Statute [X] Attached, Document ID: See PSD Application Write-up [ ] Not Applicable
10. Supplemental Requirements Comment: The following items are provided in the PSD application write-up: Process flow diagram; detailed description of control equipment (Section 4); supplemental information for construction permit application; other information required by rule or statute; and identification of additional applicable requirements. A description of stack sampling facilities; procedures for startup and shutdown; and operation and maintenance plan will be provided later.

Additional Supplemental Requirements for Title V Air Operation Permit Applications

11. Alternative Methods of Operation
[ ] Attached, Document ID:_____ [X] Not Applicable

12. Alternative Modes of Operation (Emissions Trading)
[ ] Attached, Document ID:_____ [X] Not Applicable

13. Identification of Additional Applicable Requirements
[X] Attached, Document ID: See PSD Application Write-up [ ] Not Applicable

14. Compliance Assurance Monitoring Plan
[ ] Attached, Document ID:_____ [X] Not Applicable

15. Acid Rain Part Application (Hard-copy Required)

[ ] Acid Rain Part - Phase II (Form No. 62-210.900(1)(a))
Attached, Document ID:_____

[ ] Repowering Extension Plan (Form No. 62-210.900(1)(a)1.)
Attached, Document ID:_____

[ ] New Unit Exemption (Form No. 62-210.900(1)(a)2.)
Attached, Document ID:_____

[ ] Retired Unit Exemption (Form No. 62-210.900(1)(a)3.)
Attached, Document ID:_____

[ ] Phase II NOx Compliance Plan (Form No. 62-210.900(1)(a)4.)
Attached, Document ID:_____

[ ] Phase NOx Averaging Plan (Form No. 62-210.900(1)(a)5.)
Attached, Document ID:_____

[X] Not Applicable

LEE COUNTY ENERGY RECOVERY FACILITY
PREVENTION OF SIGNIFICANT DETERIORATION
APPLICATION FOR MUNICIPAL WASTE COMBUSTOR UNIT 3

ATTACHMENT B

TRANSCRIPT OF PUBLIC MEETING REGARDING
PRELIMINARY DRAFT MATERIALS SEPARATION PLAN

October 31, 2002

LEE COUNTY

PRELIMINARY DRAFT MATERIALS SEPARATION PLAN

PUBLIC MEETING

TRANSCRIPT OF PUBLIC MEETING

A Public Meeting held in the above-styled cause, at the Board of County Commission Chambers, 2120 Main Street, Fort Myers, Florida, on the 19th day of October, 2001 commencing at 6:20 p.m.

NOLEN-MARTINA
REPORTING SERVICES
2069 First Street
Courtney Building, Suite 201
Ft. Myers, Florida 33901
(941) 334-6545
FAX (941) 332-2913

ORIGINAL

MR. DEE: Good evening, I would like to call this public hearing to order. My name is David Dee, I'm an attorney with the law firm of Landers & Parsons in Tallahassee, Florida. I'm here tonight on behalf of Lee County.

This public meeting is being called to discuss Lee County's Preliminary Draft Materials Separation Plan, which has been prepared by the County for the purposes of complying with the requirements in 40 CFR section 60.57, and to assist with the permitting of the expansion of the Lee County Resource Recovery Facility.

With me tonight are several representatives of the County, and other people that are interested in this project. If all of you would introduce yourselves and give your name and address.

MR. OWEN: My name is David Owen and I'm an Assistant County Attorney for Lee County. My address is post office box 398, Fort Myers, Florida, 33902. I'm also here on behalf of Lee County, in conjunction with Mr. David Dee.

MR. SAMPSON: My name is Lindsey Sampson, I'm the Director of the Solid Waste Department for Lee County. My address is 1500 Monroe

Street, Fort Myers, Florida, 33901, and I am with the Lee County Government.

MR. CERRATO: My name is David Cerrato, Vice-President with Malcolm, Pirnie Environmental Consultants to the County. My address is 1715 East 9th Avenue, Tampa, Florida, 33605.

MR. ROSANIA: My name is Sam Rosania, I'm with the consulting firm of Malcolm, Pirnie. My address is 1715 East 9th Avenue, Tampa, Florida, 33605.

MR. DEE: We also have in the audience several representatives from Covanta of Lee County, Inc., the operator of the Lee County resource recovery facility.

At this time, however, we have no members of the public here in attendance. The meeting was advertised to begin at 6:00, it is now approximately 6:20 p.m. For the purposes of this record, I would like to create an Exhibit Number One, which is the Notice of the Public Meeting that was published in the newspaper, also attached is an Affidavit of Publication of the Notice.

I also at this time would like to create a second exhibit, which is the Preliminary Draft

Materials Separation Plan for the Lee County Solid Waste Division, dated September 7, 2001, and prepared by Malcolm, Pirnie, Inc. And the third document I would like to attach to the record is the meeting agenda that was prepared for this meeting tonight.

(Whereupon, Lee County's Exhibit Nos. One, Two and Three were marked for identification.)

MR. DEE: Since the purpose of the meeting is to discuss the Materials Separation Plan and there is no one here from the public to discuss the plan with, I intend to adjourn the meeting at this time, unless there is anyone that has any comments or questions about the plan.

(No Response.)

MR. DEE: Hearing no comments or questions, this meeting is adjourned.

Thank you.

(Whereupon, at the hour of 6:25 p.m. the proceedings were concluded.)

STATE OF FLORIDA)
COUNTY OF LEE)

I, Betty G. Althoff, Registered Professional Court Reporter, 20th Judicial Circuit of Florida, do certify that I was authorized to and did stenographically report the foregoing proceedings and that the typewritten transcript, consisting of pages numbered 1 through 5, is a true record.

IN WITNESS WHEREOF, I have hereunto set my hand this 20th day of October, 2001.

Betty G. Althoff, RPR,
Court Reporter,
Notary Public,
State of Florida at Large.

Betty G Althoff
My Commission CC797439
Expires December 26 2002

STATE OF FLORIDA)

COUNTY OF LEE)

I, Betty G. Althoff, Registered Professional Court Reporter, 20th Judicial Circuit of Florida, do certify that I was authorized to and did stenographically report the foregoing proceedings and that the typewritten transcript, consisting of pages numbered 1 through 5, is a true record.

IN WITNESS WHEREOF, I have hereunto set my hand this 20th day of October, 2001.

Betty G. Althoff, RPR,
Court Reporter,
Notary Public,
State of Florida at Large.

NEWS-PRESS

Published every morning – Daily and Sunday
Fort Myers, Florida

Affidavit of Publication

STATE OF FLORIDA
COUNTY OF LEE

Before the undersigned authority, personally appeared
Kieanna Henry
who on oath says that he/she is the
Asst. Legal Clerk of the News-Press, a daily newspaper, published at Fort Myers, in Lee County, Florida; that the attached copy of advertisement, being a
Display
In the matter of Notice of Public Meeting
in the _____ Court
was published in said newspaper in the issues of
September 14, 2001

Affiant further says that the said News-Press is a paper of general circulation daily in Lee, Charlotte, Collier, Glades and Hendry Counties and published at Fort Myers, in said Lee County, Florida and that said newspaper has heretofore been continuously published in said Lee County; Florida, each day, and has been entered as a second class mail matter at the post office in Fort Myers in said Lee County, Florida, for a period of one year next preceding the first publication of the attached copy of the advertisement; and affiant further says that he/she has neither paid nor promised any person, firm or corporation any discount, rebate, commission or refund for the purpose of securing this advertisement for publication in the said newspaper.

Kieanna Henry

Sworn to and subscribed before me this

14th day of September 2001 by

Kieanna Henry
personally known to me or who has produced

_____

as identification, and who did or did not take an oath.

Notary Public Brenda Leighton

Print Name _____

My commission Expires:

Brenda Leighton
MY COMMISSION # CC806905 EXPIRES
February 14, 2003
BONDED THRU TROY FAIN INSURANCE, INC.

NOTICE OF PUBLIC MEETING CONCERNING LEE COUNTY'S PRELIMINARY DRAFT MATERIALS SEPARATION PLAN

The Lee County Board of County Commissioners and the Solid Waste Division of Lee County, Florida, hereby give notice that a public meeting will be held beginning at 6:00 p.m. on October 19, 2001, to present and review Lee County's Preliminary Draft Materials Separation Plan (Plan). this Plan is being prepared in accordance with the requirements of 40 Code of Federal Regulations, section 60.57b, as part of the County's efforts to obtain the environmental permits and approvals for the expansion of the Lee County Energy Recovery Facility. Lee County will accept written and oral comments from the public regarding the Plan at the public meeting, which will be held at the Lee County Board of County Commission Chambers, 2120 Main St., Ft. Myers, Florida.

Agenda for the Public Meeting

A. Introduction
B. The proposed expansion of Lee County's Energy Recovery Facility
C. The size of the area served by Lee County's Energy Recovery Facility
D. The amount of solid waste generated in Lee County's service area
E. The types and estimated amounts of materials proposed for separation
F. The methods proposed for materials separation
G. The amount of residual waste for disposal
H. Alternate disposal methods for handling the residual waste
I. Public questions and comments

Public Comment Period: In addition to commenting at the public meeting, in person or in writing, the public may submit it's written comments about the Plan to the Solid Waste Division of Lee County at 1500 Monroe St., Ft. Myers, FL 33901. Comments will be accepted from the date of this notice through October 29, 2001.

The Preliminary Draft Materials Separation Plan is available for inspection at the following locations:

Lee County Solid Waste Division 1500 Monroe St. Fort Myers, FL. 33901	M-F 9:00 AM to 5:00 PM
Ft. Myers Central Library 2050 Central Avenue Fort Myers, FL 33901	M-Th 9:00 AM to 9:00 PM F&S 9:00 AM to 6:00 PM
Cape Coral Library 921 SW 39th Terrace Cape Coral, FL 33914	M-Th 9:00 AM to 9:00 PM F&S 9:00 AM to 6:00 PM
East County Regional Library 881 Gunnery Road Lehigh Acres, FL 33971	M-Th 9:00 AM to 9:00 PM F&S 9:00 AM to 6:00 PM
South County Regional Library 21100 Three Oaks Parkway Estero, FL 33928	M-Th 9:00 AM to 9:00 PM F&S 9:00 AM to 6:00 PM

After the County has received the public's comments about the Plan, the County will prepare responses to those comments. The County also will prepare a Final Draft Materials Separation Plan after the comments to the responses are developed. The County's responses to public comments, and the County's Final Draft Materials Separation Plan, will be available for inspection at the same locations that are listed above for the inspection of the Preliminary Draft Materials Separation Plan beginning November 20, 2001.

EXHIBIT
1
10/19/01 BH

VEDNESDAY, SEPTEMBER 19th, 2001 10:30 AM TO 12:00 PM, THE
RD OF LEE COUNTY COMMISSIONERS WILL MEET WITH THE
BERS OF THE LEE COUNTY LEGISLATIVE DELEGATION TO DISCUSS
COUNTY'S LEGISLATIVE PRIORITIES FOR THE UPCOMING
LATIVE SESSION. THE MEETING WILL BE HELD IN THE FIRST FLOOR
ERENCE ROOM OF THE LEE COUNTY ADMINISTRATION BUILDING
COND STREET, FORT MYERS, FLORIDA, 33901.

TERESTED PARTIES ARE INVITED TO ATTEND; HOWEVER, NO
C INPUT WILL BE TAKEN.

NY PARTY WHO MAY WANT TO APPEAL A DECISION OF THE
RD MUST ENSURE THAT A VERBATIM RECORD OF THE
EEDINGS IS MADE.

EASE GOVERN YOURSELF ACCORDINGLY.

Sekulski REF.D091401-153

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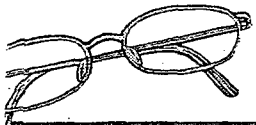

12670 NEW BRITTANY BOULEVARD
Fort Myers Florida 33907

LEE COUNTY
SWEST FLORIDA

Notice of Public Hearing For Lee Tran Route and Schedule Restructuring

: Tuesday, September 25, 2001
: 5:00 p.m.
: Old Courthouse
Lee County Board of County Commissioners' Chambers
2120 Main Street, Fort Myers, Florida 33901

Tran, Lee County's Transit Division, will be conducting a public hearing at the above time and e in order to present and discuss final route and schedule restructuring for the transit system. ecommended service modifications will affect each route in the current Lee Tran system, and create a new route and schedule network for the Lee Tran system.

Tran plans to implement the recommended changes on November 1, 2001.

ilights of the proposed changes include:

e Redesign	Routes 10, 20, 40, 50, 60, 80, 90, 100, 110, 120, 130, and Fort Myers Beach Trolley
dule Changes	All Routes (including commuter trips)
Route	Route 15, serving central Fort Myers to Edison Mall
bined with Existing Routes	Routes 85 and 115
ination	Route 150

changes are recommended in order to achieve

- A redesigned route network reflecting travel patterns of existing Lee Tran customers as well as appeal to potential customers.
- Reallocation of revenue hours of service to those areas of the system with greatest ridership demand for transit services, and
- Financial and operational efficiency within base of revenue hours currently operated and plans for expansions over a five (5) year period.

Tran welcomes all comments to the route restructuring. Please contact Lee Tran at 275-8726 rite to us at: Lee Tran, Route Restructuring, 10715 East Airport Road, Fort Myers, Florida 07 with any comments. You should also contact us at the above phone number and address any requests for assistance if you have a disability that requires special assistance or special mmo ns.

SE N YOURSELF ACCORDINGLY.

text of this Notice is pursuant to and in conformance with Section 125.66, Florida Statutes 0).

Sekulski
D091401-152

BOARD OF COUNTY COMMISSIONERS
OF LEE COUNTY, FLORIDA

NOTICE OF PUBLIC MEETING CONCERNING LEE COUNTY'S PRELIMINARY DRAFT MATERIALS SEPARATION PLAN

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G. The amount of residual waste for disposal
H. Alternate disposal methods for handling the residual waste
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News Press Sept. 14, 2001

LEE COUNTY ENERGY RECOVERY FACILITY
PREVENTION OF SIGNIFICANT DETERIORATION
APPLICATION FOR MUNICIPAL WASTE COMBUSTOR UNIT 3

ATTACHMENT C

LIST OF PERSONS CONTACTED
DURING PREPARATION OF
BEST AVAILABLE CONTROL TECHNOLOGY

October 31, 2002

Lee County Energy Recovery Facility
SCR Search Summary Spreadsheet

Contact Name	Company/Affiliation	Category	Date Contacted	Date Response Received	Status
Tony Licata	Babcock Borsig Power [Worchester, MA USA]	SCR Mfg	Aug. 13, 2001	Aug. 29, 2001	Waiting to send him flue gas flow data. Awaiting technical papers describing emissions limits and actual emissions data.
Peter Chromec	Babcock Borsig Power	SCR Mfg	Aug. 10, 2001	Sept. 19, 2001	Sent Information Request, Received general info about European experience, nothing facility specific. Received invitation to visit Swiss plants.
Peter Chromec	Babcock Borsig Power	SCR Mfg	Oct. 15, 2001	Oct. 16, 2001	Requested information on operation and emissions of facilities and list of facilities. Received list from Alfred Muller.
Edmund Fleck	ALSTOM Power	SCR Mfg	Aug. 16, 2001	Aug. 16, 2001	Sent information request, received list of plants, awaiting feasibility response.
Victor Ciarlante	Hamon Research-Cottrell	SCR Mfg	Oct. 19, 2001	Oct. 19, 2001	No direct experience of SCR on MWCs
Jim Stone	Foster Wheeler [Clinton, NJ USA]	SCR Mfg	Aug. 13, 2001		No response yet. Foster Wheeler is affiliated with Ishikawajima-Harima Heavy Industries Company of Japan.
Soren Olsen	Haldor Topsoe, Inc.		Aug. 10, 2001	Aug. 10, 2001	Does not have SCR experience on MWC or other dirty sources.
Curt McKee	Huntington Environmental		Aug. 10, 2001	Aug. 10, 2001	Does have SCR experience on diesel but not economical on a MWC.
Russ Gerlick	CRI Catalysts		Aug. 10, 2001	Aug. 10, 2001	Does have experience on dirty sources that are cleaned.
Takayuki Hishinuma	Mitsubishi Heavy Ind.	SCR Mfg	Sept. 25, 2001		No response yet.
Kurtis Gentile	Mitsubishi Heavy Ind.	SCR Mfg	Oct. 17, 2001		Will contact Mr. Hishinuma with our request. No response yet.
Robert Reed	Siemens Westinghouse Power Generation Corp.	Catalyst Mfg	Aug. 13, 2001		He sent out information request to engineers in the Germany offices.
Andreas Klatt	Siemens AG	Catalyst Mfg		Aug. 21, 2001	Received list of European facilities, paper on SCR use in MWCs and presentation on SCR use.

Lee County Energy Recovery Facility
SCR Search Summary Spreadsheet

Contact Name	Company/Affiliation	Category	Date Contacted	Date Response Received	Status
Paul James	European Integrated Pollution Prevention & Control Bureau (EIPPCB)	Gov't	Oct. 19, 2001, Oct. 22, 2001, Oct. 31, 2001	Oct. 31, 2001	Head of Waste Incineration Technical Work Group (TWG) of EIPPCB. Mr. James stated that the TWG has no info to date (kick-off meeting early Dec. 2001). He suggested contacting the persons from the Netherlands on the TWG.
Laetitia Reynaud	Eur. Federation of Waste Mgmt & Enviro. Services	Gov't	Oct. 22, 2001		Sent email request. Said she would locate person with knowledge and respond to our request.
Eric Lesueur	Eur. Federation of Waste Mgmt & Enviro. Services (FEAD).	Gov't	Oct. 22, 2001		Sent email request. On EIPPCB's Technical Work Group. Nadine De Greef responded saying she forwarded my request to FEAD's members.
Bernt Johnke	Germany Federal Environmental Agency	Gov't	Oct. 18, 2001	Dec. 19, 2001	Sent email request for SCR info from Germany's federal gov't. Received paper on SCR use in Germany.
David van Lochem (Webmaster of Belgium's Environmental Department)	Belgium Federal Department of the Environment	Gov't	Oct. 18, 2001	Oct. 19, 2001	Sent email requests to general information and two divisions within department to get name and number of persons with knowledge in Belgium's federal gov't. Told to contact the three regional gov'ts in Belgium.
info@ibgebim.be	Belgium Brussels Capital Region	Gov't	Oct. 19, 2001		Sent email to region in Belgium (info@ibgebim.be) to get name and numbers of persons with SCR knowledge on MWCs. No Response Yet.
aminal@ lin.vlaanderen.be	Belgium Flanders Region	Gov't	Oct. 19, 2001	Nov. 5, 2001	Sent email to Flanders Region in Belgium (aminal@lin.vlaanderen.be) to get name and number of persons with SCR knowledge on MWCs. Filip Francois responded with website.
de.dgrne@ mrw.wallonie.be	Belgium Walloon Region	Gov't	Oct. 19, 2001		Sent email to region in Belgium (de.dgrne@mrw.wallonie.be) to get name and number of persons with SCR knowledge on MWCs in their region. No Response Yet.
Andreas Klatt	Siemens AG [Redwitz, Germany]	Catalyst Mfg	Oct. 22, 2001		Was to provide links to cost information in Europe. Have not received this info yet.

Lee County Energy Recovery Facility
SCR Search Summary Spreadsheet

Contact Name	Company/Affiliation	Category	Date Contacted	Date Response Received	Status
	AGR Disposal - RZR Herten	Waste Disposal Company	Oct. 22, 2001		Sent email request. Has waste incineration plant in the District of Recklinghausen, Germany called RZR Herten
Roger Kohlmann	RWE Power	Waste Disposal Company	Oct. 22, 2001		Sent email request. Has refuse-fired power generating facility at Essen-Karnap (Germany)
Carl-Arne Pedersen	Renova AB (Sweden)	Waste Disposal Company	Oct. 22, 2001	Oct. 23, 2001	Sent email request. Has waste incinerator facility (Savenas) near Gothenburg, Sweden. Responded with two individuals to contact but did not provide means to contact them.
James Ray	Shanks Group plc (United Kingdom)	Waste Disposal Company	Oct. 22, 2001	Oct. 22, 2001	Sent email request. Lists waste incineration among their services. Responded with link to www.eurits.org (mainly Hazardous Waste related) and United Kingdom de NOx policy
Mr. Goverde Ton	AVR	Waste Disposal Company	Oct. 22, 2001		Sent email request. Lists incineration of domestic residual wastes among their services. No response yet.
Al Linero/ Mike Halpin	Florida Department of Environmental Protection	Gov't	Oct. 22, 2001	Oct. 22, 2001	Called to determine whether Florida DEP has any information relative to SCR use on MWCs. Does not have an information.
Dennis Malone	Babcock Borsig Power [Worchester, MA USA]	SCR Mfg		Oct. 22, 2001	Received budget proposal for cold end SCR system.
Tony Licata	Babcock Borsig Power [Worchester, MA USA]	SCR Mfg		Oct. 25, 2001	Received information on installation experience with SCR on MWCs outside USA.
Ludwig Ramacher	Trienekens AG International	Waste Disposal Company		Oct. 23, 2001	Member of FEAD. Responded with leads to contact Markus Heering and Bernd Hausmann (Represents SCR Constructor) of EIPPCB TWG.
Katie Willis	Dutch Waste Processing Association (VVAV)	Waste Mgmt Assoc.		Oct. 24, 2001	Member of FEAD. Received paper presented in Paris, France in March 2001.

Lee County Energy Recovery Facility
SCR Search Summary Spreadsheet

Contact Name	Company/Affiliation	Category	Date Contacted	Date Response Received	Status
Gerard Harmsen	RIZA (The Netherlands Institute for Inland Water Management and Waste Water Treatment)	Gov't	Oct. 31, 2001	Nov. 5, 2001	At Paul James' (EIPPCB) suggestion, I called Mr. Harmsen. He does incineration's water issues and suggested I contact Hans Holtring and Marcel Taal.
Hans W. Holtring	The Netherlands Ministry of Housing, Spacial Planning and the Environment	Gov't	Oct. 31, 2001 and Nov. 5, 2001		At Paul James' (EIPPCB) suggestion, I sent email request for information on SCR use on MWCs. No response yet.
Gert Stam	RIZA (The Netherlands Institute for Inland Water Management and Waste Water Treatment)	Gov't	Oct. 31, 2001		At Paul James' (EIPPCB) suggestion, I sent email request for information on SCR use on MWCs. No response yet.
Mr. Gerard de Vries	RIZA (The Netherlands Institute for Inland Water Management and Waste Water Treatment)	Gov't	Oct. 31, 2001		At Paul James' (EIPPCB) suggestion, I sent email request for information on SCR use on MWCs. No response yet.
Marcel Taal	INFOMIL (www.infomil.nl)	Gov't	Nov. 5, 2001	Nov. 9, 2001	At Gerard Harmsen's suggestion, I email Mr. Taal with info request and the four questions. Suggests contacting Mr. Gerben Timmer of Dutch Waste Processing Association (VVAV). Received draft document of Dutch (hazardous) waste incineration.
Filip Francois	Belgium Flanders Region	Gov't	Nov. 5, 2001	Nov. 8, 2001	Sent email follow-up asking for answers to our four questions on SCR use in Europe. Responded with individuals at two plants in Flanders.
Mr. Jacques Soenens, Mr. Johan Bonnier	IMOG in Harelbeke (Flanders Belgium)	MWC Facility	Nov. 8, 2001	Dec. 5, 2001	Sent information request email to plant director/co-director. Received information on their Belgium facility.
Mr. Paul Dobbelaere, Mr. Karel Matthys, Mr.	IVAGO in Gent (Flanders Belgium)	MWC Facility	Nov. 8, 2001		Sent email to plant director/co-director asking for answers to our four questions on SCR emissions, cost, operation, downtime.

Lee County Energy Recovery Facility
SCR Search Summary Spreadsheet

Contact Name	Company/Affiliation	Category	Date Contacted	Date Response Received	Status
Dr. Markus Heering	VDMA	SCR Constructor Assoc.	Nov. 8, 2001	Nov. 14, 2001	Sent email request w/ four questions at suggestion of Ludwig Ramacher. He knowledge of technology but not cost and operation. Suggested to contact Martin GmbH in Munich (partner of Covanta)
Mr. Bernd Hausmann	EBA European Boilermakers' Association	SCR Constructor Assoc.	Nov. 8, 2001		Sent email request w/ four questions at suggestion of Ludwig Ramacher. No response yet.
Filip Francois	Belgium Flanders Region	Gov't	Nov. 8, 2001	Nov. 9, 2001	Sent request for English translation of web site for IVAGO in Gent (Belgium) plant. No English translation. Given lead to contact Seghers Better Technology, builder of plant.
	Seghers Better Technology	MWC Constructor	Nov. 9, 2001		Sent email to Seghers Better Technology (info_solids-air@bettertechnology.com) builder of the IVAGO in Ghent Belgium plant at suggestion of Filip Francois.
Mr. Gerben Timmer	Dutch Waste Processing Association (VVAV)	Waste Mgmt Assoc.	Nov. 9, 2001	Nov. 9, 2001	At suggestion of Marcel Taal of INFOMIL, I emailed Mr. Timmer our four questions. Cannot provide detailed information. Sent copy of paper Katie Willis sent on Oct 24, 2001. Received names of four plant operators in The Netherlands.
Marcel Goemans	Seghers Better Technology [Belgium Office]	MWC Constructor	Nov. 12, 2001		Sent paper presented at various symposia. Needs info on Lee County site prior to answering our questions. Provided www.scientecmatrix.com. Dirk Earaerts of Atlanta, Ga office will call me.
Onno Maaskant	CRI Catalysts (Hague, The Netherlands)	Catalyst Mfg	Nov. 12, 2001	Nov. 12, 2001	RTP received an email asking for our questions. Sent email with questions. Responded with our questions are site specific and beyond scope of CRI. Contact Mr. Per R. Nielsen of FLS Miljo Denmark (supplier of turn-key installation of facility in Roosendaal, The Netherlands.

Lee County Energy Recovery Facility
SCR Search Summary Spreadsheet

Contact Name	Company/Affiliation	Category	Date Contacted	Date Response Received	Status
Mr. Per R. Nielsen	FLS Miljo Denmark	MWC Constructor	Nov. 12, 2001	Nov. 14, 2001	At Onno Maaskant's suggestion I emailed Mr. Nielsen and posed our fours questions to him. He responded that he cannot provide the detailed information on the Roosendaal (The Netherlands) facility and suggested contacting Casper Stuard at plant.
Mr. Gerben Timmer	Dutch Waste Processing Association (VVAV)	Waste Mgmt Assoc.	Nov. 13, 2001	Nov. 13, 2001	Called Mr. Timmer to get names of plant operators using SCR in The Netherlands. Emailed me names of four plants in The Netherlands.
Mr. Leo van Putten	AVR Rotterdam (Rotterdam City, The Netherlands)	MWC Facility	Nov. 13, 2001	Nov. 21, 2001	Emailed Mr. van Putten to get info on their experience with SCR on their MWC. Responded with operational information.
Mr. Jean Luteijn	AVR Rozenburg (Rotterdam Harbor, The Netherlands)	MWC Facility	Nov. 13, 2001	Nov. 26, 2001	Emailed Mr. Luteijn to get info on their experience with SCR on their MWC. Responded with facility specific information on AVR Rozenburg
Mr. Huub Nijkamp	Twence (Hengelo, The Netherlands)	MWC Facility	Nov. 13, 2001	Nov. 14, 2001	Emailed Mr. Nijkamp to get info on their experience with SCR on their MWC. Replied that he would help us. Gave name of process engineer at plant.
Mr. Ron Slijster	HVC (Alkmaar, The Netherlands)	MWC Facility	Nov. 13, 2001	Nov. 19, 2001	Emailed Mr. Slijster to get info on their experience with SCR on their MWC. Responded with operational and emissions information. No cost information given. I sent follow-up message (on Nov. 19, 2001) to clarify a few items.
Jurgen Bruggeman	Twence (Hengelo, The Netherlands)	MWC Facility	Nov. 14, 2001		At suggestion of Mr. Nijkamp, I emailed Mr. Bruggeman (Process Engineer) to get info on their experience with SCR on their MWC. No response.
Dirk Eeraerts	Seghers Better Technology [Atlanta, GA Office]	MWC Constructor / Designer	Nov. 19, 2001	Nov. 27, 2001	Received call from Mr. Eeraerts as follow-up to Marcel Goemans email. I briefed him on the project and our needs and sent him an email and letter containing background information and our list of questions. Needs additional information.

Lee County Energy Recovery Facility
SCR Search Summary Spreadsheet

Contact Name	Company/Affiliation	Category	Date Contacted	Date Response Received	Status
Mr. Jonas Eek, CEO Haakan Rylander	Renova AB (Sweden)	Waste Disposal Company	Nov. 26, 2001		Sent email request to these men to get operational information on their experience with SCR. Mr. Carl Arne Pedersen suggested I contact them but did not provide a means to contact them so I emailed a general mailbox for Renova.
Dirk Eeraerts	Seghers Better Technology [Atlanta, GA Office]	MWC Constructor / Designer	Nov. 27, 2001	Dec. 6, 2001	Responded with budget estimate for SCR system at Lee County ERF of $8,200,000. Additional information verification is required.
Dirk Eeraerts	Seghers Better Technology [Atlanta, GA Office]	MWC Constructor / Designer	Dec. 11, 2001	Dec. 21, 2001	Sent email to get further clarification of budget estimate. Received information on Dec. 21, 2001.
Ho Y. Kwak	Hyundai Heavy Industries Co, Ltd.	MWC Facility	Jan.3, 2002		Sent email to General Manager to obtain information on three MWCs in Sung-Nam City, Myung-Ji, and Seoul, Korea.
John Chandler	AJ Chandler & Assoc. (Enviro Consultant to Peel MWC facility)	MWC Facility	Jan. 4, 2002, Jan. 7, 2002	Jan. 4, 2002, Jan. 7, 2002	Called to get information on KMS Peel MWC in Peel Region of Ontario, Canada. Received information on operational and design history of facility as well as preliminary emissions data and costs of SCR System.
Richard Newland	Haldor Topsoe, Inc.	SCR Mfg	Mar. 20, 2002	Apr 8, 2002	Sent email requesting information and budgetary estimate for SCR system. Received estimate on Apr. 8, 2002.
Brian McCarthy	Tipaz, Inc.	Control Technology Vendor	Apr. 1, 2001		Sent email requesting information on Electron Beam technology and possible application to MWCs.
Richard Newland	Haldor Topsoe, Inc.	SCR Mfg		Apr 15, 2002	Received list of facilities using Haldor Topsoe's SCR system.
Manuel Conte	Uquifa (Spain)	Facility w/ SCR System	Apr 16, 2002	Apr 16, 2002	Sent email requesting information on their facility which was referenced by Haldor Topsoe. Facility is a fine chemicals factory combusting solvents.

Lee County Energy Recovery Facility
SCR Search Summary Spreadsheet

Contact Name	Company/Affiliation	Category	Date Contacted	Date Response Received	Status
Stefano Rossini	Provencia Autonoma di Bolzano (Italy)	Waste Incineration Plant	Apr 16, 2002, Apr. 29, 2002		Sent email requesting information on their facility which was referenced by Haldor Topsoe. Facility is listed as a waste incineration facility (type of waste not specified).
Tony Licata	Babcock Borsig Power	SCR Mfg		Apr 23, 2002	Received comments on Haldor Topsoe budgetary estimate.
Helge Rosenberg	Haldor Topsoe A/S	SCR Mfg		May 3, 2002	Received information on a municipal waste incineration facility in Italy utilizing a Haldor Topsoe SCR system
John Chandler	AJ Chandler & Assoc. (Enviro Consultant to Peel MWC facility)	MWC Facility	May 6, 2002	May 6, 2002	Results of initial compliance emissions test still in draft form.

LEE COUNTY ENERGY RECOVERY FACILITY
PREVENTION OF SIGNIFICANT DETERIORATION
APPLICATION FOR MUNICIPAL WASTE COMBUSTOR UNIT 3

ATTACHMENT D

LIST OF FACILITIES INCORPORATING SELECTIVE CATALYTIC REDUCTION

October 31, 2002

αβχδ ALSTOM POWER

February 2001

WASTE INCINERATION PLANTS WITH SCR DENOX TREATMENT

COUNTRY / CUSTOMER	LOCATION	NUMBER OF LINES	FLOW TREATED Nm^3/h	COMMIS-SIONED	TYPE OF WASTE	PROCESS
Belgium						
IMOG	HARELBEKE	2	109 000	2000	MU	XX
France						
U.V.E. SMEDAR (SICDOM)	ROUEN	3	70 000	1999	MU	ERFXRC
COMMUNAUTE URBAINE DE LILLE	LILLE	3	65 600	2001	MU	RFHEWX
Germany						
STADTWERKE MUNCHEN	MUNCHEN	2	240 000	1989	MU	CDFX
ENERGIE- UND WASSERWERKE RHEIN-NECKAR AG	MANNHEIM	2	206 000	1995	MU	XZ
RWE ENERGIE AG	ESSEN	4	168 000	1995	MU	ZX
STADTWERKE SOLINGEN	SOLINGEN	1	95 000	1995	MU	CDFX
HULS	MARL	1	40 000	1996	MS	FXXW
GML	LUDWIGSHAFEN	2	70 000	1996	MU	YEWXX
TRV	WESSELING	2	25 000	1996	HA	FXX
STADTWERKE MUNCHEN	MUNCHEN	2	200 000	1996	MU	FIX
LANDKREIS NEU-ULM	WEISSENHORN	2	48 000	1996	MU	X
ZWECKVERBAND	BAMBERG	3	40 000	1996	MU	FIX
LCB	KOLN	3	100 000	1997	MU	XX
Luxembourg						
SIDOR	LEUDELINGEN	3	42 000	1995	MU	FIX
Netherlands						
AVI TWENTE b.v.	TWENTE	2	117 000	1997	MU	EREWFIX
Sweden						
SYSAV	MALMO	2	60 000	1995	MI	X
Switzerland						
KVA LUZERN	LUZERN	2	55 000	1996	MU	WFIX
KVA NIEDERURNEN	NIEDERURNEN	2	70 000	1999	MU	EXX

LIST OF ABBREVIATIONS

TYPE OF WASTE

Code	Meaning
MU	Municipal Solid Waste
MI	Municipal Solid Waste and Industrial Waste
IN	Industrial Waste
CH	Chemical Waste
CL	Hospital Waste
CR	Cremation
HA	Hazardous Waste
IS	Industrial Sludge
MS	Sewage Sludge
MD	Fuel Derived From Compressed Municipal Solid Waste
PS	Paper Sludge

PROCESS

Code	Meaning
B	Economizer Boiler (ECO)
C	Conditioned
D	Dry Absorption System
E	Electrostatic Precipitator
F	Fabric Filter
FI	Filsorption
HE	Heat Exchanger
N	NID – Dry Absorption System
R	Absorber-Dryer-Sprayer With Rotary Atomizer
RC	Recirculation
W	Wet Scrubber
X	SCR DeNOx
XX	SCR DeNOx and DeDiox
Y	Absorber-Dryer-Sprayer With Diffusers
Z	Fixed-bed Filter

Reference List
Flue Gas Cleaning Plants For Waste Incineration Plants

BABCOCK BORSIG POWER
ENVIRONMENT

Client	Plant	Fuel	Process steps supplied by Babcock-Steinmüller-Gummersbach	Flue gas volume m^3/h, STP, wet	Reagents	End product	Year of Start-up
Hoechst AG	Gersthofen	Hazardous waste	Cyclone, one stage wet scrubbing	1 x 4,600	NaOH	Fly ash, waste water	1975
Stadt Kiel	Kiel	Municipal waste	Electrostatic precipitator, one stage wet scrubbing	3 x 31,000	CaO	Fly ash, sludge, waste water	1975
Stadt Wuppertal	Wuppertal	Municipal waste	Electrostatic precipitator, one stage wet scrubbing	2 x 100,000		Fly ash, sludge, waste water	1975
Bayer AG Leverkusen	Bürrig BE 2	Industrial / hazardous waste	Electrostatic precipitator, rotary scrubber, wet electrostatic precipitator	1 x 45,000	NaOH	Waste water	1976
RWTH Aachen	Aachen	Hospital waste	Electrostatic precipitator, one stage wet scrubbing	1 x 25,000	CaO	Fly ash, waste water	1977
Stadt Stuttgart	Stuttgart	Sewage sludge	One stage wet scrubbing	2 x 30,000	Alkaline process water	Waste water	1977
ZV MHKW Bamberg (Stadt und Landkreis)	Bamberg	Municipal waste, sewage sludge	Electrostatic precipitator, one stage wet scrubbing	2 x 45,000	CaO	Fly ash, sludge, waste water	1978
Ford AG	Köln	Hazardous waste	Electrostatic precipitator, one stage wet scrubbing	1 x 45,000	CaO	Fly ash, waste water	1979
GMVA Niederrhein GmbH (Pilot plant)	Oberhausen	Municipal waste	Spray absorber, fabric filter	1 x 7,000	NaOH; CaO; $Ca(OH)_2$	Fly ash, reaction salts	1980
Stadt Krefeld	Krefeld	Municipal waste, sewage sludge	Electrostatic precipitator, two stage wet scrubbing	3 x 110,000	CaO NaOH	Fly ash, waste water	1980
Stadtwerke Kiel	Kiel	Municipal waste	Electrostatic precipitator, one stage wet scrubbing	1 x 62,000	CaO	Fly ash, waste water	1980
Passavant-Werke Düsseldorf	Düsseldorf	Sewage Sludge	Spray absorber, electrostatic precipitator	1 x 26,000	NaOH	Fly ash, reaction salts	1981
ZV MHKW Bamberg (Stadt und Landkreis)	Bamberg	Municipal waste, sewage sludge	Electrostatic precipitator, one stage wet scrubbing	1 x 45,000	CaO	Fly ash, sludge, waste water	1982
Zweckverband Würzburg	MHKW Würzburg	Municipal waste	Quench cooler, dry injection reactor, fabric filter with activated coke injection	2 x 65,000	$Ca(OH)_2$	Salt , fly ash mixture	1984
Stadt Hamburg	Hamburg Borsigstraße	Municipal waste	Spray absorber, electrostatic precipitator	2 x 65,000		Fly ash, reaction salts	1984
Stadtwerke München (RIP north unit 3)	München	Municipal waste, sewage sludge	Spray absorber, electrostatic precipitator	2 x 170,000	CaO	Fly ash, reaction salts	1984

AUG 29 '01 11:03AM DBRILEY ENVIRONMNTL P.2

Client	Plant	Fuel	Process steps supplied by Babcock-Steinmüller-Gummersbach	Flue gas volume m^3/h, STP, wet	Reagents	End product	Year of Start-up
Ford AG	Köln	Industrial sludge	Spray absorber, electrostatic precipitator	1 x 25,000	CaO	Fly ash, reaction salts	1985
Müllheizkraftwerk Göppingen	Göppingen	Municipal waste, sewage sludge	Spray dryer, electrostatic precipitator, one stage wet scrubbing	2 x 70,000	CaO	Fly ash, salts	1985
Stadt, Hagen	Hagen	Municipal waste	Spray absorber, electrostatic precipitator	3 x 32,000	CaO	Fly ash, reaction salts	1985
Stadt Hamm	Hamm	Municipal waste	Spray absorber, fabric filter	4 x 53,000	CaO	Fly ash, reaction salts	1985
Stadtwerke Düsseldorf	Düsseldorf	Municipal waste	Spray absorber, electrostatic precipitator	3 x 135,000	CaO	Fly ash, reaction salts	1985
Rhein-Neckar AG	Mannheim	Municipal waste	Spray dryer, electrostatic precipitator, two stage wet scrubbing	2 x 150,000	Dolomit	Fly ash, salts	1986
RWE Energie AG	Essen-Karnap	Municipal waste	Electrostatic precipitator, one stage wet scrubbing	4 x 121,000	CaO	Fly ash, gypsum, sludge, waste water	1986
GMVA Niederrhein GmbH	Oberhausen	Municipal waste	Electrostatic precipitator, one SWS	4 x 150,000	CaO	Fly ash, sludge, waste water	1987
Müllheizkraftwerk Göppingen	Göppingen	Municipal waste, sewage sludge	Second wet scrubbing stage	2 x 70,000	CaO	Salts	1987
Remival*, France	Reims	Municipal waste	quench cooler, dry lime injection, fabric filter	2 x 34,000	$Ca(OH)_2$	Fly ash, reaction salts	1987
AGR Essen	RZR Herten IM 2	Industrial waste	Electrostatic precipitator, 1-stage prescrubber, 1-stage SO_2-scrubber	1 x 70,000	CaO	$CaCl_2$, gypsum	1988
BWB	SV Ruhleben	Sewage sludge	Electrostatic precipitator, 1-stage SO_2-scrubber	3 x 54,000	$CaO / CaCO_3$	Gypsum	1988
Babylon County, USA	Babylon, NJ	Municipal waste	Spray absorber, fabric filter	2 x 87,600	CaO	Fly ash, reaction salts	1988
Portland County*, USA	Portland, MA	Municipal waste	Spray absorber, electrostatic precipitator	2 x 57,000	CaO	Fly ash, reaction salts	1988
SIDOR, Luxembourg	Leudelingen	Municipal waste	Spray absorber, fabric filter	3 x 35,400	CaO	Reaction salts	1988
Bayer AG Leverkusen	Bürrig BE 1	Industrial / hazardous waste	Quench cooler*, rotary scrubber, wet electrostatic precipitator	1 x 72,000	NaOH	Waste water	1989

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Reference List
Flue Gas Cleaning Plants For Waste Incineration Plants

BABCOCK BORSIG POWER
ENVIRONMENT

Client	Plant	Fuel	Process steps supplied by Babcock-Steinmüller-Gummersbach	Flue gas volume m^3/h, STP, wet	Reagents	End product	Year of Start-up
American Ref-Fuel Company*, USA	Hempstead, NY	Municipal waste	Spray absorber, fabric filter	3 x 174,000	CaO	Fly ash, reaction salts	1989
Camden County*, USA	Camden, NJ	Municipal waste	Spray absorber, electrostatic precipitator	3 x 87,700	CaO	Fly ash, reaction salts	1989
Charleston County*, USA	Charleston, SC	Municipal waste	Spray absorber, electrostatic precipitator	2 x 83,000	CaO	Fly ash, reaction salts	1989
GML Abfallwirt-schaftsgesellschaft mbH	Ludwigshafen	Municipal waste	Spray dryer, electrostatic precipitator, two stage wet scrubber	2 x 54,000	CaO	Fly ash, salts	1989
ZV Abfallent-sorgung Offenbach	Offenbach/Main	MWS	Spray dryer, electrostatic precipitator, two stage wet scrubbing	3 x 55,000	CaO NaOH	Fly ash, salts	1989
American Ref-Fuel Company*, USA	Essex County, NJ	Municipal waste	Spay absorber, electrostatic precipitator	3 x 174,000	CaO	Fly ash, reaction salts	1990
GMVA Niederrhein GmbH	Oberhausen	Municipal waste	Retrofit of a second wet scrubbing stage	4 x 150,000	NaOH	Gypsum, waste water	1990
Indaver, Belgium	Antwerpen	Hazardous waste	Electrostatic precipitator, two stage wet scrubbing	1 x 59,000	CaO NaOH	Fly ash, waste water, sludge	1990
Syctom, France	St. Ouen, Paris	Municipal waste	Electrostatic precipitator, one stage wet scrubbing	3 x 156,000	$Ca(OH)_2$	Fly ash, waste water	1990
ZV MHKW Bamberg (Stadt u. Landkreis)	Bamberg	Municipal waste	Retrofit of a second wet scrubbing stage	3 x 37,300	NaOH	Gypsum, waste water	1990
AGR Essen	RZR Herten IM 1	Industrial waste	ACR, ACCR	1 x 70,000	NH_3	—	1991
BAG/Westfalen	Bönen	Soil treatment	Filter layer reactor	1 x 11,000	$Ca(OH)_2$	Fly ash, salts, activated carbon	1991
RWE Energie AG (Pilot plant)	Essen-Karnap	Municipal waste	Filter layer reactor, SCR	1 x 500	$Ca(OH)_2$ activated carbon	Salts, activated carbon	1991
Stadtwerke München (RIP north unit 1)	München	Sewage sludge	SNCR, spray dryer, electrostatic precipitator, two stage wet scrubbing	2 x 213,500	NH_4OH CaO NaOH	Fly ash, salts	1991
Bayer AG Leverkusen	Bürrig VA 2	Industrial / hazardous waste	Electrostatic precipitator*, quench cooler, rotary scrubber, wet electrostatic precipitator	1 x 45,000	NaOH	Waste water	1992
Ciba Geigy, Switzerland	Schweizerhalle	Solvents	SCR	1 x 50,000	NH_4OH	—	1992

AUG 29 '01 11:03AM DBRILEY ENVIRONMTL

Client	Plant	Fuel	Process steps supplied by Babcock-Steinmüller-Gummersbach	Flue gas volume m^3/h, STP, wet	Reagents	End product	Year of Start-up
GEKAL, Switzerland	Buchs-Aarau	Minicipal solid wast	Electrostatic precipitator, two stage scrubbing, fly ash treatment and solidification	2 x 54,000	CaO NaOH	Fly ash, sludge, waste water	1992
City of Rotterdam, Nehterlands	AVI ROTEB	Municipal waste	1-stage prescrubber, 1-stage SO_2-scrubber, ACR, SCR	4 x 75,000	NaOH NH_4OH	Waste water	1993
Papierfabrik Haindl	Schwedt	Residues from paper production	Electrostatic precipitator, one stage wet scrubbing	1 x 100,000	CaO	Fly ash, waste water	1993
HEW / VKR Hamburg	MVB Hamburg	Municipal waste	SNCR, quench cooler, fabric filter with activated coke injection, 2-stage HCl scrubber, 1-stage SO_2-scrubber, wet electrostatic precipitator	2 x 120,000	CaO	Gypsum, HCl	1994
AVR-Chemie Rotterdam, Netherlands	Rozenburg, DTO-8	Hazardous waste	ACR	1 x 80,000	---	—	1994
ZAR Zweckverband Abfallbeseitigung Rangau Fürth	MVA Zimdorf	Municipal waste	SCR	1 x 25,000	NH_4OH	—	1994
Entsorgungsges. Krefeld mbH & Co. KG	Krefeld	Municipal waste, sewage sludge	Spray dryer, fabric filter, two stage wet scrubbing, SCR, filter layer reactor	3 x 76,000	CaO NH_4OH	Fly ash, gypsum salts, activated carbon	1994
MPA Burgau Full scale tests	Burgau	Municipal waste (pyrolysis)	Filter layer reactor	1 x 60,000	$Ca(OH)_2$	Fly ash, salts, activated carbon	1994
Sieparg*, France	Grenoble	Municipal waste	Spray dryer, electrostatic precipitator, two stage wet scrubbing	3 x 45,900	$Ca(OH)_2$ NaOH	Fly ash, salts	1994
Von Roll Zürich, Switzerland	MVA Ingolstadt	Municipal waste	SCR	2 x 64,000	NH_4OH	---	1995
Abfallentsorgungsgesellschaft mbH Essen (AGR) (Permit engineering)	Herten	Municipal waste	Fabric filter, two stage wet scrubbing, fixed bed ACR, SCR, 2-stage HCl scrubber-rectification	2 x 131,000	CaO NH_4OH	HCl, fly ash, gypsum, OHFC to be incinerated	1995

AUG 29 '01 11:04AM DBRILEY ENVIRONMNTL P.5

Client	Plant	Fuel	Process steps supplied by Babcock-Steinmüller-Gummersbach	Flue gas volume m^3/h, STP, wet	Reagents	End product	Year of Start-up
Berliner Stadtreinigungs-betriebe	Berlin-Ruhleben	Municipal waste	SCR	4 x 148,000	NH_4OH	---	1995
Ciba Geigy, Switzerland	Basel	Hazardous waste	SCR	1 x 55,000	NH_4OH	---	1995
GMVA Nieder-rhein GmbH	Oberhausen	Municipal waste	SCR, filter layer reactor	4 x 150,000	NH_4OH $Ca(OH)_2$ activated carbon	Salts, activated carbon, (re-use in waste water treatment)	1995
MVA Bielefeld-Herford GmbH	Bielefeld	Municipal waste	Electrostatic precipitator 1, spray dryer, electrostatic precipitator 2, two stage wet scrubbing, SCR, filter layer reactor	3 x 150,000	NH_4OH $Ca(OH)_2$ activated carbon	Fly ash, salts, activated carbon	1995
Sietrm*, France	Lagny / Mame-la-Vallée	Municipal waste	Electrostatic precipitator, one stage wet scrubbing	1 x 66,000 1 x 43,800	$Ca(OH)_2$	Fly ash, waste water	1995
AWL GmbH Leverkusen	MHKW Leverkusen	Municipal waste	Quench cooler*, electrostatic precipitator*, 1-stage prescrubber, 1-stage SO_2-scrubber, filter layer reactor, SCR	3 x 69,000	NaOH, CaO $Ca(OH)_2$ activated carbon	NaCl, gypsum	1996
AGR Essen	RZR Herten IM 2	Industrial waste	ACR, SCR	70,000	NH_3	---	1996
SWD Düsseldorf	MVA Flingern	Municipal waste	SCR	2 x 350,000	NH_4OH	---	1996
Landkreis Landshut	MVA Landshut	Municipal waste	SCR-oxidation catalyst	1 x 57,000	NH_4OH	---	1996
Landkreis Neu-Ulm	MVA Weißenhorn	Municipal waste	ACR	2 x 51,000	---	---	1996
MVA Stapelfeld Hamburg	MVA, Stapelfeld 1 + 2	Municipal waste	ACR, SCR	2 x 120,000	NH_4OH	---	1996
Gesellschaft zur Entsorgung von Sondermüll in Bayern mbH	Ebenhausen	Hazardous waste	Mercury control	1 x 70,000	Na_2S_4	---	1996
GEVUDO Dordrecht, Netherlands	GEVUDO Abfalverwerking	Municipal waste	Mercury control, activated carbon dosing, SCR-oxidation catalyst	2 x 125,000	Na_2S_4 CaO NH_4OH	---	1996

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BABCOCK BORSIG POWER
CT ENVIRONMENT

REFERENCE LIST

SCR DeNOx/ DeDioxin Systems

Client Country	Waste Description Project Description	Waste Capacity Flue Gas Capacity	Units Start-up
Broomchemie B.V. The Netherlands	Off-gases and liquid wastes, Br Complete plant with combustion chamber and acid recovery	750 kg/h 6'500 Nm3/h	1 2002
DIAE Switzerland	Municipal Waste SCR DeNOx, Modification of ESP	 130'000 Nm3/h	3 2002
Regionale Milieuzorg Belgium	Municipal waste SCR-DeNOx	 75'000 Nm3/h	2 2002
Borsodchem Rt. Hungary	Off-gas, liquid and solid wastes, N Complete plant with static furnace, boiler and flue gas cleaning	950 kg/h 13'000 Nm3/h	1 2001
Uijongbu City Korea	Municipal waste SCR DeNOx/DeDioxin	 25'000 Nm3/h	2 2001
LG Philips LCD Korea	Liquid wastes SCR DeNOx/DeDioxin	 8'000 Nm3/h	1 2000
TBA Neubrandenburg Germany	Municipal waste Complete thermal waste recycling plant	10'700 kg/h 40'000 Nm3/h	2 2000
MCHZ - Ostrava Czech Republic	Hazardous waste, S Complete plant with rotary kiln	1'500 kg/h 22'600 Nm3/h	1 1999
TRA Aussernzell Germany	Municipal waste Complete thermal waste recycling plant	12'500 kg/h 72'000 Nm3/h	2 1999
BASF Española Spain	Hazardous waste, Cl Rotary kiln, SCR-DeNOx	4'200 kg/h 56'000 Nm3/h	1 1998
GEKAL, Buchs Switzerland	Municipal waste SCR DeNOx	17'600 kg/h 180'000 Nm3/h	1 1998
KVA St. Gallen Switzerland	Municipal waste SCR-DeNOx	8'500 kg/h 72'000 Nm3/h	1 1996

Status: October 2001

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E-mail: sales@ctu.ch, Homepage: www.ctu.ch

BABCOCK BORSIG POWER
CT ENVIRONMENT

REFERENCE LIST

SCR DeNOx/ DeDioxin Systems

Client Country	Waste Description Project Description	Waste Capacity Flue Gas Capacity		Units Start-up
KVA Thurgau Switzerland	Municipal waste Flue gas cleaning, waste water treatment	60'000	Nm3/h	2 1996
BASF, Ludwigshafen Germany	Hazardous waste, Cl SCR DeNOx	130'000	Nm3/h	2 1995
BASF, Ludwigshafen Germany	Hazardous waste, Cl SCR DeNOx	160'000	Nm3/h	1 1995
EVI, Rotterdam Netherlands	Municipal waste Flue gas cleaning	22'000 155'000	kg/h Nm3/h	1 1995
Lonza, Visp Switzerland	Hazardous waste SCR DeNOx	166'500	Nm3/h	1 1995
RENI, Niedergösgen Switzerland	Reject, sludge, waste wood Complete plant with fluid bed furnace	8'000 25'000	kg/h Nm3/h	1 1995
Welser Abfallverwertung Austria	Municipal waste Complete plant with grate furnace	8'000 67'500	kg/h Nm3/h	1 1995
DMR Rostock Germany	Motor off-gas SCR-DeNOx	160'000	Nm3/h	1 1994
Mobil Oil Française France	Motor off-gas SCR-DeNOx	1'000	Nm3/h	1 1994
AVR Rotterdam Netherlands	Municipal waste Flue gas cleaning	22'000 155'000	kg/h Nm3/h	6 1993
Du Pont de Nemours France	Hazardous waste Complete plant with rotary and static kiln, flue gas cleaning and waste water treatment	2'700 25'000	kg/h Nm3/h	1 1993
Knoll Switzerland	Spent solvents and off-gases, Cl, Br Complete plant with static furnace	1'250 5'000	kg/h Nm3/h	1 1993

Status: October 2001

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BABCOCK BORSIG POWER
CT ENVIRONMENT

REFERENCE LIST

SCR DeNOx/ DeDioxin Systems

Client Country	Waste Description Project Description	Waste Capacity Flue Gas Capacity		Units Start-up
Universität Heidelberg Germany	Hospital waste Revamping of grate furnace, boiler, flue gas cleaning	600 6'500	kg/h Nm3/h	2 1991
MGC Plasma Switzerland	Hazardous waste Flue gas cleaning after plasma destruction	 5'225	 Nm3/h	1 1990
Fernwärme Wien Austria	Municipal waste Revamping of grate, boiler, flue gas cleaning	17'500 110'000	kg/h Nm3/h	2 1989
Fernwärme Wien Austria	Municipal waste Complete plant with grate furnace	17'500 90'000	kg/h Nm3/h	2 1987
Fernwärme Wien Austria	Municipal waste Complete plant with grate furnace	6'000 52'000	kg/h Nm3/h	3 1985

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Topsøe
DENOX Technology and Catalyst

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Application Index

Page

Boilers

Coal Fired High Dust Installations 3
Coal Fired Low Dust Installations 4
Oil Fired Installations 4
Gas Fired Installations 5
Pet Coke Fired Installations 5

Engines

Stationary Diesel Engines 5
Marine Diesel Engines 7
Gas Engines 8

Gas Turbines 8

Other Applications 9

121 References:

21 Coal Fired Boilers
11 Oil and Gas Fired Boilers
2 Pet Coke Fired Boilers
11 Gas Turbines
8 Gas Engines
31 Stationary Diesel Engines
18 Marine Diesel Engines
19 Other Applications

User (Contractor)	Plant Size	DENOX Efficiency	Catalyst Type	Topsøe's Scope of Supply	Expected Start-up
Coal Fired Boilers					
High Dust Installations					
Belgium					
Electrabel NV, Langerlo I (Deutsche Babcock)	250 MW_e	80 %	DNX-558	Catalyst Design of Ammonia Storage	1998
Electrabel NV, Langerlo II (Deutsche Babcock)	250 MW_e	80 %	DNX-558	Catalyst Design of Ammonia Storage	2000
Denmark					
Elkraft, Stigsnæs	10,000 Nm^3/h Demonstration Unit		DNX-362		1987-1992
ELSAM/Nordjyllandsværket (Deutsche Babcock)	411 MW_e	80 %	DNX-664	Catalyst	1998
ELSAM/Preussen Elektra, Ensted (ABB, Deutsche Babcock, Haldor Topsøe A/S)	600 MW_e	88-92 %	DNX-564	Catalyst System Design Hardware Construction	1996
Energi E2, Avedøre (Haldor Topsøe A/S)	250 MW_e	80 %	DNX-364	Catalyst System Design Hardware Construction	1993
Energi E2 Amager, Unit 3	250 MW_e	94 %	DNX-564	Catalyst	2000
USA					
A.E.S. Cayuga, NJ (Foster Wheeler)	150 MW_e	90 %	DNX-758	Catalyst Design of Ammonia Injection and Flow Rectifiers	2001
Allegheny Energy, PA Harrison Unit 1, WV (Parsons)	650 MW_e	>90 %	DNX-664	Catalyst Design of Ammonia Injection and Flow Rectifiers	Not yet installed
Allegheny Energy, PA Harrison Unit 2, WV (Parsons)	650 MW_e	>90 %	DNX-664	Catalyst Design of Ammonia Injection and Flow Rectifiers	Not yet installed
Allegheny Energy, PA Harrison Unit 3, WV (Parsons)	650 MW_e	>90 %	DNX-664	Catalyst Design of Ammonia Injection and Flow Rectifiers	Not yet installed
Allegheny Energy Pleasant Unit 1, WV (Parsons)	650 MW_e	>90 %	DNX-664	Catalyst Design of Ammonia Injection and Flow Rectifiers	Not yet installed
Allegheny Energy Pleasant Unit 2, WV (Parsons)	650 MW_e	>90 %	DNX-664	Catalyst Design of Ammonia Injection and Flow Rectifiers	Not yet installed

SNOX™: Combined removal of NOx and SOx
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User (Contractor)	Plant Size	DENOX Efficiency	Catalyst Type	Topsøe's Scope of Supply	Expected Start-up
Reliant Energy W.A. Parish Unit 5, TX (Sargent & Lundy)	690 MW_e	85 %	DNX-484	Catalyst Design of Ammonia Injection and Flow Rectifiers	2003
Reliant Energy W.A. Parish Unit 6, TX (Sargent & Lundy)	690 MW_e	85 %	DNX-484	Catalyst Design of Ammonia Injection and Flow Rectifiers	2003
Reliant Energy W.A. Parish Unit 7, TX (Sargent & Lundy)	590 MW_e	80 %	DNX-284	Catalyst Design of Ammonia Injection and Flow Rectifiers	2003
Reliant Energy W.A. Parish Unit 8, TX (Sargent & Lundy)	590 MW_e	85 %	DNX-284	Catalyst Design of Ammonia Injection and Flow Rectifiers	2003
SIPCO, IL Marion Unit 4 (Sargent & Lundy)	195 MW_e	92 %	DNX-584	Catalyst Design of Ammonia Injection and Flow Rectifiers	2003
Coal Fired Boilers **Low Dust Installations**					
Denmark ELSAM, Skærbæk	10,000 Nm^3/h (SNOX™) Demonstration Plant	>95 %	DNX-532	Catalyst System Design Hardware Construction	1987-92
Nordjyllandsværket, Vodskov (Haldor Topsøe A/S)	300 MW_e (SNOX™ plant)	>95 %	DNX-632	Catalyst System Design Hardware Construction	1991
USA Ohio Edison Co., Niles, Ohio (ABB, Snamprogetti)	35 MW_e (SNOX™ plant)	>95 %	DNX-932	Catalyst System Design	1991
Oil Fired Boilers					
Sweden Shell Refinery Gothenburg	60 MW	94 %	DNX-950	Catalyst System Design Hardware	1998

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User (Contractor)	Plant Size	DENOX Efficiency	Catalyst Type	Topsøe's Scope of Supply	Expected Start-up
Gas Fired Boilers					
Denmark					
Energi E2, Avedøre II	400 MW_e	94 %	DNX-350	Catalyst	2001
Russia					
AO Mosenergo, Moscow					
Block I	120 MW_e	67 %	DNX-962	Catalyst	1996
Block II	120 MW_e	67 %	DNX-962	System Design	1999
(ZAO Haldor Topsøe, Yaroslavl)				Hardware	
				Construction	
Dzerzhinskaya Power Station Dzerzhinsk (ZAO Haldor Topsøe, Yaroslavl)	120 MW_e	80 %	DNX-652	Catalyst System Design Hardware Construction	1999
USA					
Inland Paper and Packaging Ontario, CA	73,400 Nm^3/h (Steam plant)	90 %	DNX-930	Catalyst	1995
AES					
Huntington Beach, CA	Unit 1 (215 MW)	>90 %	DNX-930	Catalyst	2001
	Unit 2 (215 MW)	>90 %	DNX-930	Catalyst	2001
Reliant Etiwanda					
Rancho Cugamonga, CA	Unit 3 (330 MW)	>90 %	DNX-930	Catalyst	2001
	Unit 4 (330 MW)	>90 %	DNX-930	Catalyst	2001
Undisclosed	Unit 1 (180 MW)	>90 %	DNX-930	Catalyst	2001
	Unit 2 (180 MW)	>90 %	DNX-930	Catalyst	2001
Pet Coke Fired Boilers					
Italy					
Enichem, Gela	Demo Unit (SNOX™ Process)	95 %	DNX-950	Catalyst Design	1991
Agip Petroli Gela	300 MW_e (SNOX™ Process)	95 %	DNX-950	Catalyst System Design	1999
Stationary Diesel Engines					
Denmark					
Grindsted El- og Varmeværk, Grindsted (Wärtsilä NSD)	*6.6 MW_e plants*			Catalyst System Design Hardware	
	Plant No. 1	83 %	DNX-653		1994
	Plant No. 2	83 %	DNX-653		1994
IFV-Energi, Slangerup	1.6 MW_e	90 %	DNX-653	Catalyst System Design Hardware	1991
IFV-Energi, Hundested	3.5 MW_e	80 %	DNX-653	Catalyst	1991

SNOX™: Combined removal of NOx and SOx
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User (Contractor)	Plant Size	DENOX Efficiency	Catalyst Type	Topsøe's Scope of Supply	Expected Start-up
				System Design Hardware	
Finland					
Waasa Pilot Power Plant (Wärtsilä NSD), Vaasa	11.7 MW_e (plant I)	92 %	DNX-951	Catalyst System Design Hardware	1998
	23.3 MW_e (plant II)	94 %	DNX-951	Catalyst System Design Hardware	1998
Middle East					
Undisclosed client (Wärtsilä NSD)	6.5 MW_e Plants			Catalyst System Design Hardware	
	Plant no. 1	60 %	DNX-951		1998
	Plant no. 2	60 %	DNX-951		1998
	Plant no. 3	60 %	DNX-951		1998
	Plant no. 4	60 %	DNX-951		1998
Sweden					
Pharmacia AB, Stockholm	3.8 MW_e	95 %	DNX-650	Catalyst System Design Hardware	1993
Russia					
Aoot Rumo	12,000 Nm^3/h (test stand)	90 %	DNX-951	Catalyst System Design Hardware	2000
United Kingdom					
Citigen Limited, London	16.3 MW_e Plants			Catalyst System Design Hardware incl. Silensors	
	Plant no. 1	94 %	DNX-653		1993
	Plant no. 2	94 %	DNX-653		1993
Taiwan					
Taiwan Cement Corp. (Wärtsilä NSD)	6.5 MW_e Plants			Catalyst System Design Hardware	
	Plant no. 1	84 %	DNX-951		1995
	Plant no. 2	84 %	DNX-951		1995
	Plant no. 3	84 %	DNX-951		1995
Tung-Chi Paper (Wärtsilä NSD)	6.5 MW_e	84 %	DNX-653	Catalyst System Design Hardware	1995
Chung-Hwa (Wärtsila NSD) Taiyuan	6.5 MW_e Plants			Catalyst System Design Hardware	
	Plant no. 1	84 %	DNX-951		1996
	Plant no. 2	84 %	DNX-951		1996
	Plant no. 3	84 %	DNX-951		1997
	Plant no. 4	84 %	DNX-951		1997
TTET (Wärtsila NSD) Taiyuan	6.5 MW_e Plants			Catalyst System Design Hardware	
	Plant no. 1	84 %	DNX-951		1998
	Plant no. 2	84 %	DNX-951		1998

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User (Contractor)	Plant Size	DENOX Efficiency	Catalyst Type	Topsøe's Scope of Supply	Expected Start-up
Asia Polymer Corporation (Wärtsila NSD) Kaohsiung	6.5 MW_e Plants			Catalyst System Design Hardware	
	Plant no. 1	84 %	DNX-951		1998
	Plant no. 2	84 %	DNX-951		1998
	Plant no. 3	84 %	DNX-951		1998
TYC (Wärtsila NSD)	10.8 MW_e Plants			Catalyst System Design Hardware	
	Plant no. 1	84 %	DNX-951		1999
	Plant no. 2	84 %	DNX-951		1999
	Plant no. 3	84 %	DNX-951		1999
USA					
Citizen Utilities Co., Kauai, Hawaii	7.9 MW_e	60 %	DNX-653	Catalyst System Design Hardware	1991
Marine Diesel Engines					
Finland					
Silja Line Oy Helsinki					
"M/S Symphony" (Wärtsilä NSD)	3 MW_e (4-stroke) Aux. engine	95 %	DNX-653	Catalyst System Design Hardware	1994
"M/S Serenade" (Wärtsilä NSD)	3 MW_e (4-stroke) Aux. engine	95 %	DNX-653	Catalyst System Design Hardware	1994
"M/S Festival"	6 MW (4-stroke)	91 %	DNX-953	Catalyst System Design Hardware	2001
	Main engine 1	91 %	DNX-953		
	Main engine 2	91 %	DNX-953		
	Main engine 3	91 %	DNX-953		
	Main engine 4	91 %	DNX-953		
Sweden					
Stena Line AB Gothenburg				Catalyst System Design Hardware	
Ferry "M/S Jutlandica"	6.5 MW (4-stroke):				
	Main engine 1	90 %	DNX-653		1996
	Main engine 2	90 %	DNX-653		1996
	Main engine 3	90 %	DNX-653		1996
	Main engine 4	90 %	DNX-653		1996
	1.8 MW_e (4-stroke):				
	Aux. engine 1	90 %	DNX-653		1996
	Aux. engine 2	90 %	DNX-653		1996
	Aux. engine 3	90 %	DNX-653		1996
	Aux. engine 4	90 %	DNX-653		1996

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User (Contractor)	Plant Size	DENOX Efficiency	Catalyst Type	Topsøe's Scope of Supply	Expected Start-up
USA					
USS-POSCO	7.9 MW_e (2-stroke)			Catalyst System Design Hardware	
South Korean cargo ships:					
"M/V Pacific Success"	Main engine	92 %	DNX-662		1989
"M/V Pittsburg"	Main engine	92 %	DNX-662		1989
"M/V Delta Pride"	Main engine	92 %	DNX-662		1991
"M/W New Horizon"	Main engine	92 %	DNX-662		1992
Gas Engines					
Denmark					
Gartneriet A. Pedersen Bellinge	3.1 MW_e (GREENOX® Process)	90 %	DNX-953	Catalyst System Design Hardware	1995
Gartneriet A. Pedersen Bellinge	2.7 MW_e (GREENOX® Process)	90 %	DNX-953	Catalyst System Design Hardware	1997
Torup Grønne Gartneri Torup	2.7 MW_e (GREENOX® Process)	95 %	DNX-931	Catalyst System Design Hardware	1997
Gartneriet Rosborg Brændekilde	2.8 MW_e (GREENOX® Process)	94.5 %	DNX-951	Catalyst System Design Hardware	1998
Masnedø Gartnerier Masnedø	1.6 MW_e and 3 MW_e plants (GREENOX® Process)			Turnkey	
	Plant No. 1 (1.6 MW_e)	88 %	DNX-953		1998
	Plant No. 2 (1.6 MW_e)	88 %	DNX-953		1998
	Plant No. 3 (3 MW_e)	90 %	DNX-931		1999
	Plant No. 4 (3 MW_e)	90 %	DNX-931		1999
Gas Turbines					
Denmark					
I/S Nordjyllandsværket Frederikshavn	17 MW_e	48 %	DNX-930	Catalyst System Design Hardware	1998
I/S Nordjyllandsværket Hirtshals	9 MW_e	30 %	DNX-930	Catalyst System Design Hardware	1998
Italy					
ISAB, Priolo, Unit 1 (Snamprogetti SpA, Foster Wheeler Energy)	161 MW_e	80 %	DNX-930	Catalyst	1999
ISAB, Priolo, Unit 2 (Snamprogetti SpA, Foster Wheeler Energy)	161 MW_e	80 %	DNX-930	Catalyst	1999
USA					
City of Glendale CA, Greyson Station Unit (AUS)	Unit 8A (24 MW)	95 %	DNX-930	Catalyst	2000
	Unit 8B and 8C (47 MW)	95 %	DNX-930	Catalyst	2000

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User (Contractor)	Plant Size	DENOX Efficiency	Catalyst Type	Topsøe's Scope of Supply	Expected Start-up
A.E.S. – Red Oak, NJ (Foster Wheeler)	3 units				
	Unit 1 (277 MW_e)	80 %	DNX-930	Catalyst	2001
	Unit 2 (277 MW_e)	80 %	DNX-930	Catalyst	2001
	Unit 3 (277 MW_e)	80 %	DNX-930	Catalyst	2001
Nepco – Linden, NJ (Foster Wheeler)	172 MW_e	86 %	DNX-930	Catalyst	2001
B. Braun Medical Inc. Irvine, California	45,000 Nm^3/h (Natural gas fired Solar Simple Cycle)	90 %	DNX-930	Catalyst	2000

Other Applications

Australia					
Australian Gold Reagents Kwinana, Western Australia	19,000/38,000 Nm^3/h (Sodium cyanide production)	>90 %	DNX-930	Catalyst System Design Hardware	1998
Czech Republic					
Palivovy Kombinat, Vresova	54,000 Nm^3/h (SNOX™ Process) Off-gas incinerator	95 %	DNX-932	Catalyst System Design	1993
Denmark					
Haldor Topsøe A/S Frederikssund	30,000 Nm^3/h	90 %	DNX-652	Catalyst System Design	1999
Haldor Topsøe A/S Frederikssund	36,000 Nm^3/h			Catalyst System Design Hardware	
	Plant No. 1	90 %	DNX-930		1999
	Plant No. 2	90 %	DNX-930		1999
	Plant No. 3	90 %	DNX-930		1999
Holland					
Budelco, Budel (Kvaerner Chemetics)	1000 MTPD (Sulfuric Acid Plant)	95 %	DNX-330	Catalyst System Design	1999
India					
Deepak Fertilizers & Petrochemicals Co. Ltd.	45,000 Nm^3/h (Nitric acid plant)	95 %	DNX-920	Catalyst System Design	2000
Italy					
Provincia Autonoma di Bolzano Bolzano	117,000 Nm^3/h Incineration Plant	85%	DNX-930	Catalyst System Design Hardware	1996
Japan					
Asahi Chemical Industry Co., Ltd., Kawasaki	50,000 Nm^3/h (SNOX™ Process Spent acid regeneration)	95 %	DNX-652	Catalyst System Design Hardware	1993
Republic of Korea					
Namhae Chemical Corp. Yochon	3,000 Nm^3/h (DNT/MNT production)	99 %	DNX-930	Catalyst System Design Hardware	1998

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User (Contractor)	Plant Size	DENOX Efficiency	Catalyst Type	Topsøe's Scope of Supply	Expected Start-up
Russia Ministry of Oil Refining and Petrochemical Industry Ishimbay	8,000 Nm^3/h	70 %	DNX-652	Catalyst System Design Hardware	
Spain Uquifa Sant Celoni	9,000 Nm^3/h (Pharmaceutical plant)	90 %	DNX-950	Catalyst System Design Hardware	1998
Sweden ABB Atom AB Västerås	7,500 Nm^3/h (Nuclear fuel rod production)	60 %	DNX-930	Catalyst System Design Hardware	1997
Taiwan Undisclosed client	10,000 Nm^3/h (Waste oil incinerator)	70 %	DNX-652	Catalyst System Design Hardware	1998
USA Haldor Topsoe Inc. Houston, Texas	18,000 Nm^3/h	90 %	DNX-652	Catalyst System Design Hardware	1994
CSI, CA (Peerless)	7,000 Nm^3/h	88 %	DNX-930	Catalyst	2000
Chevron El Segundo, California	85 MM SCFD H_2	>90	DNX-930	Catalyst System Design Hardware	2000
Y2K Textiles Fullerton, CA	2 x 5,000 Nm^3/h	<70 %	DNX-930	Catalyst	2000
Haldor Topsoe, Inc. Houston, Texas	6,000 Nm^3/h	97 %	DNX-951	Catalyst System Design Hardware	2001
DistriGas Boston, MA	2 x 65,000 Nm^3/h	>90 %	DNX-930	Catalyst	2001

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SIEMENS

Reference List - SINOx® Honeycomb Type Catalysts

Waste Incineration Plants NOx Abatement

no.	plant	utiltiy/operator	country	plant constructor	initial charge/ reload./change	fuel	gas flow [Nm³/h]	pitch [mm]	number of cells	start of operation
1	Cridor		CH	LAB	initial charge	municipal waste	63055	4.2	35 x 35	1998
2	Ferrara		I	Integral	initial charge	industrial waste	45000	3.7	40 x 40	
3	Kwacheon		KOR	LAB	initial charge	municipal waste	24688	4.3	35 x 35	1997
4	MHKW Kassel	MHKW Kassel GmbH	D	Steinmüller	initial charge	municipal waste	2 x 74216	4.2	35 x 35	1997
5	MHKW Leverkusen	AWL	D	Steinmüller	initial charge	municipal waste	3 x 95239	4.2	35 x 35	04/1996
6	MVA Houthalen	CVBA Region. Milieuzorg	B	CT Umwelttechnik	initial charge	municipal waste	2 x 77400	4.2	35 x 35	
7	MVA Ingolstadt	ZV MVA Ingolstadt	D	Steinmüller	initial charge	municipal waste	2 x 70500	4.2	35 x 35	10/1995
8	MVA Stapelfeld	MVA Stapelfeld GmbH	D	Steinmüller	initial charge	municipal waste	2 x 134500	4.2	35 x 35	09/1995
9	RZR Herten	RZR Herten	D	Steinmüller	initial charge	industrial waste	69735	4.2	35 x 35	10/1995
10	SBA Fürth	ZAR	D	Siemens	initial charge	municipal waste	2 x 48300	4.2	35 x 35	1997
11	Tadaepo		KOR	LAB	initial charge	municipal waste	57619	4.3	35 x 35	1997
12	Taejeon		KOR	LAB	reloading	municipal waste	73525	4.3	35 x 35	1998

* Catalyst ordered by the utility

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Reference List - SINOx® Honeycomb Type Catalysts

Waste Incineration Plants NOx and Dioxin/Furan

no.	plant	utiltiy/operator	country	plant constructor	initial charge/ reload./change	fuel	gas flow [Nm³/h]	pitch [mm]	number of cells	start of operation
1	AEZ Wesel	Abfallges. Kr. Wesel	D	Steinmüller	initial charge	municipal waste	2 x 122500	3.7	40 x 40	1996
2	AVA Velsen	KAB Velsen	D	Lentjes	initial charge	municipal waste	2 x 92000	3.7	40 x 40	1997
3	Azalys	SIDRU	F	LAB	initial charge	municipal waste	2 x 47000	4.2	35 x 35	1998
4	Borsinc	BorsodChem Rt.	HUN	CT Umwelttechnik	initial charge	industrial waste	22900	4.2	35 x 35	2001
5	Centraco		F	LAB	initial charge	municipal waste	37514	4.3	35 x 35	1997
6	Gavi Wijster	VAMIJ BV	NL	Lentjes	initial charge	municipal waste	3 x 141000	4.2	35 x 35	1996
7	Gevudo	Gevudo Afvalverwerking	NL	Steinmüller	initial charge	municipal waste	2 x 157329	4.2	35 x 35	1997
8	GMVA Niederrhein	GMVA	D	DBA	initial charge	municipal waste	4 x 178000	4.2	35 x 35	1995
9	GMVA Niederrhein	GMVA	D	DBA	change	municipal waste	178000	4.2	35 x 35	1996
10	Kunpo		KOR	Korea Cottrell	initial charge	municipal waste	51900	4.2	35 x 35	2000
11	KVA Gamsen	KVA Oberwallis	CH	Lurgi	initial charge	municipal waste	47000	4.2	35 x 35	1998
12	KVA Oftringen	Gemeinde-verband	CH	Lurgi	initial charge	municipal waste	75000	6.4	23 x 23	1998
13	KVA Trimmis	GEVAG	CH	Lurgi	initial charge	municipal waste	55000	4.2	35 x 35	1997
14	Melfi	Fenice Melfi	I	Fisia	initial charge	industrial waste	61125/43700	3.7	40 x 40	1998
15	MHKW Kempten	MHKW Kempten	D	Noell/KRC	initial charge	municipal waste	73000	4.2	35 x 35	1995

* Catalyst ordered by the utility

SIEMENS

Reference List - SINOx® Honeycomb Type Catalysts

Waste Incineration Plants NOx and Dioxin/Furan

no.	plant	utiltiy/operator	country	plant constructor	initial charge/ reload./change	fuel	gas flow [Nm³/h]	pitch [mm]	number of cells	start of operation
16	MHKW Kiel	MHKW Kiel	D	Noell/KRC	initial charge	municipal waste	46300	4.2	35 x 35	1995
17	MVA Hagen	HEB	D	DBA	initial charge	municipal waste	3 x 42265	4.2	35 x 35	1996
18	MVA Landshut	Stadtwerke Landshut	D	Hugo Petersen	initial charge	municipal waste	65650	4.2	35 x 35	1996
19	MVA Münster	TW Stuttgart	D	Noell/KRC	initial charge	municipal waste	3 x 116000	4.2	35 x 35	1994
20	MVA Offenbach	Zweckverb./ Umlandverb.	D	Lentjes	initial charge	municipal waste	3 x 65000	3.7	40 x 40	1996
21	MVA Solingen	SWS	D	EVT	initial charge	municipal waste	95000	4.2	35 x 35	1995
22	Paju		KOR	Integral	initial charge	municipal waste	2 x 33000	4.2	35 x 35	
23	Satom		CH	LAB	initial charge	municipal waste	71250	4.2	35 x 35	1999
24	Sion		CH	LAB	initial charge	municipal waste	69117	4.2	35 x 35	1999
25	TAN Nürnberg	TAN Nürnberg	D	Von Roll	initial charge	municipal waste	3 x 65300	3.7	40 x 40	2000
26	Uijongbu		KOR	CT Umwelttechnik	initial charge	municipal waste		3.7	40 x 40	
27	Wacker Chemie	Wacker Chemie	D	Noell/KRC	initial charge	chemical plant residues	24600/13400	4.2	35 x 35	1996

* Catalyst ordered by the utility

LEE COUNTY ENERGY RECOVERY FACILITY
PREVENTION OF SIGNIFICANT DETERIORATION
APPLICATION FOR MUNICIPAL WASTE COMBUSTOR UNIT 3

ATTACHMENT E

SELECTIVE CATALYTIC REDUCTION SYSTEM
BUDGETARY ESTIMATES RECEIVED
DURING PREPARATION OF
BEST AVAILABLE CONTROL TECHNOLOGY
ANALYSIS AND SUPPORTING CORRESPONDENCE

October 31, 2002

BABCOCK BORSIG POWER

Dennis M. Malone
Proposal Manager

October 19, 2001

Mr. Michael Hober
RTP Environmental Associates, Inc.
239 US Highway 22 East
Green Brook, NJ 08812

REFERENCE: MPLC
BBP Inquiry 501003

Dear Mr. Hober:

Per your request to Tony Licata, Babcock Borsig Power, Inc (BBP) is pleased to furnish a budget proposal to RTP Environmental Associates for a cold end SCR system to be located on the Lee County Project. The Budget proposal for this unit has the following equipment to reduce the emissions from 270 ppm to 50 ppm with a NH_3 slip of 5 ppm and a catalyst life of 24,000 hours:

SCR Inlet Duct

SCR System Bypass Duct (around the GAS to GAS heat exchanger)

SCR Outlet Duct

Gas to Gas heat exchanger

Bypass and Isolation Dampers with Seal Air Systems as required

Gas duct burners for flue gas temperature control

BBP Delta Wing® flue gas and reagent mixers

Reactor Casing and internals

Catalyst

Foundation information (loads) for all equipment furnished

Structural steel including all stairs, platforms, railing and ladders

Catalyst handling system of hoists, monorail system and loading carts

Solid Modeling for flue gas flow analysis

Aqua ammonia storage system including two storage tanks, each with the capacity of holding one truck volume (one for system operation and one for truck unloading, with truck unloading connections.

Ammonia delivery system from the tank farm to the SCR inlet duct utilizing skid mounted pumps and direct injection nozzles.

Babcock Borsig Power, Inc.
Environmental Systems Division

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Shipping Address:
5 Neponset Street
Worcester, MA 01606

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Fax: (508) 852-7548

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Complete controls system including engineering for draft controls for the SCR Bypass Damper system

Complete Field Instruments for control on the reactor including inlet In Situ NO_x Analyzers. Final NOx control will be by the CEMS monitor on the stack.

Training program for operators and Maintenance Personal

Items not included

Ductwork from the boiler to the Gas heat exchanger isolation and bypass dampers; and from the gas heater isolation dampers to the ID fan inlet.

Labor and erection equipment for the installation of the proposed equipment and any modifications to the existing structures.

Foundations and all Civil work

Electrical equipment including switchgear, MCC's, wire, conduit, cable trays, etc.

The Budget Material Price for the design, and supply of the SCR system as described above is Six Million Three Hundred Thousand Dollars ($6,300,000). For the above scope of supply, BBP estimates that the construction would be on the order of magnitude cost of Five Million Six Hundred Seventy Five Thousand Dollars ($5,675,000). These estimates are conservative and with additional data and the scope further defined, BBP expects these estimates to be reduced. As this project develops and a firm price is provided, the firm price would be contingent on the Babcock Borsig Power Board's Approval.

We look forward to a successful project working with RTP to expand the facilities at the LEE County Facility. If any additional questions arise during the review of the above, please feel free to contact me at (508) 854-3850, Fax(508) 854-3800 email: DMALONE@BBPWR.COM or our District Sales Manager Mark Moulin at (856) 988-7134, Fax (856) 988-7137or email: MMOULIN @ BBPWR.COM.

Sincerely,

Dennis M. Malone
Proposal Manager

Attachments: RTP Information Request Form
Process Flow Diagram

Cc: Joe Langone, Vice President, BBP Environment
Paul Croteau, Director, Proposals, Environmental Technology
Tony Licata, Director Customer Relations
Mark Moulin, District Sales Manager

Lee County Resource Recovery Facility
Lee County, Florida
Information Required to Determine Feasibility of SCR Technology
August 15, 2001

Size of Combustor Unit	600 tons garbage/day
Capital Cost for SCR	$ 6,300,000. MATERIAL
Annual Operating Cost of SCR	
Catalyst System	Hot Side or Cold Side
Catalyst Life Span	24,000 HRS.
Catalyst Replacement Cost	
Catalyst Disposal Cost	
Design Cost	$ 1,800,000. INCLUDED IN ABOVE
Maintenance (hours/year)	
Power Requirements	
355 ACFM	Natural Gas (~~Amount/year~~)
6.5 KW	Electricity (~~Amount/year~~)
	Fuel Oil (Amount/year)
222 LB/HR	Ammonia/~~Urea/Other~~ 19% NH_3 (~~amount/year~~)
	Other ~~(Amount/year)~~

If Cold Side Unit, Amount of Reheat Required for Catalyst SEE ATTACHED PROCESS FLOW DIAGRAM

Explanation of abbreviations used in attached tables from application for first two units:

lb/ton	=	pounds per ton
lb/MMBtu	=	pounds per million British Thermal Units
Btu/lb	=	British Thermal unit/pound
tpd	=	tons per day
MMBtu/hr	=	million British Thermal Units per hour
g/s	=	grams per second
m	=	meters
K	=	temperature degrees in units of Kelvin
m/s	=	meters per second
ft^2	=	square feet
gr/dscf	=	grains per dry standard cubic feet
lb/hr	=	pounds per hour
µg/dscm	=	micrograms per dry standard cubic meter
ppmdv	=	parts per million on a dry volume basis
ng/dscm	=	nanograms per dry standard cubic meter
mg/dscm	=	milligrams per dry standard cubic meter

BABCOCK BORSIG POWER

Dennis M. Malone
Proposal Manager

October 29, 2001

Mr. Michael Hober
RTP Environmental Associates, Inc.
239 US Highway 22 East
Green Brook, NJ 08812

REFERENCE: MPLC
BBP Inquiry 501003

Dear Mr. Hober:

The following is the response to your question on steam consumption. The steam requirements to heat the flue gas up to the required temperature of the SCR catalyst will be 7600 LB/hr. The steam supply conditions are assumed as 850 psi and at 825°F.

The Steam coil system was not included in our original estimate but would be approximately 1% of the material cost for the additional scope.

If any additional questions arise, please feel free to contact me at (508) 854-3850, Fax(508) 854-3800 email: DMALONE@BBPWR.COM or our District Sales Manager Mark Moulin at (856) 988-7134, Fax (856) 988-7137or email: MMOULIN @ BBPWR.COM.

Sincerely,

Dennis M. Malone
Proposal Manager

Attachments: Revised Process Flow Diagram

Cc: Paul Croteau, Director, Proposals, Environmental Technology
Tony Licata, Director Customer Relations
Mark Moulin, District Sales Manager

Babcock Borsig Power, Inc.
Environmental Systems Division

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www.bbpwr.com

BABCOCK BORSIG POWER

Post-It® Fax Note 7671	Date 12/4/01	# of pages ▶ 3
To Mike Huber	From Dennis Malone	
Co./Dept.	Co. BBP	
Phone #	Phone # (508) 854-3850	
Fax # (732) 968-9603	Fax # (508) 854-3800	

Dennis M. Malone
Proposal Manager

December 4, 2001

Mr. John Ardary
Covanta Energy
40 Lane Road, CN-262615
Fairfield, NJ 07007-2615

REFERENCE: MPLC
BBP Inquiry 501003

Dear Mr. Ardary:

To further describe the scope that is included in this budget proposal and to answer questions Tony Licata and I have received, I have revised the original proposal letter and underscored the items revised. Those items changed from the original are highlighted in red and underscored for faxing. I hope this resolves any questions you have had to date.

Per your request to Tony Licata, Babcock Borsig Power, Inc (BBP) is pleased to furnish a budget proposal to RTP Environmental Associates for a cold end SCR system to be located on the Lee County Project. The Budget proposal for this unit has the following equipment to reduce the emissions from 270 ppm to 50 ppm with a NH_3 slip of 5 ppm and a catalyst life of 24,000 hours:

SCR Inlet Duct

SCR System Bypass Duct (around the GAS to GAS heat exchanger)

SCR Outlet Duct

Gas to Gas heat exchanger

Bypass and Isolation Dampers with Seal Air Systems as required

Gas duct burners for flue gas temperature control

BBP Delta Wing® flue gas and reagent mixers

Reactor Casing and internals

Catalyst

Foundation information (loads) for all equipment furnished

Structural steel including all stairs, platforms, railing and ladders

Catalyst handling system of hoists, monorail system and loading carts

Solid Modeling for flue gas flow analysis

Aqua ammonia storage system including two storage tanks, each with the capacity of holding one truck volume (one for system operation and one for truck unloading, with truck unloading connections.

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www.bbpwr.com

Ammonia delivery system from the tank farm to the SCR inlet duct utilizing skid mounted pumps and direct injection nozzles.

Complete controls system including engineering for draft controls for the SCR Bypass Damper system

Complete Field Instruments for control on the reactor including inlet In Situ NO_x Analyzers. Final NOx control will be by the CEMS monitor on the stack.

Training program for operators and Maintenance Personal

Ammonia leak detectors in the ammonia storage facility and the direct injection control valve locations

BBP will furnish electrical loads, compressed air , water, steam, and auxiliary fuel requirements at the battery limits

Items not included in material pricing

Ductwork from the boiler to the Gas heat exchanger isolation and bypass dampers; and from the gas heater isolation dampers to the ID fan inlet.

Labor and erection equipment for the installation of the proposed equipment and any modifications to the existing structures.

Foundations and all Civil work

Electrical equipment including switchgear, MCC's, wire, conduit, cable trays, etc.

Upgrades to existing station's systems and services for utilities, .

Fire protection equipment

Safety equipment,

Building or enclosure

Wind load design into SCR, support steel and equipment. (Wind loads are to be handled by building enclosure and support steel separate from equipment support steel)

Items included in Construction estimate

Erection labor and equipment for the installation of proposed equipment

Foundations and civil work for proposed equipment furnished including materials

Electrical equipment including switchgear, MCC's, wire, conduit, cable trays, etc.

Items not included in Construction estimate

Materials, labor and erection equipment for any modifications to the existing structures

Relocation of overhead and underground utilities, services and obstructions

Roads and civil betterments

System enclosures/buildings

Hazardous waste material abatement

The footprint for this SCR will be approximately 23 feet square and approximately 50 feet high. This arrangement is based on the SCR directly above the gas to gas heat exchanger for a compact footprint. The height may be reduced by 10 feet if the gas to gas heat exchanger is placed to the side of the SCR and the footprint is allowed to grow in one direction by 20 feet

The Budget Material Price for the design, and supply of the SCR system as described above is Six Million Three Hundred Thousand Dollars ($6,300,000). For the above scope of supply, BBP estimates that the construction would be on the order of magnitude cost of Five Million Six Hundred Seventy Five Thousand Dollars ($5,675,000). These estimates are conservative and with additional data and the scope further defined, BBP expects these estimates to be reduced. As this project develops and a firm price is provided, the firm price would be contingent on the Babcock Borsig Power Board's Approval.

We look forward to a successful project working with RTP to expand the facilities at the LEE County Facility. If any additional questions arise during the review of the above, please feel free to contact me at (508) 854-3850, Fax(508) 854-3800 email: DMALONE@BBPWR.COM or our District Sales Manager Mark Moulin at (856) 988-7134, Fax (856) 988-7137or email: MMOULIN @ BBPWR.COM.

Sincerely,

Dennis M. Malone
Proposal Manager

Attachments: RTP Information Request Form
Process Flow Diagram

Cc: Joe Langone, Vice President, BBP Environment
Paul Croteau, Director, Proposals, Environmental Technology
Tony Licata, Director Customer Relations
Mark Moulin, District Sales Manager
Sam Rosania, MP
Mike Huber, RTP

SEGHERS the knowledge partners | BETTER TECHNOLOGY USA

Lee County Resource Recovery Facility

Waste throughput	tpd	600		
Flue gas flow , dry	dscfm	65,868	Nm3/h	145,377
Water content in flue gas	%	20%		
NOx IN	ppmdv @ 7%	260	mg/Nm3 @ 11%, dry	381
NOx OUT	ppmdv @ 7%	100	mg/Nm3 @ 11%, dry	147

Turn Key Capital Cost for SCR	million USD*	8.00 Range : +/- 10% , no building (equipment suitable for outdoor erection)
Annual Operating Cost of SCR	depends on cost of utilities	
Catalyst System	Cold Side	
Catalyst Life Span	Normal Guarantee : 2 years, expected : 5 years**	
Catalyst Replacement Cost	USD*	700,000
Catalyst Disposal Cost	depends on local disposal cost	
Design Cost	included in capital cost	

Maintenance (hours/year) very little maintenance required

Utility Requirements (nominal conditions)		per hour	per year	Unit cost USD	annual cost USD
Natural gas ***	kg	162.3	1,298,400	5 per 1000 cf	278,911
Fuel	kg	0	0		
Ammonia (100%)	kg	14	112,000		
Electricity ***	kWh	320	2,560,000	0.05	128,000

* estimate based on an exchange rate of 0.9 USD per EURO
** depending on composition of flue gas.
*** does not include energy used during start-up of system

From: Dirk_Eeraerts@bettertechnology.com
To: Scott Heath <heath@rtpenv.com>
cc: hober@rtpenv.com, Arnold_Olender@bettertechnology.com
X-Mailer: Lotus Notes Release 5.0.6a January 17, 2001
Date: Fri, 21 Dec 2001 14:38:00 -0500
Subject: Re: Further Clarification on SCR System Budgetary Estimate
X-MIMETrack: Serialize by Router on ldbel03.hudee.com/huDEE(Release 5.0.9 |November 16, 2001) at
12/21/2001 08:39:06 PM

Scott,

See my comments in your mail hereafter and the new budget and operating estimate in the attached file.

The new estimate is based on the revised flue gas flow and revised NOx level at inlet and outlet. The emission limit of 100 ppmdv (147 mg/Nm3) is very high ; an SCR system can reach an emission level of 70 mg/Nm3. The higher limit suggested by Coventa does not reduce the investment cost of the system and does not allow the advantages of SCR to come out. Basically it means that you pay for a state of the art technology and then use it only at 50% of it's abilities. As a matter of fact, Seghers has built a WtE facility where we meet 150 mg/Nm3 as daily average with a simple SNCR (i.e. non-catalytic) and flue gas recirculation.

(See attached file: Boff for RTPenv_Dec21_2001.PDF)
Happy holidays.
Sincerely,

Dirk Eeraerts
Business Development Manager
SEGHERS Scientec Matrix North America
1235 F Kennestone Circle, Marietta, Georgia 30066, USA
tel: 770 421 1181, fax: 770 421 8611

Scott Heath
<heath@rtpenv.com> To: Dirk_Eeraerts@bettertechnology.com, Arnold_Olender@bettertechnology.com
> cc: hober@rtpenv.com
Subject: Further Clarification on SCR System Budgetary Estimate
12/11/01 12:49 PM

Mr. Eeraerts,
I have received the budgetary estimate you provided to RTP Environmental Associates, Inc. concerning a Selective Catalytic Reduction system for the expansion to the Lee County Florida Energy Recovery Facility. After reviewing this estimate, I have the following questions concerning what is included in the price. Please provide the following clarification at your earliest convenience. I need to know what is included to determine extra expenses for the cost removal estimate of NOx for the BACT preparation.

In the estimate you reference NOx inlet concentration of 165 ppmdv (dry parts per million by volume) @ 7% O2 and an outlet at 50 ppmdv @ 7% O2. Covanta (operator of facility) wishes to use the following values 260 ppmdv inlet and 100 ppmdv outlet both at 7% O2. Does this affect the estimate?
--> see revised sheet attached

In the estimate you reference a dry flue gas of 90,000 dscfm (dry standard cubic feet per minute). From the operating window for the facility (as approved under Power Plant Siting Act), the maximum stack flue gas rate is 65868 dscfm corrected to 7% O2. The annual average rate is 59461 dscfm corrected to 7% O2. Please recompute for these values. I apologize for providing the other rate. The 90,000 dscfm value provide was at 10.5% O2.
--> see revised sheet attached. Please note that the values given for the composition of the flue gas in your mail dd Dec 05, result in a total of 120%.

What size ID fan is required for this system?
--> Sizing of system components goes beyond the scope of this budget estimate.

In the estimate, you use the term 'Turn Key Capital Cost for SCR'. What all does this price include?

Please note whether the following items are included in the $8,200,000 SEGHER's estimated.

--> see hereafter, this is valid for our initial estimate as well as for the new budget in attachment:

Capital Costs
Ammonia Storage Tanks : --> included
Flue Gas Ductwork : --> included
Instrumentation: --> included
Taxes : --> taxes and import duties are not included.
Freight : --> included

System Integration: --> If this refers to the modifications in the existing control system, this is not included. I have included in the new estimate extra engineering for functional description of the interfaces with the existing control system. Actual re-programming of the existing system is not included.

Installation Costs
Foundation and Support: --> included
Handling and Erection: --> included
Electrical: --> included
Piping: --> included
Insulation: --> included
Painting: --> included
Site Preparation: --> not included, we assume site is ready since this is an existing plant. We can not estimate this cost without knowing the current status of the site.
Structural Steel: --> included
Buildings: --> not included, SCR system is designed for outdoors operation.
SCR Building enclosure : --> not included, SCR system is designed for outdoors operation.
Engineering: --> included
Construction of the SCR System and field expenses: --> included

Operating Costs
Please provide the operating requirements of the system. Lee County is using $0.05 per kilowatt of electricity and $5.00 per 1000 cubic feet of natural gas.

--> see attached sheet, electrical consumption is an estimate of the total consumption including the increased power consumption of the ID fan.

Can you provide an estimate of annual downtime of the system?

--> availability of the system is minimum 8000 h/y

I noticed in the estimate that it was based on a natural gas reheat configuration. Can you please provide an estimate of the cost for a configuration to use steam from the header to reheat the flue gas? How much steam (number of pounds at what pressure) would be required and what additional capital costs would be incurred with ductwork and insulation? If I can find out how much steam would be required, then I can determine the amount of cost incurred by the facility to divert steam from the generator-set.

--> I did not find the flue gas temperature in your data (I may have overlooked it) but we have assumed a temperature of 141C at the inlet of the SCR system. The flue gas has to be heated to 230C before entering the SCR. In our proposal we have assumed the following temp profile :
- first step heating in flue gas - flue gas heat exchanger which increases the temp from 141C to 200C. This involves a heat transfer of 12,070 MJ/h (11.44 million BTU/h). This heat exchanger cools the flue gas leaving the

SCR from 228C to 171C.
second step heating with in line gas burner which increases the temp from 200C to 230C. This involves a heat transfer of 6,885 MJ/h (6.53 million BTU/h).
The optimization of this temperature profile and the possible use of steam goes beyond the scope of a simple budget estimate but I trust that with the values indicated above together with the steam characteristics of the plant (which we don't have), RTP will be able to estimate the steam consumption and possible savings on natural gas consumption. The impact on the investment cost depends on the size of the steam heat exchanger, the set-up of the existing facility (will determine length of steam pipes) and the steam characteristics (Temp and pressure).

I thank you for your assistance with this project and look forward to receiving your response. Please feel free to contact me with questions or comments on this request. Happy Holidays.

Scott Heath

****

Scott P. Heath
Environmental Scientist
heath@rtpenv.com

RTP Environmental Associates, Inc.
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Green Brook, New Jersey 08812 USA

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732-968-2569 ext. 311 (Direct Line)
Fax: 732-968-9603

http://www.rtpenv.com
****

Boff for RTPenv_Dec21_2001.PDF

HALDOR TOPSØE A/S
DK-2800 LYNGBY
DENMARK

4 February 2002
53101-983 rev. 0 PNC

Technical/Commercial Budget Proposal

Topsøe SCR DENOX Unit

Client: State of Florida

Project: Waste Incinerator

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Table of Contents

1. INTRODUCTION 3

2. DESIGN CONSIDERATION 3

3. DESIGN DATA 5

4. CONSUMPTION FIGURES 5

5. SCOPE OF SUPPLY 6

6. CLIENT'S SUPPLY 8

7. BUDGET PRICE 8

8. TERMS OF PAYMENT 9

9. DELIVERY TIME 9

10. GUARANTEES 9

11. LIMITATIONS OF LIABILITY 10

12. VALIDITY 10

1. Introduction

This Technical/Commercial Budget Proposal is in response to inquiry received on 9 January 2002 and subsequent e-mail of 16 January 2002.

2. Design Consideration

Reducing Agent

Please note that anhydrous NH_3 has been foreseen as the preferred reducing agent. Alternatively, the unit can be designed for the use of aqueous solution of urea or aqueous NH_3. The price difference is insignificant.

Minimum Operating Temperature

The minimum operating temperature for the SCR DENOX unit is determined by the dew point of ammonium bisulphate (NH_4HSO_4). Condensation of ammonium bisulphate (ABS) on the active catalyst surface area causes some deactivation of the catalyst, and although later operation at a higher temperature may reactivate the catalyst, a certain permanent deactivation must be expected over time. An additional implication of severe condensation of ammonium bisulphate is an increased pressure drop due to clogging of the DNX catalyst channels.

The condensation of ABS is a simple thermodynamic gas phase phenomenon. The dew point temperature is only dependent on the concentration (partial pressure) of ammonia (NH_3), moisture (H_2O) and sulphur trioxide (SO_3):

$$NH_3 + H_2O + SO_3 \rightarrow NH_4HSO_4$$

A higher partial pressure of any of the reactants will lead to an increase in the dew point temperature of ABS.

When determining the minimum catalyst operating temperature, a distinction must be made between the dew point for ABS in the bulk phase and in the catalyst pores, because the vapour pressure of ABS is lower in the micropores than in the bulk phase. This effect is normally referred to as capillary condensation, and implies that the dew point temperature in the micropores is higher than the dew point temperature in the bulk phase. As a consequence, the first condensation of ABS will take place in the micropores of the catalyst.

Several references exist in the literature where the bulk phase dew point temperature of ABS is determined. The formula used by Haldor Topsøe A/S for calculation of the dew point for ABS in the catalyst pores is based on literature studies, in-house laboratory experiments, pilot tests and industrial feedback. We have found that the dew point

temperature for ABS in the micropores is approx. 35 - 40°C higher than the dew point temperature in the bulk phase. This is in general agreement with figures reported in the literature by others.

It is normally recommended to operate the SCR DENOX catalyst at a minimum temperature of 10°C above the dew point of ABS in the catalyst pores in order to account for lateral temperature differences in the SCR reactor. The minimum operating temperature is calculated for each case based on project specific operating conditions.

Finally, it should be mentioned that condensation of ABS is a thermodynamic phenomenon and will therefore be harmful to any type/manufacture of catalyst

With an assumed SOx content of maximum 1 ppm_v after the bag filter and with an assumed maximum SO_2 to SO_3 oxidation of 3%, the minimum inlet temperature for the SCR catalyst is in the order of 270-280 (520-540°F).

Layout

In order to cope with the above minimum inlet temperature for the catalyst and also in order to ensure an acceptable catalyst activity per volume of catalyst, the flue gas has to be heated up before entering the SCR unit.

The cold non-cleaned flue gas exchanges heat with the cleaned hot flue gas in a gas/gas heat exchanger, and then the non-cleaned gas is further heated to the operating temperature of the catalyst by means of a gas or oil heater. After the heater the NH_3 is injected into the hot flue gas, and the flue gas is passed through the catalyst where the NH_3 and the NOX will react on the surface of the catalyst and form free nitrogen and water vapour. The cleaned flue gas is then passed through the heat exchanger and the cold cleaned flue gas is routed to the stack.

3. Design Data

The design is based on the data given/assumed below:

Flue gas source:		Waste Incinerator
Flue gas mass:	ACFM	170,000 (ref. t = 300°F)
Pressure:	mmWG	800
Temperature:	°C	149
O_2 content:	vol-%	10
H_2O content:	vol-%	10
SO_2 content:	ppm_v	< 30 (at 7% O_2)
SO_3 content:	ppm_v	< 1 (at 7% O_2)
NOx content, inlet:	ppm_v	260 (at 7% O_2)
NOx content, outlet:	ppm_v	< 150 (at 7% O_2)
NH_3 slip:	ppm_v	< 5

All data at actual O_2, wet gas, unless otherwise specified.

4. Consumption Figures

At the conditions specified in Section 3 above the expected consumption is as follows:

NH_3	kg/h	< 10
Electric Power:	kW	5 - 7
Instrument air:	Nl/min	30 – 40
Oil/Gas:	MWh/h	< 2.8

5. Scope of Supply

5.1. Battery limits

Flue gas system:

- inlet/outlet heat exchanger
- inlet/outlet preheater
- inlet/outlet NH_3 injection nozzle system
- inlet/outlet mixer elements
- inlet/outlet reactor

NH_3 piping:

- inlet/outlet skid-mounted NH_3 evaporator and flow control assembly
- inlet/outlet NH_3 injection nozzle system

Control system:

- inlet/outlet locally placed transmitters
- inlet/outlet analyser
- inlet/outlet control cabinet

5.2. Equipment per unit

- one (1) charge of proprietary Topsøe deNOx catalyst type DNX 950.
- one (1) catalytic reactor (exclusive of inlet pipe).
- one (1) gas/gas heat exchanger
- one (1) oil/gas fired preheater
- one (1) NH_3 injection nozzle system for installation in the rectangular inlet pipe
- one (1) pre-fabricated NH_3 evaporator and flow control assembly fitted electrical heated evaporator, flow meter, flow control valve, indicating instruments, valves and fittings.
- one (1) NOx analyser, complete with transmitter/receiver unit, measuring probe, purge air unit, analog input/output, strip chart recorder, etc.
- one (1) control system, complete with PLC with digital/analog, input/output cards, metering pump frequency converters and control gear, flow relays, main switches, MCBs, terminals, etc.
- one (1) lot of instruments, piping, valves etc., as required within the battery limits.

5.3. Engineering and Documentation

- Project time schedule
- Layout and general arrangement
- Detailed engineering and detail drawings
- Arrangement and installation drawings
- Erection documentation
- "As built" drawings and documentation including material certificates, inspection and test reports
- Operation and maintenance manuals including sub-suppliers' documentation and specifications
- Spare parts list

5.4. Erection and Commissioning

Our scope of supply is exclusive of erection and commissioning, but we can offer supervision assistance during erection and commissioning of the unit by one of our engineers at a per diem rate as specified in Section 7.2 below.

Travelling costs, board and lodging for our supervisor will be invoiced at actual cost.

We estimate the minimum supervision assistance required to be approx. 10 man-days. The man-days are inclusive of training of personnel (see below).

In connection with the above, please note that in order to maintain our guarantee terms, as specified in Section 10.2 below, loading of catalyst into the reactor as well as commissioning of the unit must be supervised by one of our experts.

5.5. Training and Education of Operators

During commissioning/hand-over of the unit, we recommend a two-day seminar to be conducted by our supervisor giving detailed instructions on how to control, operate and maintain the unit.

6. Client's Supply

- Design and supply of equipment foundations
- Connection lines for utility supply to the unit
- Piping, power and control cables between various equipment, as per the documentation and cable list of Haldor Topsøe A/S
- Lighting and earthing installations
- NH_3 storage facilities
- Inlet pipe to reactor
- Manpower for erection, tools and assembly materials
- Manpower for insulation and cladding of the reactor
- Manpower for catalyst loading
- Manpower for commissioning
- Insulation and cladding material for the reactor.
- Flue gas fan (if applicable)

7. Budget Price

7.1. Equipment, Catalyst and Engineering

The total price of the supply of one (1) SCR DENOX unit, complete with associated equipment, accessories, materials and services, as specified in Section 5 above, is:

EUR 1,500,000.00

- The above price includes delivery of all equipment EXW Copenhagen (Incoterms 2000).
- The above price is exclusive of any duties and value added tax (VAT).
- The price is exclusive of installation, erection and supervision.

7.2. Per Diem Rates

We can offer supervision assistance by one of our engineers for erection, catalyst loading and commissioning of the unit at a per diem rate of:

EUR 950.00

for days out of office in 2002. Travelling costs, board and lodging will be charged at actual cost.

8. Terms of Payment

The price given in this proposal is based on the following terms of payment:

a. 30% on signing of technically and commercially clarified contract
b. 30% within 3 months after order
c. 30% within 30 days after delivery (prorata)
d. 10% after commissioning of the unit; however, not later than 3 months after mechanical completion.

9. Delivery Time

Our normal delivery time for one (1) SCR DENOX unit, as specified above, is 5 - 6 months.

10. Guarantees

10.1. Mechanical Guarantee

The equipment and machinery supplied are guaranteed against faulty material and bad workmanship for a period of 12 months after commissioning/acceptance; however, max. 18 months after delivery of equipment.
In case of failure to meet this guarantee, the client shall inform Haldor Topsøe A/S in writing without delay, and if it can be excluded that the failure is due to:

a) normal wear and tear
b) maloperation
c) repairs, changes or replacements made by the client without consent of Haldor Topsøe A/S,

Haldor Topsøe A/S shall without delay repair or replace the faulty part. Replaced parts under the guarantee shall on request be returned to Haldor Topsøe A/S.

10.2. Performance Guarantee

At the conditions specified in Section 3 above and on the condition that the entire equipment for the unit is constructed and installed in accordance with the instruction manuals and recommendations issued by Haldor Topsøe A/S, it is guaranteed that the concentration of NO_x in the reactor outlet gas will not exceed the value, as specified in Section 3 above, at steady load conditions i.e. at stable exhaust flow rate, temperature, composition and pressure.

The guarantee period is 16,000 operating hours; however, maximum two years starting from the day the exhaust gas is passed through the unit for the first time.

The unit is designed for an NH_3 slip of less than 5 ppm_v (wet gas, actual O_2), and during steady operation this can be maintained. However, at sudden changes of load, minor overshooting may occur.

The above-mentioned performance shall be attained and proven by a performance test not later than 3 months after completion of installation of the unit. If it turns out during the initial start-up period or during the performance test run that the guaranteed performance cannot be obtained, Haldor Topsøe A/S will make good, i.e. will modify the installation or change the catalyst, at own cost.

If the performance test, due to no fault of Haldor Topsøe A/S, cannot take place within 3 months after completion of the installation of the unit, the performance test shall be deemed to have taken place, and the final instalment falls due.

If the catalyst has to be replaced or additional elements have to be added during the subsequent guarantee period in order to obtain the guaranteed performance, a prorated discount is given on the price of the replacement catalyst calculated as:

$$\frac{(16{,}000 - X)}{16{,}000} \times 100\%$$

where X is the number of actual operating hours achieved from initial start-up of the SCR unit.

11. Limitations of Liability

Haldor Topsøe A/S is under no circumstances responsible for indirect or consequential damage due to non-fulfilment of any guarantee or for any other reason.

12. Validity

This proposal is a budget proposal only and as such valid for 60 days from the date of issue.

HALDOR TOPSØE A/S

Nicolai Christoffersen
Equipment Division

HALDOR TOPSØE A/S
DK-2800 LYNGBY
DENMARK

26 March 2002
53101-1016 rev. 0 PNC

Technical/Commercial Budget Proposal

Topsøe SCR DENOX Unit

Client: RTP Environmental Associates Inc.

Project: Energy Recovery Facility
Lee County, Florida

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Table of Contents

1. INTRODUCTION 3

2. DESIGN CONSIDERATION 3

3. DESIGN DATA 5

4. CONSUMPTION FIGURES 5

5. SCOPE OF SUPPLY 6

6. CLIENT'S SUPPLY 8

7. BUDGET PRICE 8

8. TERMS OF PAYMENT 9

9. DELIVERY TIME 9

10. GUARANTEES 9

11. LIMITATIONS OF LIABILITY 10

12. VALIDITY 10

1. Introduction

This Technical/Commercial Budget Proposal is in response to inquiry received on 20 March 2002.

2. Design Consideration

Reducing Agent

Please note that anhydrous NH_3 has been foreseen as the preferred reducing agent. Alternatively, the unit can be designed for the use of aqueous solution of urea or aqueous NH_3. The price difference is insignificant.

Minimum Operating Temperature

The minimum operating temperature for the SCR DENOX unit is determined by the dew point of ammonium bisulphate (NH_4HSO_4). Condensation of ammonium bisulphate (ABS) on the active catalyst surface area causes some deactivation of the catalyst, and although later operation at a higher temperature may reactivate the catalyst, a certain permanent deactivation must be expected over time. An additional implication of severe condensation of ammonium bisulphate is an increased pressure drop due to clogging of the DNX catalyst channels.

The condensation of ABS is a simple thermodynamic gas phase phenomenon. The dew point temperature is only dependent on the concentration (partial pressure) of ammonia (NH_3), moisture (H_2O) and sulphur trioxide (SO_3):

$$NH_3 + H_2O + SO_3 \rightarrow NH_4HSO_4$$

A higher partial pressure of any of the reactants will lead to an increase in the dew point temperature of ABS.

When determining the minimum catalyst operating temperature, a distinction must be made between the dew point for ABS in the bulk phase and in the catalyst pores, because the vapour pressure of ABS is lower in the micropores than in the bulk phase. This effect is normally referred to as capillary condensation, and implies that the dew point temperature in the micropores is higher than the dew point temperature in the bulk phase. As a consequence, the first condensation of ABS will take place in the micropores of the catalyst.

Several references exist in the literature where the bulk phase dew point temperature of ABS is determined. The formula used by Haldor Topsøe A/S for calculation of the dew point for ABS in the catalyst pores is based on literature studies, in-house laboratory experiments, pilot tests and industrial feedback. We have found that the dew point

temperature for ABS in the micropores is approx. 35 - 40°C higher than the dew point temperature in the bulk phase. This is in general agreement with figures reported in the literature by others.

It is normally recommended to operate the SCR DENOX catalyst at a minimum temperature of 10°C above the dew point of ABS in the catalyst pores in order to account for lateral temperature differences in the SCR reactor. The minimum operating temperature is calculated for each case based on project specific operating conditions.

Finally, it should be mentioned that condensation of ABS is a thermodynamic phenomenon and will therefore be harmful to any type/manufacture of catalyst

With an SO_2 content of maximum 6 ppm_v (wet gas) after the bag filter and with an assumed maximum SO_2 to SO_3 oxidation of 3%, the minimum inlet temperature for the SCR catalyst is in the order of 270-280 (520-540°F).

Layout

In order to cope with the above minimum inlet temperature for the catalyst and also in order to ensure an acceptable catalyst activity per volume of catalyst, the flue gas has to be heated up before entering the SCR unit.

The cold non-cleaned flue gas exchanges heat with the cleaned hot flue gas in a gas/gas heat exchanger, and then the non-cleaned gas is further heated to the operating temperature of the catalyst by means of a gas or oil heater. After the heater the NH_3 is injected into the hot flue gas, and the flue gas is passed through the catalyst where the NH_3 and the NOx will react on the surface of the catalyst and form free nitrogen and water vapour. The cleaned flue gas is then passed through the heat exchanger and the cold cleaned flue gas is routed to the stack.

3. Design Data

The design is based on the data given/assumed below:

Flue gas source:		Waste Incinerator
Flue gas flow:	scfm	99,101 [1]
Pressure:	mmWG	800
Temperature:	°F	240
O_2 content:	vol-%	8.4
H_2O content:	vol-%	20
CO_2 content	vol-%	7.3
N_2 content:		Balance
SO_2 content:	ppm_v	< 6 [2]
SO_3 content:	ppm_v	< 0.2
NOx content, inlet:	ppm_v	< 156 [3]
NOx content, outlet:	ppm_v	< 60 [4]
NOx removal efficiency:	%	~ 62
Particulate matter:	gr/scf	1.2×10^{-3}
NH_3 slip:	ppm_v	< 10

All data at actual O_2, wet gas, unless otherwise specified.

4. Consumption Figures

At the conditions specified in Section 3 above the expected consumption is as follows:

NH_3	lbs/h	< 29
Electric Power:	kW	5 - 7
Instrument air:	scfm	1 - 2
Oil/Gas:	MM BTU/hr	< 12

[1] Corresponding to 59,461scfm @ 7 vol-% O_2, dry gas
[2] Corresponding to 10 ppm_v @ 7 vol-% O_2, dry gas
[3] Corresponding to 260 ppm_v @ 7 vol-% O_2, dry gas
[4] Corresponding to 100 ppm_v 2 7 vol-% O_2, dry gas

5. Scope of Supply

5.1. Battery limits

Flue gas system:

- inlet/outlet heat exchanger
- inlet/outlet preheater
- inlet/outlet NH_3 injection nozzle system
- inlet/outlet reactor

NH_3 piping:.

- inlet/outlet skid-mounted NH_3 evaporator and flow control assembly
- inlet/outlet NH_3 injection nozzle system

Control system:

- inlet/outlet locally placed transmitters
- inlet/outlet analyser
- inlet/outlet control cabinet

5.2. Equipment per unit

- one (1) charge of proprietary Topsøe deNOx catalyst type DNX 950.
- one (1) catalytic reactor (exclusive of inlet pipe).
- one (1) gas/gas heat exchanger
- one (1) oil/gas fired preheater
- one (1) NH_3 injection nozzle system for installation in the rectangular inlet pipe
- one (1) pre-fabricated NH_3 evaporator and flow control assembly fitted electrical heated evaporator, flow meter, flow control valve, indicating instruments, valves and fittings.
- one (1) NOx analyser, complete with transmitter/receiver unit, measuring probe, purge air unit, analog input/output, strip chart recorder, etc.
- one (1) control system, complete with PLC with digital/analog, input/output cards, metering pump frequency converters and control gear, flow relays, main switches, MCBs, terminals, etc.
- one (1) lot of instruments, piping, valves etc., as required within the battery limits.

5.3. Engineering and Documentation

- Project time schedule
- Layout and general arrangement
- Detailed engineering and detail drawings
- Arrangement and installation drawings
- Erection documentation
- "As built" drawings and documentation including material certificates, inspection and test reports
- Operation and maintenance manuals including sub-suppliers' documentation and specifications
- Spare parts list

5.4. Erection and Commissioning

Our scope of supply is exclusive of erection and commissioning, but we can offer supervision assistance during erection and commissioning of the unit by one of our engineers at a per diem rate as specified in Section 7.2 below.

Travelling costs, board and lodging for our supervisor will be invoiced at actual cost.

We estimate the minimum supervision assistance required to be approx. 20 man-days. The man-days are inclusive of training of personnel (see below).

In connection with the above, please note that in order to maintain our guarantee terms, as specified in Section 10.2 below, loading of catalyst into the reactor as well as commissioning of the unit must be supervised by one of our experts.

5.5. Training and Education of Operators

During commissioning/hand-over of the unit, we recommend a two-day seminar to be conducted by our supervisor giving detailed instructions on how to control, operate and maintain the unit.

6. Client's Supply

- Design and supply of equipment foundations
- Connection lines for utility supply to the unit
- Piping, power and control cables between various equipment, as per the documentation and cable list of Haldor Topsøe A/S
- Lighting and earthing installations
- NH_3 storage facilities
- Inlet pipe to reactor
- Manpower for erection, tools and assembly materials
- Manpower for insulation and cladding of the reactor
- Manpower for catalyst loading
- Manpower for commissioning
- Insulation and cladding material for the reactor and heat exchanger.
- Flue gas fan (if applicable)

7. Budget Price

7.1. Equipment, Catalyst and Engineering

The total price of the supply of one (1) SCR DENOX unit, complete with associated equipment, accessories, materials and services, as specified in Section 5 above, is:

EUR 1,450,000.00

- The above price includes delivery of all equipment EXW Copenhagen (Incoterms 2000).
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- The price is exclusive of installation, erection and supervision.

7.2. Per Diem Rates

We can offer supervision assistance by one of our engineers for erection, catalyst loading and commissioning of the unit at a per diem rate of:

EUR 950.00

for days out of office in 2002. Travelling costs, board and lodging will be charged at actual cost.

8. Terms of Payment

The price given in this proposal is based on the following terms of payment:

a. 30% on signing of technically and commercially clarified contract
b. 30% within 3 months after order
c. 30% within 30 days after delivery (prorata)
d. 10% after commissioning of the unit; however, not later than 3 months after mechanical completion.

9. Delivery Time

Our normal delivery time for one (1) SCR DENOX unit, as specified above, is 5 - 6 months.

10. Guarantees

10.1. Mechanical Guarantee

The equipment and machinery supplied are guaranteed against faulty material and bad workmanship for a period of 12 months after commissioning/acceptance; however, max. 18 months after delivery of equipment.
In case of failure to meet this guarantee, the client shall inform Haldor Topsøe A/S in writing without delay, and if it can be excluded that the failure is due to:

a) normal wear and tear
b) maloperation
c) repairs, changes or replacements made by the client without consent of Haldor Topsøe A/S,

Haldor Topsøe A/S shall without delay repair or replace the faulty part. Replaced parts under the guarantee shall on request be returned to Haldor Topsøe A/S.

10.2. Performance Guarantee

At the conditions specified in Section 3 above and on the condition that the entire equipment for the unit is constructed and installed in accordance with the instruction manuals and recommendations issued by Haldor Topsøe A/S, it is guaranteed that the concentration of NO_x in the reactor outlet gas will not exceed the value, as specified in Section 3 above, at steady load conditions i.e. at stable exhaust flow rate, temperature, composition and pressure.

The guarantee period is 16,000 operating hours; however, maximum two years starting from the day the exhaust gas is passed through the unit for the first time.

The unit is designed for an NH_3 slip of less than 10 ppm_v (wet gas, actual O_2), and during steady operation this can be maintained. However, at sudden changes of load, minor overshooting may occur.

The above-mentioned performance shall be attained and proven by a performance test not later than 3 months after completion of installation of the unit. If it turns out during the initial start-up period or during the performance test run that the guaranteed performance cannot be obtained, Haldor Topsøe A/S will make good, i.e. will modify the installation or change the catalyst, at own cost.

If the performance test, due to no fault of Haldor Topsøe A/S, cannot take place within 3 months after completion of the installation of the unit, the performance test shall be deemed to have taken place, and the final instalment falls due.

If the catalyst has to be replaced or additional elements have to be added during the subsequent guarantee period in order to obtain the guaranteed performance, a prorated discount is given on the price of the replacement catalyst calculated as:

$$\frac{(16{,}000 - X)}{16{,}000} \times 100\%$$

where X is the number of actual operating hours achieved from initial start-up of the SCR unit.

11. Limitations of Liability

Haldor Topsøe A/S is under no circumstances responsible for indirect or consequential damage due to non-fulfilment of any guarantee or for any other reason.

12. Validity

This proposal is a budget proposal only and as such valid for 60 days from the date of issue.

HALDOR TOPSØE A/S

Nicolai Christoffersen
Equipment Division

LEE COUNTY ENERGY RECOVERY FACILITY
PREVENTION OF SIGNIFICANT DETERIORATION
APPLICATION FOR MUNICIPAL WASTE COMBUSTOR UNIT 3

ATTACHMENT F

COST REMOVAL VALUES FOR NITROGEN OXIDES

October 31, 2002

Estimate of Selective Catalytic Reduction Costs
for Lee County Energy Recovery Facility
With Flue Gas Reheat Using Steam Diverted from Header

Cost Component	Costs	Basis of Cost Component
Direct Capital Costs		
SCR Associated Equipment	$6,424,110	Supplier Est. w/ 1% for Steam System, Adjusted for Temp
Ammonia Storage Tanks	Included	Ammonia Storage
Flue Gas Ductwork	$100,000	Engineering Estimate
Instrumentation	Included	In-situ NOx Analyzer
Freight	$321,206	5% of Associated Equip.; OAQPS Control Cost Manual
System Integration	$100,000	Engineering Estimate
Firewater Booster Pump	$23,000	Supplier Neutral Estimate
Increase ID Fan Size	$50,000	Supplier Neutral Estimate; Increased size due to pressure drop across SCR System
Total Direct Capital Costs (TDCC)	$7,018,316	
Direct Installation Costs		
Installation	$5,686,750	Supplier Est. w/ 1% for Steam System, Adjusted for Temp
Foundation and Supports	Included	Included in Supplier Quote for Installation of SCR System
Handling and Erection	Included	Included in Supplier Quote for Installation of SCR System
Electrical	Included	Included in Supplier Quote for Installation of SCR System
Piping	Included	Included in Supplier Quote for Installation of SCR System
Insulation for Ductwork	Included	Included in Supplier Quote for Installation of SCR System
Painting	$30,000	SCR Structural Steel, Piping and Exposed Metals
Site Preparation	$29,000	Existing Roads, Demolition & Restoration, SCR Footprint
Buildings (Process CEM)	$25,000	Engineering Estimate
Concrete	$40,000	Aqueous Ammonia Spill Containment
Miscellaneous Steel	Included	Platforms, Ladders, etc.
SCR Building Enclosure/Struct. Steel	$530,000	Supplier Neutral Estimate; Windload Req. for Hurricanes
Electrical Systems	$56,000	Grounding, Lightning Protection, Lighting, etc.
Instrumentation Systems	$8,000	Systems Monitoring and Control
Insulation Systems	$29,000	Insulating Steam Line to SCR Building
ID Fan Increase	$50,000	Engineering Estimate; Installation with Dampers
Piping Systems	$216,000	Fire Protection Standpipe/Sprinklers, Steam, Service Air, Relocate Propane, Potable Water, Ammonia, Steam, Condensate Return
Total Direct Installation Costs (TDIC)	$6,699,750	
Total Capital Costs (TCC)	$13,718,066	Sum of TDCC and TDIC
Indirect Costs		
Vendor Engineering and Related Costs	$1,097,445	8% of TCC
Construction and Field Expenses	Included	Included in Supplier Quote for SCR System
Vendor Fees	$685,903	5% of TCC
Project Management & Oversight	Included	Included in Vendor Engineering and Related Costs
Start-Up	$274,361	2% of TCC; OAQPS Control Cost Manual, Chapter 3
Performance Tests	$137,181	1% of TCC; OAQPS Control Cost Manual, Chapter 3
Contingencies	$1,371,807	10% of TCC;
Total Indirect Capital Costs (TInCC)	$3,566,697	
Total Direct, Indirect and Capital Costs (TDICC)	$17,284,763	

Estimate of Selective Catalytic Reduction Costs
for Lee County Energy Recovery Facility
With Flue Gas Reheat Using Steam Diverted from Header

Cost Component	Costs	Basis of Cost Component
Direct Annual Costs		
Operations and Maintenance Labor	$56,160	24 hours/week at $45/hour
Ammonia to control 260 ppm inlet NOx	$53,700	$300 per ton for Ammonia*
Catalyst Disposal Costs	$15,000	Engineering Estimate
Catalyst Cost	$90,000	1/3 Catalyst-3 year catalyst life
Regulatory Compliance Costs	$25,000	Engineering Estimate
Spare Parts Inventory Replacement	$96,362	1.5% of SCR Associated Equipment
Total Direct Annual Costs (TDAC)	$336,222	
Annual Energy Costs		
Annual Electrical Needs	$2,847	6.5 kW X 8,760 hours per year at $0.05 per kWh
Annual Additional ID Fan Power	$116,946	267 kW X 8,760 hours per year at $0.05 per kWh
Total Energy Costs (TEC)	$119,793	
Indirect Annual Costs		
Management/Overhead	$33,696	60% of Operations and Maintenance Labor
Insurance	$137,181	1% of Total Capital Costs
Miscellaneous Painting	$10,000	Supplier Neutral Estimate
Miscellaneous Equipment Rebuild	$72,271	Supplier Neutral Estimate; 75% of Spare Parts Above
Lost Power from Reheat	$321,930	Eng. Est. -- 735 kW X 8,760 hours/year at $0.05 per kWh
Annualized Total Direct Capital	$2,812,231	0.1627 Capital Recovery Factor of 10% over 10 years multiplied by sum of TDICC
Total Indirect Annual Costs (TIAC)	$3,387,309	
Total Annualized Costs	$3,843,323	Sum of TDAC, TEC and TIAC (for 260 ppm)
Cost Effectiveness of SCR System		Cost Per Ton NOx Removed
	$12,769	301 Tons NOx Removed (260 ppm inlet; 100 ppm outlet; 62% Removal)

Note: 'Included' denotes item is assumed to be included in supplier budgetary estimate for SCR Associated Equipment and Installation. [See letter from Dennis Malone (Babcock Borsig Power) to Michael Hober (RTP Environmental) dated October 19, 2001, October 29, 2001, and December 4, 2001]

The above cost does not include revenue lost due to additional or unscheduled system shutdown. Based on a cost of $56 per ton of waste at 600 tons of waste per day and over an annual shutdown of 10 days, this cost is estimated to be approximately $336,000 due to lost tipping fees. In addition to this, the amount of revenue lost due to not producing steam during these 10 days is estimated to be approximately $177,000; bringing the Total Annualized costs and cost effectiveness (respectively) to:

Total Annualized Costs $4,290,521 Cost per ton NOx removed $14,254

This cost does not include costs for the electrical needs of the system (1008.5kW over 240 hours at $0.05/kWh) and ammonia usage because system will not operate.

* Note: Ammonia usage is based on information provided by Covanta and ratioed based on 100% availability of Unit 3.

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With Flue Gas Reheat Using Steam Diverted from Header

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Insulation for Ductwork	Included	Included in Supplier Quote for Installation of SCR System
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Site Preparation	$29,000	Existing Roads, Demolition & Restoration, SCR Footprint
Buildings (Process CEM)	$25,000	Engineering Estimate
Concrete	$40,000	Aqueous Ammonia Spill Containment
Miscellaneous Steel	Included	Platforms, Ladders, etc.
SCR Building Enclosure/Struct. Steel	$530,000	Supplier Neutral Estimate; Windload Req. for Hurricanes
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for Lee County Energy Recovery Facility
With Flue Gas Reheat Using Steam Diverted from Header

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Annual Additional ID Fan Power	$116,946	267 kW X 8,760 hours per year at $0.05 per kWh
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Miscellaneous Painting	$10,000	Supplier Neutral Estimate
Miscellaneous Equipment Rebuild	$72,271	Supplier Neutral Estimate; 75% of Spare Parts Above
Lost Power from Reheat	$321,930	Eng. Est. -- 735 kW X 8,760 hours/year at $0.05 per kWh
Annualized Total Direct Capital	$2,272,946	0.1315 Capital Recovery Factor of 10% over 15 years multiplied by sum of TDICC
Total Indirect Annual Costs (TIAC)	$2,848,024	
Total Annualized Costs	$3,304,039	Sum of TDAC, TEC and TIAC (for 260 ppm)
Cost Effectiveness of SCR System		Cost Per Ton NOx Removed
	$10,977	301 Tons NOx Removed (260 ppm inlet; 100 ppm outlet; 62% Removal)

Note: 'Included' denotes item is assumed to be included in supplier budgetary estimate for SCR Associated Equipment and Installation. [See letter from Dennis Malone (Babcock Borsig Power) to Michael Hober (RTP Environmental) dated October 19, 2001, October 29, 2001, and December 4, 2001]

The above cost does not include revenue lost due to additional or unscheduled system shutdown. Based on a cost of $56 per ton of waste at 600 tons of waste per day and over an annual shutdown of 10 days, this cost is estimated to be approximately $336,000 due to lost tipping fees. In addition to this, the amount of revenue lost due to not producing steam during these 10 days is estimated to be approximately $177,000; bringing the Total Annualized costs and cost effectiveness (respectively) to:

Total Annualized Costs $3,751,237 Cost per ton NOx removed $12,463

This cost does not include costs for the electrical needs of the system (1008.5kW over 240 hours at $0.05/kWh) and ammonia usage because system will not operate.

* Note: Ammonia usage is based on information provided by Covanta and ratioed based on 100% availability of Unit 3.

Estimate of Selective Catalytic Reduction Costs
for Lee County Energy Recovery Facility
With Flue Gas Reheat Using Steam Diverted from Header

Cost Component	Costs	Basis of Cost Component
Direct Capital Costs		
SCR Associated Equipment	$6,424,110	Supplier Est. w/ 1% for Steam System, Adjusted for Temp
Ammonia Storage Tanks	Included	Ammonia Storage
Flue Gas Ductwork	$100,000	Engineering Estimate
Instrumentation	Included	In-situ NOx Analyzer
Freight	$321,206	5% of Associated Equip.; OAQPS Control Cost Manual
System Integration	$100,000	Engineering Estimate
Firewater Booster Pump	$23,000	Supplier Neutral Estimate
Increase ID Fan Size	$50,000	Supplier Neutral Estimate; Increased size due to pressure drop across SCR System
Total Direct Capital Costs (TDCC)	$7,018,316	
Direct Installation Costs		
Installation	$5,686,750	Supplier Est. w/ 1% for Steam System, Adjusted for Temp
Foundation and Supports	Included	Included in Supplier Quote for Installation of SCR System
Handling and Erection	Included	Included in Supplier Quote for Installation of SCR System
Electrical	Included	Included in Supplier Quote for Installation of SCR System
Piping	Included	Included in Supplier Quote for Installation of SCR System
Insulation for Ductwork	Included	Included in Supplier Quote for Installation of SCR System
Painting	$30,000	SCR Structural Steel, Piping and Exposed Metals
Site Preparation	$29,000	Existing Roads, Demolition & Restoration, SCR Footprint
Buildings (Process CEM)	$25,000	Engineering Estimate
Concrete	$40,000	Aqueous Ammonia Spill Containment
Miscellaneous Steel	Included	Platforms, Ladders, etc.
SCR Building Enclosure/Struct. Steel	$530,000	Supplier Neutral Estimate; Windload Req. for Hurricanes
Electrical Systems	$56,000	Grounding, Lightning Protection, Lighting, etc.
Instrumentation Systems	$8,000	Systems Monitoring and Control
Insulation Systems	$29,000	Insulating Steam Line to SCR Building
ID Fan Increase	$50,000	Engineering Estimate; Installation with Dampers
Piping Systems	$216,000	Fire Protection Standpipe/Sprinklers, Steam, Service Air, Relocate Propane, Potable Water, Ammonia, Steam, Condensate Return
Total Direct Installation Costs (TDIC)	$6,699,750	
Total Capital Costs (TCC)	$13,718,066	Sum of TDCC and TDIC
Indirect Costs		
Vendor Engineering and Related Costs	$1,097,445	8% of TCC
Construction and Field Expenses	Included	Included in Supplier Quote for SCR System
Vendor Fees	$685,903	5% of TCC
Project Management & Oversight	Included	Included in Vendor Engineering and Related Costs
Start-Up	$274,361	2% of TCC; OAQPS Control Cost Manual, Chapter 3
Performance Tests	$137,181	1% of TCC; OAQPS Control Cost Manual, Chapter 3
Contingencies	$1,371,807	10% of TCC;
Total Indirect Capital Costs (TInCC)	$3,566,697	
Total Direct, Indirect and Capital Costs (TDICC)	$17,284,763	

Estimate of Selective Catalytic Reduction Costs
for Lee County Energy Recovery Facility
With Flue Gas Reheat Using Steam Diverted from Header

Cost Component	Costs	Basis of Cost Component
Direct Annual Costs		
Operations and Maintenance Labor	$56,160	24 hours/week at $45/hour
Ammonia to control 260 ppm inlet NOx	$53,700	$300 per ton for Ammonia*
Catalyst Disposal Costs	$15,000	Engineering Estimate
Catalyst Cost	$90,000	1/3 Catalyst-3 year catalyst life
Regulatory Compliance Costs	$25,000	Engineering Estimate
Spare Parts Inventory Replacement	$96,362	1.5% of SCR Associated Equipment
Total Direct Annual Costs (TDAC)	$336,222	
Annual Energy Costs		
Annual Electrical Needs	$2,847	6.5 kW X 8,760 hours per year at $0.05 per kWh
Annual Additional ID Fan Power	$116,946	267 kW X 8,760 hours per year at $0.05 per kWh
Total Energy Costs (TEC)	$119,793	
Indirect Annual Costs		
Management/Overhead	$33,696	60% of Operations and Maintenance Labor
Insurance	$137,181	1% of Total Capital Costs
Miscellaneous Painting	$10,000	Supplier Neutral Estimate
Miscellaneous Equipment Rebuild	$72,271	Supplier Neutral Estimate; 75% of Spare Parts Above
Lost Power from Reheat	$321,930	Eng. Est. -- 735 kW X 8,760 hours/year at $0.05 per kWh
Annualized Total Direct Capital	$2,461,350	0.1424 Capital Recovery Factor of 7% over 10 years multiplied by sum of TDICC
Total Indirect Annual Costs (TIAC)	$3,036,428	
Total Annualized Costs	$3,492,443	Sum of TDAC, TEC and TIAC (for 260 ppm)
Cost Effectiveness of SCR System		Cost Per Ton NOx Removed
	$11,603	301 Tons NOx Removed (260 ppm inlet; 100 ppm outlet; 62% Removal)

Note: 'Included' denotes item is assumed to be included in supplier budgetary estimate for SCR Associated Equipment and Installation. [See letter from Dennis Malone (Babcock Borsig Power) to Michael Hober (RTP Environmental) dated October 19, 2001, October 29, 2001, and December 4, 2001]

The above cost does not include revenue lost due to additional or unscheduled system shutdown. Based on a cost of $56 per ton of waste at 600 tons of waste per day and over an annual shutdown of 10 days, this cost is estimated to be approximately $336,000 due to lost tipping fees. In addition to this, the amount of revenue lost due to not producing steam during these 10 days is estimated to be approximately $177,000; bringing the Total Annualized costs and cost effectiveness (respectively) to:

Total Annualized Costs $3,939,641 Cost per ton NOx removed $13,089

This cost does not include costs for the electrical needs of the system (1008.5kW over 240 hours at $0.05/kWh) and ammonia usage because system will not operate.

* Note: Ammonia usage is based on information provided by Covanta and ratioed based on 100% availability of Unit 3.

Estimate of Selective Catalytic Reduction Costs
for Lee County Energy Recovery Facility
With Flue Gas Reheat Using Steam Diverted from Header

Cost Component	Costs	Basis of Cost Component
Direct Capital Costs		
SCR Associated Equipment	$6,424,110	Supplier Est. w/ 1% for Steam System, Adjusted for Temp
Ammonia Storage Tanks	Included	Ammonia Storage
Flue Gas Ductwork	$100,000	Engineering Estimate
Instrumentation	Included	In-situ NOx Analyzer
Freight	$321,206	5% of Associated Equip.; OAQPS Control Cost Manual
System Integration	$100,000	Engineering Estimate
Firewater Booster Pump	$23,000	Supplier Neutral Estimate
Increase ID Fan Size	$50,000	Supplier Neutral Estimate; Increased size due to pressure drop across SCR System
Total Direct Capital Costs (TDCC)	$7,018,316	
Direct Installation Costs		
Installation	$5,686,750	Supplier Est. w/ 1% for Steam System, Adjusted for Temp
Foundation and Supports	Included	Included in Supplier Quote for Installation of SCR System
Handling and Erection	Included	Included in Supplier Quote for Installation of SCR System
Electrical	Included	Included in Supplier Quote for Installation of SCR System
Piping	Included	Included in Supplier Quote for Installation of SCR System
Insulation for Ductwork	Included	Included in Supplier Quote for Installation of SCR System
Painting	$30,000	SCR Structural Steel, Piping and Exposed Metals
Site Preparation	$29,000	Existing Roads, Demolition & Restoration, SCR Footprint
Buildings (Process CEM)	$25,000	Engineering Estimate
Concrete	$40,000	Aqueous Ammonia Spill Containment
Miscellaneous Steel	Included	Platforms, Ladders, etc.
SCR Building Enclosure/Struct. Steel	$530,000	Supplier Neutral Estimate; Windload Req. for Hurricanes
Electrical Systems	$56,000	Grounding, Lightning Protection, Lighting, etc.
Instrumentation Systems	$8,000	Systems Monitoring and Control
Insulation Systems	$29,000	Insulating Steam Line to SCR Building
ID Fan Increase	$50,000	Engineering Estimate; Installation with Dampers
Piping Systems	$216,000	Fire Protection Standpipe/Sprinklers, Steam, Service Air, Relocate Propane, Potable Water, Ammonia, Steam, Condensate Return
Total Direct Installation Costs (TDIC)	$6,699,750	
Total Capital Costs (TCC)	$13,718,066	Sum of TDCC and TDIC
Indirect Costs		
Vendor Engineering and Related Costs	$1,097,445	8% of TCC
Construction and Field Expenses	Included	Included in Supplier Quote for SCR System
Vendor Fees	$685,903	5% of TCC
Project Management & Oversight	Included	Included in Vendor Engineering and Related Costs
Start-Up	$274,361	2% of TCC; OAQPS Control Cost Manual, Chapter 3
Performance Tests	$137,181	1% of TCC; OAQPS Control Cost Manual, Chapter 3
Contingencies	$1,371,807	10% of TCC;
Total Indirect Capital Costs (TInCC)	$3,566,697	
Total Direct, Indirect and Capital Costs (TDICC)	$17,284,763	

Estimate of Selective Catalytic Reduction Costs
for Lee County Energy Recovery Facility
With Flue Gas Reheat Using Steam Diverted from Header

Cost Component	Costs	Basis of Cost Component
Direct Annual Costs		
Operations and Maintenance Labor	$56,160	24 hours/week at $45/hour
Ammonia to control 260 ppm inlet NOx	$53,700	$300 per ton for Ammonia*
Catalyst Disposal Costs	$15,000	Engineering Estimate
Catalyst Cost	$90,000	1/3 Catalyst-3 year catalyst life
Regulatory Compliance Costs	$25,000	Engineering Estimate
Spare Parts Inventory Replacement	$96,362	1.5% of SCR Associated Equipment
Total Direct Annual Costs (TDAC)	$336,222	
Annual Energy Costs		
Annual Electrical Needs	$2,847	6.5 kW X 8,760 hours per year at $0.05 per kWh
Annual Additional ID Fan Power	$116,946	267 kW X 8,760 hours per year at $0.05 per kWh
Total Energy Costs (TEC)	$119,793	
Indirect Annual Costs		
Management/Overhead	$33,696	60% of Operations and Maintenance Labor
Insurance	$137,181	1% of Total Capital Costs
Miscellaneous Painting	$10,000	Supplier Neutral Estimate
Miscellaneous Equipment Rebuild	$72,271	Supplier Neutral Estimate; 75% of Spare Parts Above
Lost Power from Reheat	$321,930	Eng. Est. -- 735 kW X 8,760 hours/year at $0.05 per kWh
Annualized Total Direct Capital	$1,897,867	0.1098 Capital Recovery Factor of 7% over 15 years multiplied by sum of TDICC
Total Indirect Annual Costs (TIAC)	$2,472,945	
Total Annualized Costs	$2,928,959	Sum of TDAC, TEC and TIAC (for 260 ppm)
Cost Effectiveness of SCR System		Cost Per Ton NOx Removed
	$9,731	301 Tons NOx Removed (260 ppm inlet; 100 ppm outlet; 62% Removal)

Note: 'Included' denotes item is assumed to be included in supplier budgetary estimate for SCR Associated Equipment and Installation. [See letter from Dennis Malone (Babcock Borsig Power) to Michael Hober (RTP Environmental) dated October 19, 2001, October 29, 2001, and December 4, 2001]

The above cost does not include revenue lost due to additional or unscheduled system shutdown. Based on a cost of $56 per ton of waste at 600 tons of waste per day and over an annual shutdown of 10 days, this cost is estimated to be approximately $336,000 due to lost tipping fees. In addition to this, the amount of revenue lost due to not producing steam during these 10 days is estimated to be approximately $177,000; bringing the Total Annualized costs and cost effectiveness (respectively) to:

Total Annualized Costs $3,376,157 Cost per ton NOx removed $11,216

This cost does not include costs for the electrical needs of the system (1008.5kW over 240 hours at $0.05/kWh) and ammonia usage because system will not operate.

* Note: Ammonia usage is based on information provided by Covanta and ratioed based on 100% availability of Unit 3.

Estimate of Selective Catalytic Reduction Costs
for Lee County Energy Recovery Facility
With Flue Gas Reheat Using Steam Diverted from Header

Cost Component	Costs	Basis of Cost Component
Direct Capital Costs		
SCR Associated Equipment	$6,424,110	Supplier Est. w/ 1% for Steam System, Adjusted for Temp
Ammonia Storage Tanks	Included	Ammonia Storage
Flue Gas Ductwork	$100,000	Engineering Estimate
Instrumentation	Included	In-situ NOx Analyzer
Freight	$321,206	5% of Associated Equip.; OAQPS Control Cost Manual
System Integration	$100,000	Engineering Estimate
Firewater Booster Pump	$23,000	Supplier Neutral Estimate
Increase ID Fan Size	$50,000	Supplier Neutral Estimate; Increased size due to pressure drop across SCR System
Total Direct Capital Costs (TDCC)	$7,018,316	
Direct Installation Costs		
Installation	$5,686,750	Supplier Est. w/ 1% for Steam System, Adjusted for Temp
Foundation and Supports	Included	Included in Supplier Quote for Installation of SCR System
Handling and Erection	Included	Included in Supplier Quote for Installation of SCR System
Electrical	Included	Included in Supplier Quote for Installation of SCR System
Piping	Included	Included in Supplier Quote for Installation of SCR System
Insulation for Ductwork	Included	Included in Supplier Quote for Installation of SCR System
Painting	$30,000	SCR Structural Steel, Piping and Exposed Metals
Site Preparation	$29,000	Existing Roads, Demolition & Restoration, SCR Footprint
Buildings (Process CEM)	$25,000	Engineering Estimate
Concrete	$40,000	Aqueous Ammonia Spill Containment
Miscellaneous Steel	Included	Platforms, Ladders, etc.
SCR Building Enclosure/Struct. Steel	$530,000	Supplier Neutral Estimate; Windload Req. for Hurricanes
Electrical Systems	$56,000	Grounding, Lightning Protection, Lighting, etc.
Instrumentation Systems	$8,000	Systems Monitoring and Control
Insulation Systems	$29,000	Insulating Steam Line to SCR Building
ID Fan Increase	$50,000	Engineering Estimate; Installation with Dampers
Piping Systems	$216,000	Fire Protection Standpipe/Sprinklers, Steam, Service Air, Relocate Propane, Potable Water, Ammonia, Steam, Condensate Return
Total Direct Installation Costs (TDIC)	$6,699,750	
Total Capital Costs (TCC)	$13,718,066	Sum of TDCC and TDIC
Indirect Costs		
Vendor Engineering and Related Costs	$1,097,445	8% of TCC
Construction and Field Expenses	Included	Included in Supplier Quote for SCR System
Vendor Fees	$685,903	5% of TCC
Project Management & Oversight	Included	Included in Vendor Engineering and Related Costs
Start-Up	$274,361	2% of TCC; OAQPS Control Cost Manual, Chapter 3
Performance Tests	$137,181	1% of TCC; OAQPS Control Cost Manual, Chapter 3
Contingencies	$1,371,807	10% of TCC;
Total Indirect Capital Costs (TInCC)	$3,566,697	
Total Direct, Indirect and Capital Costs (TDICC)	$17,284,763	

Estimate of Selective Catalytic Reduction Costs
for Lee County Energy Recovery Facility
With Flue Gas Reheat Using Steam Diverted from Header

Cost Component	Costs	Basis of Cost Component
Direct Annual Costs		
Operations and Maintenance Labor	$56,160	24 hours/week at $45/hour
Ammonia to control 260 ppm inlet NOx	$53,700	$300 per ton for Ammonia*
Catalyst Disposal Costs	$15,000	Engineering Estimate
Catalyst Cost	$90,000	1/3 Catalyst-3 year catalyst life
Regulatory Compliance Costs	$25,000	Engineering Estimate
Spare Parts Inventory Replacement	$96,362	1.5% of SCR Associated Equipment
Total Direct Annual Costs (TDAC)	$336,222	
Annual Energy Costs		
Annual Electrical Needs	$2,847	6.5 kW X 8,760 hours per year at $0.05 per kWh
Annual Additional ID Fan Power	$116,946	267 kW X 8,760 hours per year at $0.05 per kWh
Total Energy Costs (TEC)	$119,793	
Indirect Annual Costs		
Management/Overhead	$33,696	60% of Operations and Maintenance Labor
Insurance	$137,181	1% of Total Capital Costs
Miscellaneous Painting	$10,000	Supplier Neutral Estimate
Miscellaneous Equipment Rebuild	$72,271	Supplier Neutral Estimate; 75% of Spare Parts Above
Lost Power from Reheat	$321,930	Eng. Est. -- 735 kW X 8,760 hours/year at $0.05 per kWh
Annualized Total Direct Capital	$1,631,682	0.0944 Capital Recovery Factor of 7% over 20 years multiplied by sum of TDICC
Total Indirect Annual Costs (TIAC)	$2,206,759	
Total Annualized Costs	$2,662,774	Sum of TDAC, TEC and TIAC (for 260 ppm)
Cost Effectiveness of SCR System		Cost Per Ton NOx Removed
	$8,846	301 Tons NOx Removed (260 ppm inlet; 100 ppm outlet; 62% Removal)

Note: 'Included' denotes item is assumed to be included in supplier budgetary estimate for SCR Associated Equipment and Installation. [See letter from Dennis Malone (Babcock Borsig Power) to Michael Hober (RTP Environmental) dated October 19, 2001, October 29, 2001, and December 4, 2001]

The above cost does not include revenue lost due to additional or unscheduled system shutdown. Based on a cost of $56 per ton of waste at 600 tons of waste per day and over an annual shutdown of 10 days, this cost is estimated to be approximately $336,000 due to lost tipping fees. In addition to this, the amount of revenue lost due to not producing steam during these 10 days is estimated to be approximately $177,000; bringing the Total Annualized costs and cost effectiveness (respectively) to:

Total Annualized Costs $3,109,972 Cost per ton NOx removed $10,332

This cost does not include costs for the electrical needs of the system (1008.5kW over 240 hours at $0.05/kWh) and ammonia usage because system will not operate.

* Note: Ammonia usage is based on information provided by Covanta and ratioed based on 100% availability of Unit 3.

Estimate of Selective Catalytic Reduction Costs
for Lee County Energy Recovery Facility
With Flue Gas Reheat Using Natural Gas Combustion

Cost Component	Costs	Basis of Cost Component
Direct Capital Costs		
SCR Associated Equipment	$6,300,000	Supplier Estimate
Ammonia Storage Tanks	Included	Ammonia Storage
Flue Gas Ductwork	$100,000	Engineering Estimate
Instrumentation	Included	In-situ NOx Analyzer
Freight	$315,000	5% of Associated Equip.; OAQPS Control Cost Manual
System Integration	$100,000	Engineering Estimate
Firewater Booster Pump	$23,000	Supplier Neutral Estimate
Increase ID Fan Size	$60,000	Supplier Neutral Estimate; Increased size due to pressure drop across SCR System
Total Direct Capital Costs (TDCC)	$6,898,000	
Direct Installation Costs		
Installation	$5,675,000	Supplier Estimate
Foundation and Supports	Included	Included in Supplier Quote for Installation of SCR System
Handling and Erection	Included	Included in Supplier Quote for Installation of SCR System
Electrical	Included	Included in Supplier Quote for Installation of SCR System
Piping	Included	Included in Supplier Quote for Installation of SCR System
Insulation for Ductwork	Included	Included in Supplier Quote for Installation of SCR System
Painting	$30,000	SCR Structural Steel, Piping and Exposed Metals
Site Preparation	$29,000	Existing Roads, Demolition & Restoration, SCR Footprint
Buildings (Process CEM)	$25,000	Engineering Estimate
Concrete	$40,000	Aqueous Ammonia Spill Containment
Miscellaneous Steel	Included	Platforms, Ladders, etc.
SCR Building Enclosure/Struct. Steel	$530,000	Supplier Neutral Estimate; Windload Req. for Hurricanes
Electrical Systems	$56,000	Grounding, Lightning Protection, Lighting, etc.
Instrumentation Systems	$8,000	Systems Monitoring and Control
ID Fan Increase	$60,000	Engineering Estimate; Installation with Dampers
Piping Systems	$166,000	Fire Protection Standpipe/Sprinklers, Service Air, Potable Water, Ammonia, Gas Piping
Total Direct Installation Costs (TDIC)	$6,619,000	
Total Capital Costs (TCC)	$13,517,000	Sum of TDCC and TDIC
Indirect Costs		
Vendor Engineering and Related Costs	$1,081,360	8% of TCC
Construction and Field Expenses	Included	Included in Supplier Quote for SCR System
Vendor Fees	$675,850	5% of TCC
Project Management & Oversight	Included	Included in Vendor Engineering and Related Costs
Start-Up	$270,340	2% of TCC; OAQPS Control Cost Manual, Chapter 3
Performance Tests	$135,170	1% of TCC; OAQPS Control Cost Manual, Chapter 3
Contingencies	$1,351,700	10% of TCC;
Total Indirect Capital Costs (TInCC)	$3,514,420	
Total Direct, Indirect and Capital Costs (TDICC)	$17,031,420	

Estimate of Selective Catalytic Reduction Costs
for Lee County Energy Recovery Facility
With Flue Gas Reheat Using Natural Gas Combustion

Cost Component	Costs	Basis of Cost Component
Direct Annual Costs		
Operations and Maintenance Labor	$56,160	24 hours/week at $45/hour
Ammonia to control 260 ppm inlet NOx	$53,700	$300 per ton for Ammonia*
Catalyst Disposal Costs	$15,000	Engineering Estimate
Catalyst Cost	$90,000	1/3 Catalyst-3 year catalyst life
Regulatory Compliance Costs	$25,000	Engineering Estimate
Spare Parts Inventory Replacement	$94,500	*1.5% of SCR Associated Equipment*
Total Direct Annual Costs (TDAC)	$334,360	
Annual Energy Costs		
Annual Electrical Energy Usage	$2,847	*6.5 kW X 8,760 hours per year at $0.05 per kWh*
Annual Additional ID Fan Power	$130,962	299 kW X 8,760 hours per year at $0.05 per kWh
Annual Natural Gas Usage	$1,280,080	256,016 Mcf at $5.00 per 1000 cf of Natural Gas Based on Supplier Est.; Adjusted for Temp
Total Energy Costs (TEC)	$1,413,889	
Indirect Annual Costs		
Management/Overhead	$33,696	60% of Operations and Maintenance Labor
Insurance	$135,170	1% of Total Capital Costs
Miscellaneous Painting	$10,000	Supplier Neutral Estimate
Miscellaneous Equipment Rebuild	$70,875	Supplier Neutral Estimate; 75% of Spare Parts Above
Annualized Total Direct Capital	$2,771,012	0.1627 Capital Recovery Factor of 10% over 10 years multiplied by sum of TDICC
Total Indirect Annual Costs (TIAC)	$3,020,753	
Total Annualized Costs	$4,769,002	*Sum of TDAC, TEC and TIAC (for 260 ppm)*
Cost Effectiveness of SCR System		Cost Per Ton NOx Removed
	$15,844	301 Tons NOx Removed (260 ppm inlet; 100 ppm outlet; 62% Removal)

Note: 'Included' *denotes item* is assumed to be included in supplier budgetary estimate for SCR Associated Equipment and Installation. [See letter from Dennis Malone (Babcock Borsig Power) to Michael Hober (RTP Environmental) dated October 19, 2001, October 29, 2001, and December 4, 2001]

The above cost does not include revenue lost due to additional or unscheduled system shutdown. Based on a cost of $56 per ton of waste at 600 tons of waste per day and over an annual shutdown of 10 days, this cost is estimated to be approximately $336,000 due to lost tipping fees. In addition to this, the amount of revenue lost due to not producing steam during these 10 days is estimated to be approximately $177,000; bringing the Total Annualized costs and cost effectiveness (respectively) to:

Total Annualized Costs $5,224,636 Cost per ton NOx removed $17,358

This cost does not include costs for the electrical needs of the system (305.5kW over 240 hours at $0.05/kWh) and ammonia usage because system will not operate.

* Note: Ammonia usage is based on information provided by Covanta and ratioed based on 100% availability of Unit 3.

Estimate of Selective Catalytic Reduction Costs
for Lee County Energy Recovery Facility
With Flue Gas Reheat Using Natural Gas Combustion

Cost Component	Costs	Basis of Cost Component
Direct Capital Costs		
SCR Associated Equipment	$6,300,000	Supplier Estimate
Ammonia Storage Tanks	Included	Ammonia Storage
Flue Gas Ductwork	$100,000	Engineering Estimate
Instrumentation	Included	In-situ NOx Analyzer
Freight	$315,000	5% of Associated Equip.; OAQPS Control Cost Manual
System Integration	$100,000	Engineering Estimate
Firewater Booster Pump	$23,000	Supplier Neutral Estimate
Increase ID Fan Size	$60,000	Supplier Neutral Estimate; Increased size due to pressure drop across SCR System
Total Direct Capital Costs (TDCC)	$6,898,000	
Direct Installation Costs		
Installation	$5,675,000	Supplier Estimate
Foundation and Supports	Included	Included in Supplier Quote for Installation of SCR System
Handling and Erection	Included	Included in Supplier Quote for Installation of SCR System
Electrical	Included	Included in Supplier Quote for Installation of SCR System
Piping	Included	Included in Supplier Quote for Installation of SCR System
Insulation for Ductwork	Included	Included in Supplier Quote for Installation of SCR System
Painting	$30,000	SCR Structural Steel, Piping and Exposed Metals
Site Preparation	$29,000	Existing Roads, Demolition & Restoration, SCR Footprint
Buildings (Process CEM)	$25,000	Engineering Estimate
Concrete	$40,000	Aqueous Ammonia Spill Containment
Miscellaneous Steel	Included	Platforms, Ladders, etc.
SCR Building Enclosure/Struct. Steel	$530,000	Supplier Neutral Estimate; Windload Req. for Hurricanes
Electrical Systems	$56,000	Grounding, Lightning Protection, Lighting, etc.
Instrumentation Systems	$8,000	Systems Monitoring and Control
ID Fan Increase	$60,000	Engineering Estimate; Installation with Dampers
Piping Systems	$166,000	Fire Protection Standpipe/Sprinklers, Service Air, Potable Water, Ammonia, Gas Piping
Total Direct Installation Costs (TDIC)	$6,619,000	
Total Capital Costs (TCC)	$13,517,000	Sum of TDCC and TDIC
Indirect Costs		
Vendor Engineering and Related Costs	$1,081,360	8% of TCC
Construction and Field Expenses	Included	Included in Supplier Quote for SCR System
Vendor Fees	$675,850	5% of TCC
Project Management & Oversight	Included	Included in Vendor Engineering and Related Costs
Start-Up	$270,340	2% of TCC; OAQPS Control Cost Manual, Chapter 3
Performance Tests	$135,170	1% of TCC; OAQPS Control Cost Manual, Chapter 3
Contingencies	$1,351,700	10% of TCC;
Total Indirect Capital Costs (TInCC)	$3,514,420	
Total Direct, Indirect and Capital Costs (TDICC)	$17,031,420	

Estimate of Selective Catalytic Reduction Costs
for Lee County Energy Recovery Facility
With Flue Gas Reheat Using Natural Gas Combustion

Cost Component	Costs	Basis of Cost Component
Direct Annual Costs		
Operations and Maintenance Labor	$56,160	24 hours/week at $45/hour
Ammonia to control 260 ppm inlet NOx	$53,700	$300 per ton for Ammonia*
Catalyst Disposal Costs	$15,000	Engineering Estimate
Catalyst Cost	$90,000	1/3 Catalyst-3 year catalyst life
Regulatory Compliance Costs	$25,000	Engineering Estimate
Spare Parts Inventory Replacement	$94,500	1.5% of SCR Associated Equipment
Total Direct Annual Costs (TDAC)	$334,360	
Annual Energy Costs		
Annual Electrical Energy Usage	$2,847	6.5 kW X 8,760 hours per year at $0.05 per kWh
Annual Additional ID Fan Power	$130,962	299 kW X 8,760 hours per year at $0.05 per kWh
Annual Natural Gas Usage	$1,280,080	256,016 Mcf at $5.00 per 1000 cf of Natural Gas Based on Supplier Est.; Adjusted for Temp
Total Energy Costs (TEC)	$1,413,889	
Indirect Annual Costs		
Management/Overhead	$33,696	60% of Operations and Maintenance Labor
Insurance	$135,170	1% of Total Capital Costs
Miscellaneous Painting	$10,000	Supplier Neutral Estimate
Miscellaneous Equipment Rebuild	$70,875	Supplier Neutral Estimate; 75% of Spare Parts Above
Annualized Total Direct Capital	$2,239,632	0.1315 Capital Recovery Factor of 10% over 15 years multiplied by sum of TDICC
Total Indirect Annual Costs (TIAC)	$2,489,373	
Total Annualized Costs	$4,237,622	Sum of TDAC, TEC and TIAC (for 260 ppm)
Cost Effectiveness of SCR System		Cost Per Ton NOx Removed
	$14,078	301 Tons NOx Removed (260 ppm inlet; 100 ppm outlet; 62% Removal)

Note: 'Included' denotes item is assumed to be included in supplier budgetary estimate for SCR Associated Equipment and Installation. [See letter from Dennis Malone (Babcock Borsig Power) to Michael Hober (RTP Environmental) dated October 19, 2001, October 29, 2001, and December 4, 2001]

The above cost does not include revenue lost due to additional or unscheduled system shutdown. Based on a cost of $56 per ton of waste at 600 tons of waste per day and over an annual shutdown of 10 days, this cost is estimated to be approximately $336,000 due to lost tipping fees. In addition to this, the amount of revenue lost due to not producing steam during these 10 days is estimated to be approximately $177,000; bringing the Total Annualized costs and cost effectiveness (respectively) to:

Total Annualized Costs $4,693,256 Cost per ton NOx removed $15,592

This cost does not include costs for the electrical needs of the system (305.5kW over 240 hours at $0.05/kWh) and ammonia usage because system will not operate.

* Note: Ammonia usage is based on information provided by Covanta and ratioed based on 100% availability of Unit 3.

Estimate of Selective Catalytic Reduction Costs
for Lee County Energy Recovery Facility
With Flue Gas Reheat Using Natural Gas Combustion

Cost Component	Costs	Basis of Cost Component
Direct Capital Costs		
SCR Associated Equipment	$6,300,000	Supplier Estimate
Ammonia Storage Tanks	Included	Ammonia Storage
Flue Gas Ductwork	$100,000	Engineering Estimate
Instrumentation	Included	In-situ NOx Analyzer
Freight	$315,000	5% of Associated Equip.; OAQPS Control Cost Manual
System Integration	$100,000	Engineering Estimate
Firewater Booster Pump	$23,000	Supplier Neutral Estimate
Increase ID Fan Size	$60,000	Supplier Neutral Estimate; Increased size due to pressure drop across SCR System
Total Direct Capital Costs (TDCC)	$6,898,000	
Direct Installation Costs		
Installation	$5,675,000	Supplier Estimate
Foundation and Supports	Included	Included in Supplier Quote for Installation of SCR System
Handling and Erection	Included	Included in Supplier Quote for Installation of SCR System
Electrical	Included	Included in Supplier Quote for Installation of SCR System
Piping	Included	Included in Supplier Quote for Installation of SCR System
Insulation for Ductwork	Included	Included in Supplier Quote for Installation of SCR System
Painting	$30,000	SCR Structural Steel, Piping and Exposed Metals
Site Preparation	$29,000	Existing Roads, Demolition & Restoration, SCR Footprint
Buildings (Process CEM)	$25,000	Engineering Estimate
Concrete	$40,000	Aqueous Ammonia Spill Containment
Miscellaneous Steel	Included	Platforms, Ladders, etc.
SCR Building Enclosure/Struct. Steel	$530,000	Supplier Neutral Estimate; Windload Req. for Hurricanes
Electrical Systems	$56,000	Grounding, Lightning Protection, Lighting, etc.
Instrumentation Systems	$8,000	Systems Monitoring and Control
ID Fan Increase	$60,000	Engineering Estimate; Installation with Dampers
Piping Systems	$166,000	Fire Protection Standpipe/Sprinklers, Service Air, Potable Water, Ammonia, Gas Piping
Total Direct Installation Costs (TDIC)	$6,619,000	
Total Capital Costs (TCC)	$13,517,000	Sum of TDCC and TDIC
Indirect Costs		
Vendor Engineering and Related Costs	$1,081,360	8% of TCC
Construction and Field Expenses	Included	Included in Supplier Quote for SCR System
Vendor Fees	$675,850	5% of TCC
Project Management & Oversight	Included	Included in Vendor Engineering and Related Costs
Start-Up	$270,340	2% of TCC; OAQPS Control Cost Manual, Chapter 3
Performance Tests	$135,170	1% of TCC; OAQPS Control Cost Manual, Chapter 3
Contingencies	$1,351,700	10% of TCC;
Total Indirect Capital Costs (TInCC)	$3,514,420	
Total Direct, Indirect and Capital Costs (TDICC)	$17,031,420	

Estimate of Selective Catalytic Reduction Costs
for Lee County Energy Recovery Facility
With Flue Gas Reheat Using Natural Gas Combustion

Cost Component	Costs	Basis of Cost Component
Direct Annual Costs		
Operations and Maintenance Labor	$56,160	24 hours/week at $45/hour
Ammonia to control 260 ppm inlet NOx	$53,700	$300 per ton for Ammonia*
Catalyst Disposal Costs	$15,000	Engineering Estimate
Catalyst Cost	$90,000	1/3 Catalyst-3 year catalyst life
Regulatory Compliance Costs	$25,000	Engineering Estimate
Spare Parts Inventory Replacement	$94,500	1.5% of SCR Associated Equipment
Total Direct Annual Costs (TDAC)	$334,360	
Annual Energy Costs		
Annual Electrical Energy Usage	$2,847	6.5 kW X 8,760 hours per year at $0.05 per kWh
Annual Additional ID Fan Power	$130,962	299 kW X 8,760 hours per year at $0.05 per kWh
Annual Natural Gas Usage	$1,280,080	256,016 Mcf at $5.00 per 1000 cf of Natural Gas Based on Supplier Est.; Adjusted for Temp
Total Energy Costs (TEC)	$1,413,889	
Indirect Annual Costs		
Management/Overhead	$33,696	60% of Operations and Maintenance Labor
Insurance	$135,170	1% of Total Capital Costs
Miscellaneous Painting	$10,000	Supplier Neutral Estimate
Miscellaneous Equipment Rebuild	$70,875	Supplier Neutral Estimate; 75% of Spare Parts Above
Annualized Total Direct Capital	$2,425,274	0.1424 Capital Recovery Factor of 7% over 10 years multiplied by sum of TDICC
Total Indirect Annual Costs (TIAC)	$2,675,015	
Total Annualized Costs	$4,423,264	Sum of TDAC, TEC and TIAC (for 260 ppm)
Cost Effectiveness of SCR System		Cost Per Ton NOx Removed
	$14,695	301 Tons NOx Removed (260 ppm inlet; 100 ppm outlet; 62% Removal)

Note: 'Included' denotes item is assumed to be included in supplier budgetary estimate for SCR Associated Equipment and Installation. [See letter from Dennis Malone (Babcock Borsig Power) to Michael Hober (RTP Environmental) dated October 19, 2001, October 29, 2001, and December 4, 2001]

The above cost does not include revenue lost due to additional or unscheduled system shutdown. Based on a cost of $56 per ton of waste at 600 tons of waste per day and over an annual shutdown of 10 days, this cost is estimated to be approximately $336,000 due to lost tipping fees. In addition to this, the amount of revenue lost due to not producing steam during these 10 days is estimated to be approximately $177,000; bringing the Total Annualized costs and cost effectiveness (respectively) to:

Total Annualized Costs $4,878,898 Cost per ton NOx removed $16,209

This cost does not include costs for the electrical needs of the system (305.5kW over 240 hours at $0.05/kWh) and ammonia usage because system will not operate.

* Note: Ammonia usage is based on information provided by Covanta and ratioed based on 100% availability of Unit 3.

Estimate of Selective Catalytic Reduction Costs
for Lee County Energy Recovery Facility
With Flue Gas Reheat Using Natural Gas Combustion

Cost Component	Costs	Basis of Cost Component
Direct Capital Costs		
SCR Associated Equipment	$6,300,000	Supplier Estimate
Ammonia Storage Tanks	Included	Ammonia Storage
Flue Gas Ductwork	$100,000	Engineering Estimate
Instrumentation	Included	In-situ NOx Analyzer
Freight	$315,000	5% of Associated Equip.; OAQPS Control Cost Manual
System Integration	$100,000	Engineering Estimate
Firewater Booster Pump	$23,000	Supplier Neutral Estimate
Increase ID Fan Size	$60,000	Supplier Neutral Estimate; Increased size due to pressure drop across SCR System
Total Direct Capital Costs (TDCC)	$6,898,000	
Direct Installation Costs		
Installation	$5,675,000	Supplier Estimate
Foundation and Supports	Included	Included in Supplier Quote for Installation of SCR System
Handling and Erection	Included	Included in Supplier Quote for Installation of SCR System
Electrical	Included	Included in Supplier Quote for Installation of SCR System
Piping	Included	Included in Supplier Quote for Installation of SCR System
Insulation for Ductwork	Included	Included in Supplier Quote for Installation of SCR System
Painting	$30,000	SCR Structural Steel, Piping and Exposed Metals
Site Preparation	$29,000	Existing Roads, Demolition & Restoration, SCR Footprint
Buildings (Process CEM)	$25,000	Engineering Estimate
Concrete	$40,000	Aqueous Ammonia Spill Containment
Miscellaneous Steel	Included	Platforms, Ladders, etc.
SCR Building Enclosure/Struct. Steel	$530,000	Supplier Neutral Estimate; Windload Req. for Hurricanes
Electrical Systems	$56,000	Grounding, Lightning Protection, Lighting, etc.
Instrumentation Systems	$8,000	Systems Monitoring and Control
ID Fan Increase	$60,000	Engineering Estimate; Installation with Dampers
Piping Systems	$166,000	Fire Protection Standpipe/Sprinklers, Service Air, Potable Water, Ammonia, Gas Piping
Total Direct Installation Costs (TDIC)	$6,619,000	
Total Capital Costs (TCC)	$13,517,000	Sum of TDCC and TDIC
Indirect Costs		
Vendor Engineering and Related Costs	$1,081,360	8% of TCC
Construction and Field Expenses	Included	Included in Supplier Quote for SCR System
Vendor Fees	$675,850	5% of TCC
Project Management & Oversight	Included	Included in Vendor Engineering and Related Costs
Start-Up	$270,340	2% of TCC; OAQPS Control Cost Manual, Chapter 3
Performance Tests	$135,170	1% of TCC; OAQPS Control Cost Manual, Chapter 3
Contingencies	$1,351,700	10% of TCC;
Total Indirect Capital Costs (TInCC)	$3,514,420	
Total Direct, Indirect and Capital Costs (TDICC)	$17,031,420	

Estimate of Selective Catalytic Reduction Costs
for Lee County Energy Recovery Facility
With Flue Gas Reheat Using Natural Gas Combustion

Cost Component	Costs	Basis of Cost Component
Direct Annual Costs		
Operations and Maintenance Labor	$56,160	24 hours/week at $45/hour
Ammonia to control 260 ppm inlet NOx	$53,700	$300 per ton for Ammonia*
Catalyst Disposal Costs	$15,000	Engineering Estimate
Catalyst Cost	$90,000	1/3 Catalyst-3 year catalyst life
Regulatory Compliance Costs	$25,000	Engineering Estimate
Spare Parts Inventory Replacement	$94,500	1.5% of SCR Associated Equipment
Total Direct Annual Costs (TDAC)	$334,360	
Annual Energy Costs		
Annual Electrical Energy Usage	$2,847	6.5 kW X 8,760 hours per year at $0.05 per kWh
Annual Additional ID Fan Power	$130,962	299 kW X 8,760 hours per year at $0.05 per kWh
Annual Natural Gas Usage	$1,280,080	256,016 Mcf at $5.00 per 1000 cf of Natural Gas Based on Supplier Est.; Adjusted for Temp
Total Energy Costs (TEC)	$1,413,889	
Indirect Annual Costs		
Management/Overhead	$33,696	60% of Operations and Maintenance Labor
Insurance	$135,170	1% of Total Capital Costs
Miscellaneous Painting	$10,000	Supplier Neutral Estimate
Miscellaneous Equipment Rebuild	$70,875	Supplier Neutral Estimate; 75% of Spare Parts Above
Annualized Total Direct Capital	$1,870,050	0.1098 Capital Recovery Factor of 7% over 15 years multiplied by sum of TDICC
Total Indirect Annual Costs (TIAC)	$2,119,791	
Total Annualized Costs	$3,868,040	*Sum of TDAC, TEC and TIAC (for 260 ppm)*
Cost Effectiveness of SCR System		Cost Per Ton NOx Removed
	$12,851	301 Tons NOx Removed (260 ppm inlet; 100 ppm outlet; 62% Removal)

Note: 'Included' denotes item is assumed to be included in supplier budgetary estimate for SCR Associated Equipment and Installation. [See letter from Dennis Malone (Babcock Borsig Power) to Michael Hober (RTP Environmental) dated October 19, 2001, October 29, 2001, and December 4, 2001]

The above cost does not include revenue lost due to additional or unscheduled system shutdown. Based on a cost of $56 per ton of waste at 600 tons of waste per day and over an annual shutdown of 10 days, this cost is estimated to be approximately $336,000 due to lost tipping fees. In addition to this, the amount of revenue lost due to not producing steam during these 10 days is estimated to be approximately $177,000; bringing the Total Annualized costs and cost effectiveness (respectively) to:

Total Annualized Costs $4,323,674 Cost per ton NOx removed $14,364

This cost does not include costs for the electrical needs of the system (305.5kW over 240 hours at $0.05/kWh) and ammonia usage because system will not operate.

* Note: Ammonia usage is based on information provided by Covanta and ratioed based on 100% availability of Unit 3.

Estimate of Selective Catalytic Reduction Costs
for Lee County Energy Recovery Facility
With Flue Gas Reheat Using Natural Gas Combustion

Cost Component	Costs	Basis of Cost Component
Direct Capital Costs		
SCR Associated Equipment	$6,300,000	Supplier Estimate
Ammonia Storage Tanks	Included	Ammonia Storage
Flue Gas Ductwork	$100,000	Engineering Estimate
Instrumentation	Included	In-situ NOx Analyzer
Freight	$315,000	5% of Associated Equip.; OAQPS Control Cost Manual
System Integration	$100,000	Engineering Estimate
Firewater Booster Pump	$23,000	Supplier Neutral Estimate
Increase ID Fan Size	$60,000	Supplier Neutral Estimate; Increased size due to pressure drop across SCR System
Total Direct Capital Costs (TDCC)	$6,898,000	
Direct Installation Costs		
Installation	$5,675,000	Supplier Estimate
Foundation and Supports	Included	Included in Supplier Quote for Installation of SCR System
Handling and Erection	Included	Included in Supplier Quote for Installation of SCR System
Electrical	Included	Included in Supplier Quote for Installation of SCR System
Piping	Included	Included in Supplier Quote for Installation of SCR System
Insulation for Ductwork	Included	Included in Supplier Quote for Installation of SCR System
Painting	$30,000	SCR Structural Steel, Piping and Exposed Metals
Site Preparation	$29,000	Existing Roads, Demolition & Restoration, SCR Footprint
Buildings (Process CEM)	$25,000	Engineering Estimate
Concrete	$40,000	Aqueous Ammonia Spill Containment
Miscellaneous Steel	Included	Platforms, Ladders, etc.
SCR Building Enclosure/Struct. Steel	$530,000	Supplier Neutral Estimate; Windload Req. for Hurricanes
Electrical Systems	$56,000	Grounding, Lightning Protection, Lighting, etc.
Instrumentation Systems	$8,000	Systems Monitoring and Control
ID Fan Increase	$60,000	Engineering Estimate; Installation with Dampers
Piping Systems	$166,000	Fire Protection Standpipe/Sprinklers, Service Air, Potable Water, Ammonia, Gas Piping
Total Direct Installation Costs (TDIC)	$6,619,000	
Total Capital Costs (TCC)	$13,517,000	Sum of TDCC and TDIC
Indirect Costs		
Vendor Engineering and Related Costs	$1,081,360	8% of TCC
Construction and Field Expenses	Included	Included in Supplier Quote for SCR System
Vendor Fees	$675,850	5% of TCC
Project Management & Oversight	Included	Included in Vendor Engineering and Related Costs
Start-Up	$270,340	2% of TCC; OAQPS Control Cost Manual, Chapter 3
Performance Tests	$135,170	1% of TCC; OAQPS Control Cost Manual, Chapter 3
Contingencies	$1,351,700	10% of TCC;
Total Indirect Capital Costs (TInCC)	$3,514,420	
Total Direct, Indirect and Capital Costs (TDICC)	$17,031,420	

Estimate of Selective Catalytic Reduction Costs
for Lee County Energy Recovery Facility
With Flue Gas Reheat Using Natural Gas Combustion

Cost Component	Costs	Basis of Cost Component
Direct Annual Costs		
Operations and Maintenance Labor	$56,160	24 hours/week at $45/hour
Ammonia to control 260 ppm inlet NOx	$53,700	$300 per ton for Ammonia*
Catalyst Disposal Costs	$15,000	Engineering Estimate
Catalyst Cost	$90,000	1/3 Catalyst-3 year catalyst life
Regulatory Compliance Costs	$25,000	Engineering Estimate
Spare Parts Inventory Replacement	$94,500	1.5% of SCR Associated Equipment
Total Direct Annual Costs (TDAC)	$334,360	
Annual Energy Costs		
Annual Electrical Energy Usage	$2,847	6.5 kW X 8,760 hours per year at $0.05 per kWh
Annual Additional ID Fan Power	$130,962	299 kW X 8,760 hours per year at $0.05 per kWh
Annual Natural Gas Usage	$1,280,080	256,016 Mcf at $5.00 per 1000 cf of Natural Gas Based on Supplier Est.; Adjusted for Temp
Total Energy Costs (TEC)	$1,413,889	
Indirect Annual Costs		
Management/Overhead	$33,696	60% of Operations and Maintenance Labor
Insurance	$135,170	1% of Total Capital Costs
Miscellaneous Painting	$10,000	Supplier Neutral Estimate
Miscellaneous Equipment Rebuild	$70,875	Supplier Neutral Estimate; 75% of Spare Parts Above
Annualized Total Direct Capital	$1,607,766	0.0944 Capital Recovery Factor of 7% over 20 years multiplied by sum of TDICC
Total Indirect Annual Costs (TIAC)	$1,857,507	
Total Annualized Costs	$3,605,756	Sum of TDAC, TEC and TIAC (for 260 ppm)
Cost Effectiveness of SCR System		Cost Per Ton NOx Removed
	$11,979	301 Tons NOx Removed (260 ppm inlet; 100 ppm outlet; 62% Removal)

Note: 'Included' denotes item is assumed to be included in supplier budgetary estimate for SCR Associated Equipment and Installation. [See letter from Dennis Malone (Babcock Borsig Power) to Michael Hober (RTP Environmental) dated October 19, 2001, October 29, 2001, and December 4, 2001]

The above cost does not include revenue lost due to additional or unscheduled system shutdown. Based on a cost of $56 per ton of waste at 600 tons of waste per day and over an annual shutdown of 10 days, this cost is estimated to be approximately $336,000 due to lost tipping fees. In addition to this, the amount of revenue lost due to not producing steam during these 10 days is estimated to be approximately $177,000; bringing the Total Annualized costs and cost effectiveness (respectively) to:

Total Annualized Costs $4,061,390 *Cost per ton NOx removed* $13,493

This cost does not include costs for the electrical needs of the system (305.5kW over 240 hours at $0.05/kWh) and ammonia usage because system will not operate.

* Note: Ammonia usage is based on information provided by Covanta and ratioed based on 100% availability of Unit 3.

Estimate of Selective Catalytic Reduction Costs
for Lee County Energy Recovery Facility
With Flue Gas Reheat Using Natural Gas Combustion

Cost Component	Costs	Basis of Cost Component
Direct Capital Costs		
SCR Associated Equipment	$8,800,000	Supplier Estimate
Ammonia Storage Tanks	Included	Ammonia Storage
Import Duty	$110,000	5% of Estimated 25% Import Value
Flue Gas Ductwork	$100,000	Engineering Estimate
Instrumentation	Included	In-situ NOx Analyzer
Freight	Included	Included in Supplier Quote for Capital Equipment
System Integration	$100,000	Engineering Estimate
Firewater Booster Pump	$23,000	Supplier Neutral Estimate
Increase ID Fan Size	$60,000	Supplier Neutral Estimate; Increased size due to pressure drop across SCR System
Total Direct Capital Costs (TDCC)	$9,193,000	
Direct Installation Costs		
Installation	Included	Included in Supplier Quote for Installation of SCR System
Foundation and Supports	Included	Included in Supplier Quote for Installation of SCR System
Handling and Erection	Included	Included in Supplier Quote for Installation of SCR System
Electrical	Included	Included in Supplier Quote for Installation of SCR System
Piping	Included	Included in Supplier Quote for Installation of SCR System
Insulation for Ductwork	Included	Included in Supplier Quote for Installation of SCR System
Painting	Included	Included in Supplier Quote for Installation of SCR System
Site Preparation	$29,000	Existing Roads, Demolition & Restoration, SCR Footprint
Buildings (Process CEM)	$25,000	*Engineering Estimate*
Concrete	$40,000	Aqueous Ammonia Spill Containment
Miscellaneous Steel	$11,000	Platforms, Ladders, etc.
SCR Building Enclosure/Struct. Steel	$530,000	Supplier Neutral Estimate; Windload Req. for Hurricanes
Electrical Systems	$56,000	Grounding, Lightning Protection, Lighting, etc.
Instrumentation Systems	$8,000	Systems Monitoring and Control
ID Fan Increase	$60,000	Engineering Estimate; Installation with Dampers
Piping Systems	$166,000	Fire Protection Standpipe/Sprinklers, Service Air, Potable Water, Ammonia, Gas Piping
Total Direct Installation Costs (TDIC)	$925,000	
Total Capital Costs (TCC)	$10,118,000	Sum of TDCC and TDIC
Indirect Costs		
Vendor Engineering and Related Costs	$809,440	8% of TCC
Construction and Field Expenses	Included	Included in Supplier Quote for SCR System
Vendor Fees	$505,900	5% of TCC
Project Management & Oversight	Included	Included in Vendor Engineering and Related Costs
Start-Up	$202,360	2% of TCC; OAQPS Control Cost Manual, Chapter 3
Performance Tests	$101,180	1% of TCC; OAQPS Control Cost Manual, Chapter 3
Contingencies	$1,011,800	10% of TCC;
Total Indirect Capital Costs (TInCC)	$2,630,680	
Total Direct, Indirect and Capital Costs (TDICC)	$12,748,680	

Estimate of Selective Catalytic Reduction Costs
for Lee County Energy Recovery Facility
With Flue Gas Reheat Using Natural Gas Combustion

Cost Component	Costs	Basis of Cost Component
Direct Annual Costs		
Operations and Maintenance Labor	$56,160	24 hours/week at $45/hour
Ammonia to control 260 ppm inlet NOx	$53,700	$300 per ton for Ammonia*
Catalyst Disposal Costs	$15,000	Engineering Estimate
Catalyst Cost	$350,000	1/2 Catalyst-2 year catalyst life
Regulatory Compliance Costs	$25,000	Engineering Estimate
Spare Parts Inventory Replacement	$132,000	1.5% of SCR Associated Equipment
Total Direct Annual Costs (TDAC)	$631,860	
Annual Energy Costs		
Annual Electrical Energy Usage (Including 250 kW for ID Fan)	$140,160	320 kW X 8,760 hours per year at $0.05 per kWh
Annual Natural Gas Usage	$305,408	Based on Supplier Estimate (Based on 8,760 hr/yr)
Total Energy Costs (TEC)	$445,568	
Indirect Annual Costs		
Management/Overhead	$33,696	60% of Operations and Maintenance Labor
Insurance	$101,180	1% of Total Capital Costs
Miscellaneous Painting	$10,000	Supplier Neutral Estimate
Miscellaneous Equipment Rebuild	$99,000	Supplier Neutral Estimate; 75% of Spare Parts Above
Annualized Total Direct Capital	$2,074,210	0.1627 Capital Recovery Factor of 10% over 10 years multiplied by sum of TDICC
Total Indirect Annual Costs (TIAC)	$2,318,086	
Total Annualized Costs	$3,395,514	Sum of TDAC, TEC and TIAC (for 260 ppm)
Cost Effectiveness of SCR System		Cost Per Ton NOx Removed
	$11,281	301 Tons NOx Removed (260 ppm inlet; 100 ppm outlet; 62% Removal)

Note: 'Included' denotes item is assumed to be included in supplier budgetary estimate for SCR Associated Equipment and Installation. [See email from Dirk Eeraerts (SEGHER's Better Technology) to Scott Heath (RTP Environmental) dated December 21, 2001]

The above cost does not include revenue lost due to additional or unscheduled system shutdown. Based on a cost of $56 per ton of waste at 600 tons of waste per day and over an annual shutdown of 10 days, this cost is estimated to be approximately $336,000 due to lost tipping fees. In addition to this, the amount of revenue lost due to not producing steam during these 10 days is estimated to be approximately $177,000; bringing the Total Annualized costs and cost effectiveness (respectively) to:

Total Annualized Costs $3,850,896 Cost per ton NOx removed $12,794

This cost does not include costs for the electrical needs of the system (326.5kW over 240 hours at $0.05/kWh) and ammonia usage because system will not operate.

* Note: Ammonia usage is based on information provided by Covanta and ratioed based on 100% availability of Unit 3.

Estimate of Selective Catalytic Reduction Costs
for Lee County Energy Recovery Facility
With Flue Gas Reheat Using Natural Gas Combustion

Cost Component	Costs	Basis of Cost Component
Direct Capital Costs		
SCR Associated Equipment	$8,800,000	Supplier Estimate
Ammonia Storage Tanks	Included	Ammonia Storage
Import Duty	$110,000	5% of Estimated 25% Import Value
Flue Gas Ductwork	$100,000	Engineering Estimate
Instrumentation	Included	In-situ NOx Analyzer
Freight	Included	Included in Supplier Quote for Capital Equipment
System Integration	$100,000	Engineering Estimate
Firewater Booster Pump	$23,000	Supplier Neutral Estimate
Increase ID Fan Size	$60,000	Supplier Neutral Estimate; Increased size due to pressure drop across SCR System
Total Direct Capital Costs (TDCC)	$9,193,000	
Direct Installation Costs		
Installation	Included	Included in Supplier Quote for Installation of SCR System
Foundation and Supports	Included	Included in Supplier Quote for Installation of SCR System
Handling and Erection	Included	Included in Supplier Quote for Installation of SCR System
Electrical	Included	Included in Supplier Quote for Installation of SCR System
Piping	Included	Included in Supplier Quote for Installation of SCR System
Insulation for Ductwork	Included	Included in Supplier Quote for Installation of SCR System
Painting	Included	Included in Supplier Quote for Installation of SCR System
Site Preparation	$29,000	Existing Roads, Demolition & Restoration, SCR Footprint
Buildings (Process CEM)	$25,000	Engineering Estimate
Concrete	$40,000	Aqueous Ammonia Spill Containment
Miscellaneous Steel	$11,000	Platforms, Ladders, etc.
SCR Building Enclosure/Struct. Steel	$530,000	Supplier Neutral Estimate; Windload Req. for Hurricanes
Electrical Systems	$56,000	Grounding, Lightning Protection, Lighting, etc.
Instrumentation Systems	$8,000	Systems Monitoring and Control
ID Fan Increase	$60,000	Engineering Estimate; Installation with Dampers
Piping Systems	$166,000	Fire Protection Standpipe/Sprinklers, Service Air, Potable Water, Ammonia, Gas Piping
Total Direct Installation Costs (TDIC)	$925,000	
Total Capital Costs (TCC)	$10,118,000	Sum of TDCC and TDIC
Indirect Costs		
Vendor Engineering and Related Costs	$809,440	8% of TCC
Construction and Field Expenses	Included	Included in Supplier Quote for SCR System
Vendor Fees	$505,900	5% of TCC
Project Management & Oversight	Included	Included in Vendor Engineering and Related Costs
Start-Up	$202,360	2% of TCC; OAQPS Control Cost Manual, Chapter 3
Performance Tests	$101,180	1% of TCC; OAQPS Control Cost Manual, Chapter 3
Contingencies	$1,011,800	10% of TCC;
Total Indirect Capital Costs (TInCC)	$2,630,680	
Total Direct, Indirect and Capital Costs (TDICC)	$12,748,680	

Estimate of Selective Catalytic Reduction Costs
for Lee County Energy Recovery Facility
With Flue Gas Reheat Using Natural Gas Combustion

Cost Component	Costs	Basis of Cost Component
Direct Annual Costs		
Operations and Maintenance Labor	$56,160	24 hours/week at $45/hour
Ammonia to control 260 ppm inlet NOx	$53,700	$300 per ton for Ammonia*
Catalyst Disposal Costs	$15,000	Engineering Estimate
Catalyst Cost	$350,000	1/2 Catalyst-2 year catalyst life
Regulatory Compliance Costs	$25,000	Engineering Estimate
Spare Parts Inventory Replacement	$132,000	1.5% of SCR Associated Equipment
Total Direct Annual Costs (TDAC)	$631,860	
Annual Energy Costs		
Annual Electrical Energy Usage (Including 250 kW for ID Fan)	$140,160	320 kW X 8,760 hours per year at $0.05 per kWh
Annual Natural Gas Usage	$305,408	Based on Supplier Estimate (Based on 8,760 hr/yr)
Total Energy Costs (TEC)	$445,568	
Indirect Annual Costs		
Management/Overhead	$33,696	60% of Operations and Maintenance Labor
Insurance	$101,180	1% of Total Capital Costs
Miscellaneous Painting	$10,000	Supplier Neutral Estimate
Miscellaneous Equipment Rebuild	$99,000	Supplier Neutral Estimate; 75% of Spare Parts Above
Annualized Total Direct Capital	$1,676,451	0.1315 Capital Recovery Factor of 10% over 15 years multiplied by sum of TDICC
Total Indirect Annual Costs (TIAC)	$1,920,327	
Total Annualized Costs	$2,997,755	*Sum of* TDAC, TEC and TIAC (for 260 ppm)
Cost Effectiveness of SCR System		Cost Per Ton NOx Removed
	$9,959	301 Tons NOx Removed (260 ppm inlet; 100 ppm outlet; 62% Removal)

Note: 'Included' denotes item is assumed to be included in supplier budgetary estimate for SCR Associated Equipment and Installation. [See email from Dirk Eeraerts (SEGHER's Better Technology) to Scott Heath (RTP Environmental) dated December 21, 2001]

The above cost does not include revenue lost due to additional or unscheduled system shutdown. Based on a cost of $56 per ton of waste at 600 tons of waste per day and over an annual shutdown of 10 days, this cost is estimated to be approximately $336,000 due to lost tipping fees. In addition to this, the amount of revenue lost due to not producing steam during these 10 days is estimated to be approximately $177,000; bringing the *Total Annualized costs and cost effectiveness* (respectively) to:

Total Annualized Costs $3,453,137 Cost per ton NOx removed $11,472

This cost does not include costs for the electrical needs of the system (326.5kW over 240 hours at $0.05/kWh) and ammonia usage because system will not operate.

* Note: Ammonia usage is based on information provided by Covanta and ratioed based on 100% availability of Unit 3.

Estimate of Selective Catalytic Reduction Costs
for Lee County Energy Recovery Facility
With Flue Gas Reheat Using Natural Gas Combustion

Cost Component	Costs	Basis of Cost Component
Direct Capital Costs		
SCR Associated Equipment	$8,800,000	Supplier Estimate
Ammonia Storage Tanks	Included	Ammonia Storage
Import Duty	$110,000	5% of Estimated 25% Import Value
Flue Gas Ductwork	$100,000	Engineering Estimate
Instrumentation	Included	In-situ NOx Analyzer
Freight	Included	Included in Supplier Quote for Capital Equipment
System Integration	$100,000	Engineering Estimate
Firewater Booster Pump	$23,000	Supplier Neutral Estimate
Increase ID Fan Size	$60,000	Supplier Neutral Estimate; Increased size due to pressure drop across SCR System
Total Direct Capital Costs (TDCC)	$9,193,000	
Direct Installation Costs		
Installation	Included	Included in Supplier Quote for Installation of SCR System
Foundation and Supports	Included	Included in Supplier Quote for Installation of SCR System
Handling and Erection	Included	Included in Supplier Quote for Installation of SCR System
Electrical	Included	Included in Supplier Quote for Installation of SCR System
Piping	Included	Included in Supplier Quote for Installation of SCR System
Insulation for Ductwork	Included	Included in Supplier Quote for Installation of SCR System
Painting	Included	Included in Supplier Quote for Installation of SCR System
Site Preparation	$29,000	Existing Roads, Demolition & Restoration, SCR Footprint
Buildings (Process CEM)	$25,000	Engineering Estimate
Concrete	$40,000	Aqueous Ammonia Spill Containment
Miscellaneous Steel	$11,000	Platforms, Ladders, etc.
SCR Building Enclosure/Struct. Steel	$530,000	Supplier Neutral Estimate; Windload Req. for Hurricanes
Electrical Systems	$56,000	Grounding, Lightning Protection, Lighting, etc.
Instrumentation Systems	$8,000	Systems Monitoring and Control
ID Fan Increase	$60,000	Engineering Estimate; Installation with Dampers
Piping Systems	$166,000	Fire Protection Standpipe/Sprinklers, Service Air, Potable Water, Ammonia, Gas Piping
Total Direct Installation Costs (TDIC)	$925,000	
Total Capital Costs (TCC)	$10,118,000	Sum of TDCC and TDIC
Indirect Costs		
Vendor Engineering and Related Costs	$809,440	8% of TCC
Construction and Field Expenses	Included	Included in Supplier Quote for SCR System
Vendor Fees	$505,900	5% of TCC
Project Management & Oversight	Included	Included in Vendor Engineering and Related Costs
Start-Up	$202,360	2% of TCC; OAQPS Control Cost Manual, Chapter 3
Performance Tests	$101,180	1% of TCC; OAQPS Control Cost Manual, Chapter 3
Contingencies	$1,011,800	10% of TCC;
Total Indirect Capital Costs (TInCC)	$2,630,680	
Total Direct, Indirect and Capital Costs (TDICC)	$12,748,680	

Estimate of Selective Catalytic Reduction Costs
for Lee County Energy Recovery Facility
With Flue Gas Reheat Using Natural Gas Combustion

Cost Component	Costs	Basis of Cost Component
Direct Annual Costs		
Operations and Maintenance Labor	$56,160	24 hours/week at $45/hour
Ammonia to control 260 ppm inlet NOx	$53,700	$300 per ton for Ammonia*
Catalyst Disposal Costs	$15,000	Engineering Estimate
Catalyst Cost	$350,000	1/2 Catalyst-2 year catalyst life
Regulatory Compliance Costs	$25,000	Engineering Estimate
Spare Parts Inventory Replacement	$132,000	1.5% of SCR Associated Equipment
Total Direct Annual Costs (TDAC)	$631,860	
Annual Energy Costs		
Annual Electrical Energy Usage (Including 250 kW for ID Fan)	$140,160	320 kW X 8,760 hours per year at $0.05 per kWh
Annual Natural Gas Usage	$305,408	Based on Supplier Estimate (Based on 8,760 hr/yr)
Total Energy Costs (TEC)	$445,568	
Indirect Annual Costs		
Management/Overhead	$33,696	60% of Operations and Maintenance Labor
Insurance	$101,180	1% of Total Capital Costs
Miscellaneous Painting	$10,000	Supplier Neutral Estimate
Miscellaneous Equipment Rebuild	$99,000	Supplier Neutral Estimate; 75% of Spare Parts Above
Annualized Total Direct Capital	$1,815,412	0.1424 Capital Recovery Factor of 7% over 10 years multiplied by sum of TDICC
Total Indirect Annual Costs (TIAC)	$2,059,288	
Total Annualized Costs	$3,136,716	Sum of TDAC, TEC and TIAC (for 260 ppm)
Cost Effectiveness of SCR System		Cost Per Ton NOx Removed
	$10,421	301 Tons NOx Removed (260 ppm inlet; 100 ppm outlet; 62% Removal)

Note: 'Included' denotes item is assumed to be included in supplier budgetary estimate for SCR Associated Equipment and Installation. [See email from Dirk Eeraerts (SEGHER's Better Technology) to Scott Heath (RTP Environmental) dated December 21, 2001]

The above cost does not include revenue lost due to additional or unscheduled system shutdown. Based on a cost of $56 per ton of waste at 600 tons of waste per day and over an annual shutdown of 10 days, this cost is estimated to be approximately $336,000 due to lost tipping fees. In addition to this, the amount of revenue lost due to not producing steam during these 10 days is estimated to be approximately $177,000; bringing the Total Annualized costs and cost effectiveness (respectively) to:

Total Annualized Costs $3,592,098 Cost per ton NOx removed $11,934

This cost does not include costs for the electrical needs of the system (326.5kW over 240 hours at $0.05/kWh) and ammonia usage because system will not operate.

* Note: Ammonia usage is based on information provided by Covanta and ratioed based on 100% availability of Unit 3.

Estimate of Selective Catalytic Reduction Costs
for Lee County Energy Recovery Facility
With Flue Gas Reheat Using Natural Gas Combustion

Cost Component	Costs	Basis of Cost Component
Direct Capital Costs		
SCR Associated Equipment	$8,800,000	Supplier Estimate
Ammonia Storage Tanks	Included	Ammonia Storage
Import Duty	$110,000	5% of Estimated 25% Import Value
Flue Gas Ductwork	$100,000	Engineering Estimate
Instrumentation	Included	In-situ NOx Analyzer
Freight	Included	Included in Supplier Quote for Capital Equipment
System Integration	$100,000	Engineering Estimate
Firewater Booster Pump	$23,000	Supplier Neutral Estimate
Increase ID Fan Size	$60,000	Supplier Neutral Estimate; Increased size due to pressure drop across SCR System
Total Direct Capital Costs (TDCC)	$9,193,000	
Direct Installation Costs		
Installation	Included	Included in Supplier Quote for Installation of SCR System
Foundation and Supports	Included	Included in Supplier Quote for Installation of SCR System
Handling and Erection	Included	Included in Supplier Quote for Installation of SCR System
Electrical	Included	Included in Supplier Quote for Installation of SCR System
Piping	Included	Included in Supplier Quote for Installation of SCR System
Insulation for Ductwork	Included	Included in Supplier Quote for Installation of SCR System
Painting	Included	Included in Supplier Quote for Installation of SCR System
Site Preparation	$29,000	Existing Roads, Demolition & Restoration, SCR Footprint
Buildings (Process CEM)	$25,000	Engineering Estimate
Concrete	$40,000	Aqueous Ammonia Spill Containment
Miscellaneous Steel	$11,000	Platforms, Ladders, etc.
SCR Building Enclosure/Struct. Steel	$530,000	Supplier Neutral Estimate; Windload Req. for Hurricanes
Electrical Systems	$56,000	Grounding, Lightning Protection, Lighting, etc.
Instrumentation Systems	$8,000	Systems Monitoring and Control
ID Fan Increase	$60,000	Engineering Estimate; Installation with Dampers
Piping Systems	$166,000	Fire Protection Standpipe/Sprinklers, Service Air, Potable Water, Ammonia, Gas Piping
Total Direct Installation Costs (TDIC)	$925,000	
Total Capital Costs (TCC)	$10,118,000	Sum of TDCC and TDIC
Indirect Costs		
Vendor Engineering and Related Costs	$809,440	8% of TCC
Construction and Field Expenses	Included	Included in Supplier Quote for SCR System
Vendor Fees	$505,900	5% of TCC
Project Management & Oversight	Included	Included in Vendor Engineering and Related Costs
Start-Up	$202,360	2% of TCC; OAQPS Control Cost Manual, Chapter 3
Performance Tests	$101,180	1% of TCC; OAQPS Control Cost Manual, Chapter 3
Contingencies	$1,011,800	10% of TCC;
Total Indirect Capital Costs (TInCC)	$2,630,680	
Total Direct, Indirect and Capital Costs (TDICC)	$12,748,680	

Estimate of Selective Catalytic Reduction Costs
for Lee County Energy Recovery Facility
With Flue Gas Reheat Using Natural Gas Combustion

Cost Component	Costs	Basis of Cost Component
Direct Annual Costs		
Operations and Maintenance Labor	$56,160	24 hours/week at $45/hour
Ammonia to control 260 ppm inlet NOx	$53,700	$300 per ton for Ammonia*
Catalyst Disposal Costs	$15,000	Engineering Estimate
Catalyst Cost	$350,000	1/2 Catalyst-2 year catalyst life
Regulatory Compliance Costs	$25,000	Engineering Estimate
Spare Parts Inventory Replacement	$132,000	1.5% of SCR Associated Equipment
Total Direct Annual Costs (TDAC)	$631,860	
Annual Energy Costs		
Annual Electrical Energy Usage (Including 250 kW for ID Fan)	$140,160	320 kW X 8,760 hours per year at $0.05 per kWh
Annual Natural Gas Usage	$305,408	Based on Supplier Estimate (Based on 8,760 hr/yr)
Total Energy Costs (TEC)	$445,568	
Indirect Annual Costs		
Management/Overhead	$33,696	60% of Operations and Maintenance Labor
Insurance	$101,180	1% of Total Capital Costs
Miscellaneous Painting	$10,000	Supplier Neutral Estimate
Miscellaneous Equipment Rebuild	$99,000	Supplier Neutral Estimate; 75% of Spare Parts Above
Annualized Total Direct Capital	$1,399,805	0.1098 Capital Recovery Factor of 7% over 15 years multiplied by sum of TDICC
Total Indirect Annual Costs (TIAC)	$1,643,681	
Total Annualized Costs	$2,721,109	Sum of TDAC, TEC and TIAC (for 260 ppm)
Cost Effectiveness of SCR System		Cost Per Ton NOx Removed
	$9,040	301 Tons NOx Removed (260 ppm inlet; 100 ppm outlet; 62% Removal)

Note: 'Included' denotes item is assumed to be included in supplier budgetary estimate for SCR Associated Equipment and Installation. [See email from Dirk Eeraerts (SEGHER's Better Technology) to Scott Heath (RTP Environmental) dated December 21, 2001]

The above cost does not include revenue lost due to additional or unscheduled system shutdown. Based on a cost of $56 per ton of waste at 600 tons of waste per day and over an annual shutdown of 10 days, this cost is estimated to be approximately $336,000 due to lost tipping fees. In addition to this, the amount of revenue lost due to not producing steam during these 10 days is estimated to be approximately $177,000; bringing the *Total Annualized costs and cost effectiveness (respectively) to:*

Total Annualized Costs $3,176,491 Cost per ton NOx removed $10,553

This cost does not include costs for the electrical needs of the system (326.5kW over 240 hours at $0.05/kWh) *and ammonia usage because system will not operate.*

* Note: Ammonia usage is based on information provided by Covanta and ratioed based on 100% availability of Unit 3.

Estimate of Selective Catalytic Reduction Costs
for Lee County Energy Recovery Facility
With Flue Gas Reheat Using Natural Gas Combustion

Cost Component	Costs	Basis of Cost Component
Direct Capital Costs		
SCR Associated Equipment	$8,800,000	Supplier Estimate
Ammonia Storage Tanks	Included	Ammonia Storage
Import Duty	$110,000	5% of Estimated 25% Import Value
Flue Gas Ductwork	$100,000	Engineering Estimate
Instrumentation	Included	In-situ NOx Analyzer
Freight	Included	Included in Supplier Quote for Capital Equipment
System Integration	$100,000	Engineering Estimate
Firewater Booster Pump	$23,000	Supplier Neutral Estimate
Increase ID Fan Size	$60,000	Supplier Neutral Estimate; Increased size due to pressure drop across SCR System
Total Direct Capital Costs (TDCC)	$9,193,000	
Direct Installation Costs		
Installation	Included	Included in Supplier Quote for Installation of SCR System
Foundation and Supports	Included	Included in Supplier Quote for Installation of SCR System
Handling and Erection	Included	Included in Supplier Quote for Installation of SCR System
Electrical	Included	Included in Supplier Quote for Installation of SCR System
Piping	Included	Included in Supplier Quote for Installation of SCR System
Insulation for Ductwork	Included	Included in Supplier Quote for Installation of SCR System
Painting	Included	Included in Supplier Quote for Installation of SCR System
Site Preparation	$29,000	Existing Roads, Demolition & Restoration, SCR Footprint
Buildings (Process CEM)	$25,000	Engineering Estimate
Concrete	$40,000	Aqueous Ammonia Spill Containment
Miscellaneous Steel	$11,000	Platforms, Ladders, etc.
SCR Building Enclosure/Struct. Steel	$530,000	Supplier Neutral Estimate; Windload Req. for Hurricanes
Electrical Systems	$56,000	Grounding, Lightning Protection, Lighting, etc.
Instrumentation Systems	$8,000	Systems Monitoring and Control
ID Fan Increase	$60,000	Engineering Estimate; Installation with Dampers
Piping Systems	$166,000	Fire Protection Standpipe/Sprinklers, Service Air, Potable Water, Ammonia, Gas Piping
Total Direct Installation Costs (TDIC)	$925,000	
Total Capital Costs (TCC)	$10,118,000	Sum of TDCC and TDIC
Indirect Costs		
Vendor Engineering and Related Costs	$809,440	8% of TCC
Construction and Field Expenses	Included	Included in Supplier Quote for SCR System
Vendor Fees	$505,900	5% of TCC
Project Management & Oversight	Included	Included in Vendor Engineering and Related Costs
Start-Up	$202,360	2% of TCC; OAQPS Control Cost Manual, Chapter 3
Performance Tests	$101,180	1% of TCC; OAQPS Control Cost Manual, Chapter 3
Contingencies	$1,011,800	10% of TCC;
Total Indirect Capital Costs (TInCC)	$2,630,680	
Total Direct, Indirect and Capital Costs (TDICC)	$12,748,680	

Estimate of Selective Catalytic Reduction Costs
for Lee County Energy Recovery Facility
With Flue Gas Reheat Using Natural Gas Combustion

Cost Component	Costs	Basis of Cost Component
Direct Annual Costs		
Operations and Maintenance Labor	$56,160	24 hours/week at $45/hour
Ammonia to control 260 ppm inlet NOx	$53,700	$300 per ton for Ammonia*
Catalyst Disposal Costs	$15,000	Engineering Estimate
Catalyst Cost	$350,000	1/2 Catalyst-2 year catalyst life
Regulatory Compliance Costs	$25,000	Engineering Estimate
Spare Parts Inventory Replacement	$132,000	1.5% of SCR Associated Equipment
Total Direct Annual Costs (TDAC)	$631,860	
Annual Energy Costs		
Annual Electrical Energy Usage (Including 250 kW for ID Fan)	$140,160	320 kW X 8,760 hours per year at $0.05 per kWh
Annual Natural Gas Usage	$305,408	Based on Supplier Estimate (Based on 8,760 hr/yr)
Total Energy Costs (TEC)	$445,568	
Indirect Annual Costs		
Management/Overhead	$33,696	60% of Operations and Maintenance Labor
Insurance	$101,180	1% of Total Capital Costs
Miscellaneous Painting	$10,000	Supplier Neutral Estimate
Miscellaneous Equipment Rebuild	$99,000	Supplier Neutral Estimate; 75% of Spare Parts Above
Annualized Total Direct Capital	$1,203,475	0.0944 Capital Recovery Factor of 7% over 20 years multiplied by sum of TDICC
Total Indirect Annual Costs (TIAC)	$1,447,351	
Total Annualized Costs	$2,524,779	Sum of TDAC, TEC and TIAC (for 260 ppm)
Cost Effectiveness of SCR System		Cost Per Ton NOx Removed
	$8,388	301 Tons NOx Removed (260 ppm inlet; 100 ppm outlet; 62% Removal)

Note: 'Included' denotes item is assumed to be included in supplier budgetary estimate for SCR Associated Equipment and Installation. [See email from Dirk Eeraerts (SEGHER's Better Technology) to Scott Heath (RTP Environmental) dated December 21, 2001]

The above cost does not include revenue lost due to additional or unscheduled system shutdown. Based on a cost of $56 per ton of waste at 600 tons of waste per day and over an annual shutdown of 10 days, this cost is estimated to be approximately $336,000 due to lost tipping fees. In addition to this, the amount of revenue lost due to not producing steam during these 10 days is estimated to be approximately $177,000; bringing the Total Annualized costs and cost effectiveness (respectively) to:

Total Annualized Costs $2,980,161 Cost per ton NOx removed $9,901

This cost does not include costs for the electrical needs of the system (326.5kW over 240 hours at $0.05/kWh) and ammonia usage because system will not operate.

* Note: Ammonia usage is based on information provided by Covanta and ratioed based on 100% availability of Unit 3.

Estimate of Selective Non-Catalytic Reduction Costs
for Lee County Energy Recovery Facility
Aqueous Ammonia SNCR System

Cost Component	Costs	Basis of Cost Component
Direct Capital Costs		
SNCR Associated Equipment	$655,400	Engineering Estimate
Ammonia Storage Tank	Included	Ammonia Storage
Pumps and Blowers	Included	Engineering Estimate
Electrical & Instrumentation	Included	Engineering Estimate
Freight	Included	Included in Vendor Quote for Capital Equipment
System Integration	$50,000	Engineering Estimate
Total Direct Capital Costs (TDCC)	$705,400	
Direct Installation Costs		
Installation	$582,230	Engineering Estimate
Foundation and Supports	Included	Included in Eng. Est. for Installation of SNCR System
Handling and Erection	Included	Included in Eng. Est. for Installation of SNCR System
Electrical	Included	Included in Eng. Est. for Installation of SNCR System
Piping	Included	Included in Eng. Est. for Installation of SNCR System
Insulation for Ductwork	Included	Included in Eng. Est. for Installation of SNCR System
Painting	Included	Included in Eng. Est. for Installation of SNCR System
Site Preparation	$16,300	Existing Roads, Demolition & Restoration
Total Direct Installation Costs (TDIC)	$598,530	
Total Capital Costs (TCC)	$1,303,930	Sum of TDCC and TDIC
Indirect Costs		
Vendor Engineering and Related Costs	$104,314	8% of TCC
Construction and Field Expenses	Included	Included in Engineering Estimate of SNCR System
Vendor Fees	$65,197	5% of TCC
Project Management & Oversight	Included	Included in Vendor Engineering and Related Costs
Start-Up	$114,800	Vendor Neutral Estimate
Performance Tests	Included	Included in Engineering Estimate of SNCR System
Contingencies	$130,393	10% of TCC;
Total Indirect Capital Costs (TInCC)	$414,704	
Total Direct, Indirect and Capital Costs (TDICC)	$1,718,634	

Estimate of Selective Non-Catalytic Reduction Costs
for Lee County Energy Recovery Facility
Aqueous Ammonia SNCR System

Cost Component	Costs	Basis of Cost Component
Direct Annual Costs		
Operations and Maintenance Labor	$54,000	1200 Man hours per year @ $45/hour
Ammonia to control NOx to 150 ppm	$53,700	$300 per ton for Ammonia*
Regulatory Compliance Costs	$25,000	Engineering Estimate
Spare Parts Inventory Replacement	$9,831	1.5% of SCR Associated Equipment
Total Direct Annual Costs (TDAC)	$142,531	
Annual Energy Costs		
Annual Electrical Energy Usage	$3,066	7 kW X 8,760 hours per year at $0.05 per kWh at 100% System Availability
Total Energy Costs (TEC)	$3,066	
Indirect Annual Costs		
Management/Overhead	$32,400	60% of Operations and Maintenance Labor
Administration	$34,373	2% of TDICC
Insurance	$17,186	1% of TDICC
Miscellaneous Painting	$3,000	Vendor Neutral Estimate
Miscellaneous Equipment Rebuild	$7,373	Vendor Neutral Estimate; 75% of Spare Parts Above
Lost Power	$13,140	Eng. Est. (30kW X 8,760 hours/year X $0.05/kWh)
Annualized Total Direct Capital	$279,622	0.1627 Capital Recovery Factor of 10% over 10 years multiplied by sum of TDICC
Total Indirect Annual Costs (TIAC)	$387,094	
Total Annualized Costs	$532,691	Sum of TDAC, TEC and TIAC (for 260 ppm)
Cost Effectiveness of SNCR System		Cost Per Ton NOx Removed
	$2,586	206 Tons NOx Removed (260 ppm inlet; 150 ppm outlet; 42% Removal)

* Note: Ammonia usage is based on information provided by Covanta and ratioed based on 100% availability of Unit 3.

Estimate of Selective Non-Catalytic Reduction Costs
for Lee County Energy Recovery Facility
Aqueous Ammonia SNCR System

Cost Component	Costs	Basis of Cost Component
Direct Capital Costs		
SNCR Associated Equipment	$655,400	Engineering Estimate
Ammonia Storage Tank	Included	Ammonia Storage
Pumps and Blowers	Included	Engineering Estimate
Electrical & Instrumentation	Included	Engineering Estimate
Freight	Included	Included in Vendor Quote for Capital Equipment
System Integration	$50,000	Engineering Estimate
Total Direct Capital Costs (TDCC)	$705,400	
Direct Installation Costs		
Installation	$582,230	Engineering Estimate
Foundation and Supports	Included	Included in Eng. Est. for Installation of SNCR System
Handling and Erection	Included	Included in Eng. Est. for Installation of SNCR System
Electrical	Included	Included in Eng. Est. for Installation of SNCR System
Piping	Included	Included in Eng. Est. for Installation of SNCR System
Insulation for Ductwork	Included	Included in Eng. Est. for Installation of SNCR System
Painting	Included	Included in Eng. Est. for Installation of SNCR System
Site Preparation	$16,300	Existing Roads, Demolition & Restoration
Total Direct Installation Costs (TDIC)	$598,530	
Total Capital Costs (TCC)	$1,303,930	Sum of TDCC and TDIC
Indirect Costs		
Vendor Engineering and Related Costs	$104,314	8% of TCC
Construction and Field Expenses	Included	Included in Engineering Estimate of SNCR System
Vendor Fees	$65,197	5% of TCC
Project Management & Oversight	Included	Included in Vendor Engineering and Related Costs
Start-Up	$114,800	Vendor Neutral Estimate
Performance Tests	Included	Included in Engineering Estimate of SNCR System
Contingencies	$130,393	10% of TCC;
Total Indirect Capital Costs (TInCC)	$414,704	
Total Direct, Indirect and Capital Costs (TDICC)	$1,718,634	

Estimate of Selective Non-Catalytic Reduction Costs
for Lee County Energy Recovery Facility
Aqueous Ammonia SNCR System

Cost Component	Costs	Basis of Cost Component
Direct Annual Costs		
Operations and Maintenance Labor	$54,000	1200 Man hours per year @ $45/hour
Ammonia to control NOx to 150 ppm	$53,700	$300 per ton for Ammonia*
Regulatory Compliance Costs	$25,000	Engineering Estimate
Spare Parts Inventory Replacement	$9,831	1.5% of SCR Associated Equipment
Total Direct Annual Costs (TDAC)	$142,531	
Annual Energy Costs		
Annual Electrical Energy Usage	$3,066	7 kW X 8,760 hours per year at $0.05 per kWh at 100% System Availability
Total Energy Costs (TEC)	$3,066	
Indirect Annual Costs		
Management/Overhead	$32,400	60% of Operations and Maintenance Labor
Administration	$34,373	2% of TDICC
Insurance	$17,186	1% of TDICC
Miscellaneous Painting	$3,000	Vendor Neutral Estimate
Miscellaneous Equipment Rebuild	$7,373	Vendor Neutral Estimate; 75% of Spare Parts Above
Lost Power	$13,140	Eng. Est. (30kW X 8,760 hours/year X $0.05/kWh)
Annualized Total Direct Capital	$226,000	0.1315 Capital Recovery Factor of 10% over 15 years multiplied by sum of TDICC
Total Indirect Annual Costs (TIAC)	$333,473	
Total Annualized Costs	$479,070	Sum of TDAC, TEC and TIAC (for 260 ppm)
Cost Effectiveness of SNCR System	$2,326	Cost Per Ton NOx Removed 206 Tons NOx Removed (260 ppm inlet; 150 ppm outlet; 42% Removal)

* Note: Ammonia usage is based on information provided by Covanta and ratioed based on 100% availability of Unit 3.

Estimate of Selective Non-Catalytic Reduction Costs
for Lee County Energy Recovery Facility
Aqueous Ammonia SNCR System

Cost Component	Costs	Basis of Cost Component
Direct Capital Costs		
SNCR Associated Equipment	$655,400	Engineering Estimate
Ammonia Storage Tank	Included	Ammonia Storage
Pumps and Blowers	Included	Engineering Estimate
Electrical & Instrumentation	Included	Engineering Estimate
Freight	Included	Included in Vendor Quote for Capital Equipment
System Integration	$50,000	Engineering Estimate
Total Direct Capital Costs (TDCC)	$705,400	
Direct Installation Costs		
Installation	$582,230	Engineering Estimate
Foundation and Supports	Included	Included in Eng. Est. for Installation of SNCR System
Handling and Erection	Included	Included in Eng. Est. for Installation of SNCR System
Electrical	Included	Included in Eng. Est. for Installation of SNCR System
Piping	Included	Included in Eng. Est. for Installation of SNCR System
Insulation for Ductwork	Included	Included in Eng. Est. for Installation of SNCR System
Painting	Included	Included in Eng. Est. for Installation of SNCR System
Site Preparation	$16,300	Existing Roads, Demolition & Restoration
Total Direct Installation Costs (TDIC)	$598,530	
Total Capital Costs (TCC)	$1,303,930	Sum of TDCC and TDIC
Indirect Costs		
Vendor Engineering and Related Costs	$104,314	8% of TCC
Construction and Field Expenses	Included	Included in Engineering Estimate of SNCR System
Vendor Fees	$65,197	5% of TCC
Project Management & Oversight	Included	Included in Vendor Engineering and Related Costs
Start-Up	$114,800	Vendor Neutral Estimate
Performance Tests	Included	Included in Engineering Estimate of SNCR System
Contingencies	$130,393	10% of TCC;
Total Indirect Capital Costs (TInCC)	$414,704	
Total Direct, Indirect and Capital Costs (TDICC)	$1,718,634	

Estimate of Selective Non-Catalytic Reduction Costs
for Lee County Energy Recovery Facility
Aqueous Ammonia SNCR System

Cost Component	Costs	Basis of Cost Component
Direct Annual Costs		
Operations and Maintenance Labor	$54,000	1200 Man hours per year @ $45/hour
Ammonia to control NOx to 150 ppm	$53,700	$300 per ton for Ammonia*
Regulatory Compliance Costs	$25,000	Engineering Estimate
Spare Parts Inventory Replacement	$9,831	1.5% of SCR Associated Equipment
Total Direct Annual Costs (TDAC)	$142,531	
Annual Energy Costs		
Annual Electrical Energy Usage	$3,066	7 kW X 8,760 hours per year at $0.05 per kWh at 100% System Availability
Total Energy Costs (TEC)	$3,066	
Indirect Annual Costs		
Management/Overhead	$32,400	60% of Operations and Maintenance Labor
Administration	$34,373	2% of TDICC
Insurance	$17,186	1% of TDICC
Miscellaneous Painting	$3,000	Vendor Neutral Estimate
Miscellaneous Equipment Rebuild	$7,373	Vendor Neutral Estimate; 75% of Spare Parts Above
Lost Power	$13,140	Eng. Est. (30kW X 8,760 hours/year X $0.05/kWh)
Annualized Total Direct Capital	$244,733	0.1424 Capital Recovery Factor of 7% over 10 years multiplied by sum of TDICC
Total Indirect Annual Costs (TIAC)	$352,206	
Total Annualized Costs	$497,803	Sum of TDAC, TEC and TIAC (for 260 ppm)
Cost Effectiveness of SNCR System		Cost Per Ton NOx Removed
	$2,417	206 Tons NOx Removed (260 ppm inlet; 150 ppm outlet; 42% Removal)

* Note: Ammonia usage is based on information provided by Covanta and ratioed based on 100% availability of Unit 3.

Estimate of Selective Non-Catalytic Reduction Costs
for Lee County Energy Recovery Facility
Aqueous Ammonia SNCR System

Cost Component	Costs	Basis of Cost Component
Direct Capital Costs		
SNCR Associated Equipment	$655,400	Engineering Estimate
Ammonia Storage Tank	Included	Ammonia Storage
Pumps and Blowers	Included	Engineering Estimate
Electrical & Instrumentation	Included	Engineering Estimate
Freight	Included	Included in Vendor Quote for Capital Equipment
System Integration	$50,000	Engineering Estimate
Total Direct Capital Costs (TDCC)	$705,400	
Direct Installation Costs		
Installation	$582,230	Engineering Estimate
Foundation and Supports	Included	Included in Eng. Est. for Installation of SNCR System
Handling and Erection	Included	Included in Eng. Est. for Installation of SNCR System
Electrical	Included	Included in Eng. Est. for Installation of SNCR System
Piping	Included	Included in Eng. Est. for Installation of SNCR System
Insulation for Ductwork	Included	Included in Eng. Est. for Installation of SNCR System
Painting	Included	Included in Eng. Est. for Installation of SNCR System
Site Preparation	$16,300	Existing Roads, Demolition & Restoration
Total Direct Installation Costs (TDIC)	$598,530	
Total Capital Costs (TCC)	$1,303,930	Sum of TDCC and TDIC
Indirect Costs		
Vendor Engineering and Related Costs	$104,314	8% of TCC
Construction and Field Expenses	Included	Included in Engineering Estimate of SNCR System
Vendor Fees	$65,197	5% of TCC
Project Management & Oversight	Included	Included in Vendor Engineering and Related Costs
Start-Up	$114,800	Vendor Neutral Estimate
Performance Tests	Included	Included in Engineering Estimate of SNCR System
Contingencies	$130,393	10% of TCC;
Total Indirect Capital Costs (TInCC)	$414,704	
Total Direct, Indirect and Capital Costs (TDICC)	$1,718,634	

Estimate of Selective Non-Catalytic Reduction Costs
for Lee County Energy Recovery Facility
Aqueous Ammonia SNCR System

Cost Component	Costs	Basis of Cost Component
Direct Annual Costs		
Operations and Maintenance Labor	$54,000	1200 Man hours per year @ $45/hour
Ammonia to control NOx to 150 ppm	$53,700	$300 per ton for Ammonia*
Regulatory Compliance Costs	$25,000	Engineering Estimate
Spare Parts Inventory Replacement	$9,831	1.5% of SCR Associated Equipment
Total Direct Annual Costs (TDAC)	$142,531	
Annual Energy Costs		
Annual Electrical Energy Usage	$3,066	7 kW X 8,760 hours per year at $0.05 per kWh at 100% System Availability
Total Energy Costs (TEC)	$3,066	
Indirect Annual Costs		
Management/Overhead	$32,400	60% of Operations and Maintenance Labor
Administration	$34,373	2% of TDICC
Insurance	$17,186	1% of TDICC
Miscellaneous Painting	$3,000	Vendor Neutral Estimate
Miscellaneous Equipment Rebuild	$7,373	Vendor Neutral Estimate; 75% of Spare Parts Above
Lost Power	$13,140	Eng. Est. (30kW X 8,760 hours/year X $0.05/kWh)
Annualized Total Direct Capital	$188,706	0.1098 Capital Recovery Factor of 7% over 15 years multiplied by sum of TDICC
Total Indirect Annual Costs (TIAC)	$296,178	
Total Annualized Costs	$441,775	Sum of TDAC, TEC and TIAC (for 260 ppm)
Cost Effectiveness of SNCR System	$2,145	Cost Per Ton NOx Removed 206 Tons NOx Removed (260 ppm inlet; 150 ppm outlet; 42% Removal)

* Note: Ammonia usage is based on information provided by Covanta and ratioed based on 100% availability of Unit 3.

Estimate of Selective Non-Catalytic Reduction Costs
for Lee County Energy Recovery Facility
Aqueous Ammonia SNCR System

Cost Component	Costs	Basis of Cost Component
Direct Capital Costs		
SNCR Associated Equipment	$655,400	Engineering Estimate
Ammonia Storage Tank	Included	Ammonia Storage
Pumps and Blowers	Included	Engineering Estimate
Electrical & Instrumentation	Included	Engineering Estimate
Freight	Included	Included in Vendor Quote for Capital Equipment
System Integration	$50,000	Engineering Estimate
Total Direct Capital Costs (TDCC)	$705,400	
Direct Installation Costs		
Installation	$582,230	Engineering Estimate
Foundation and Supports	Included	Included in Eng. Est. for Installation of SNCR System
Handling and Erection	Included	Included in Eng. Est. for Installation of SNCR System
Electrical	Included	Included in Eng. Est. for Installation of SNCR System
Piping	Included	Included in Eng. Est. for Installation of SNCR System
Insulation for Ductwork	Included	Included in Eng. Est. for Installation of SNCR System
Painting	Included	Included in Eng. Est. for Installation of SNCR System
Site Preparation	$16,300	Existing Roads, Demolition & Restoration
Total Direct Installation Costs (TDIC)	$598,530	
Total Capital Costs (TCC)	$1,303,930	Sum of TDCC and TDIC
Indirect Costs		
Vendor Engineering and Related Costs	$104,314	8% of TCC
Construction and Field Expenses	Included	Included in Engineering Estimate of SNCR System
Vendor Fees	$65,197	5% of TCC
Project Management & Oversight	Included	Included in Vendor Engineering and Related Costs
Start-Up	$114,800	Vendor Neutral Estimate
Performance Tests	Included	Included in Engineering Estimate of SNCR System
Contingencies	$130,393	10% of TCC;
Total Indirect Capital Costs (TInCC)	$414,704	
Total Direct, Indirect and Capital Costs (TDICC)	$1,718,634	

Estimate of Selective Non-Catalytic Reduction Costs
for Lee County Energy Recovery Facility
Aqueous Ammonia SNCR System

Cost Component	Costs	Basis of Cost Component
Direct Annual Costs		
Operations and Maintenance Labor	$54,000	1200 Man hours per year @ $45/hour
Ammonia to control NOx to 150 ppm	$53,700	$300 per ton for Ammonia*
Regulatory Compliance Costs	$25,000	Engineering Estimate
Spare Parts Inventory Replacement	$9,831	1.5% of SCR Associated Equipment
Total Direct Annual Costs (TDAC)	$142,531	
Annual Energy Costs		
Annual Electrical Energy Usage	$3,066	7 kW X 8,760 hours per year at $0.05 per kWh at 100% System Availability
Total Energy Costs (TEC)	$3,066	
Indirect Annual Costs		
Management/Overhead	$32,400	60% of Operations and Maintenance Labor
Administration	$34,373	2% of TDICC
Insurance	$17,186	1% of TDICC
Miscellaneous Painting	$3,000	Vendor Neutral Estimate
Miscellaneous Equipment Rebuild	$7,373	Vendor Neutral Estimate; 75% of Spare Parts Above
Lost Power	$13,140	Eng. Est. (30kW X 8,760 hours/year X $0.05/kWh)
Annualized Total Direct Capital	$162,239	0.0944 Capital Recovery Factor of 7% over 20 years multiplied by sum of TDICC
Total Indirect Annual Costs (TIAC)	$269,711	
Total Annualized Costs	$415,308	Sum of TDAC, TEC and TIAC (for 260 ppm)
Cost Effectiveness of SNCR System		Cost Per Ton NOx Removed
	$2,016	206 Tons NOx Removed (260 ppm inlet; 150 ppm outlet; 42% Removal)

* Note: Ammonia usage is based on information provided by Covanta and ratioed based on 100% availability of Unit 3.

LEE COUNTY ENERGY RECOVERY FACILITY
PREVENTION OF SIGNIFICANT DETERIORATION
APPLICATION FOR MUNICIPAL WASTE COMBUSTOR UNIT 3

ATTACHMENT G

VERIFICATION OF FACILITY
RISK MANAGEMENT PLAN
SUBMISSION AND COMPLETENESS

October 31, 2002

II E111

RECEIVED

JUL 13 1999

Facility Name: Lee County Solid Waste Resource Recovery Facility
EPA ID: 1000 0006 8749

EPA United States Environmental Protection Agency

OGDEN MARTIN SYSTEMS OF LEE, INC.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460
OFFICE OF SOLID WASTE AND EMERGENCY RESPONSE

T. Eriksen
OMS of Lee, Inc. (Operator)
10500 Buckingham Road
Fort Myers, FL 33905

June 29, 1999

EPA Facility ID#:	1000 0006 8749
Postmark Date:	06/20/1999
Anniversary Date:	06/20/2004

NOTIFICATION LETTER: COMPLETE RMP

The U.S. Environmental Protection Agency (EPA) received your Risk Management Plan (RMP) dated with the above postmark date. **This letter notifies you that your RMP is "complete" according to EPA's completion check.** The completion check is a program implemented by EPA to determine whether a submitted RMP includes the minimum amount of information every RMP must provide. The completion check does not assess whether a submitted RMP should have provided additional information or whether the information it provides is accurate or appropriate. In other words, it does not indicate that the RMP meets the requirements of 40 CFR Part 68.

Please note the anniversary date indicated above. Your RMP must be revised and updated by this date or earlier as required by 40 CFR §68.190. Please also note your EPA Facility ID number as identified at the top of this letter; all future Risk Management Plan submissions, corrections and other correspondence must include this number.

Your RMP (excluding the Offsite Consequence Analysis data) can be viewed on RMP*Info™, a national database on the Internet at http://www.epa.gov/enviro.

Facility Name: Lee County Solid Waste Resource Recovery Facility
EPA ID: 1000 0006 8749

If you have any questions, please call one of the following numbers:

(1) For RMP rule interpretation questions, call the EPCRA Hotline at (800) 424-9346 or (703) 412-9810 (in the D.C. Metro area).

(2) For RMP*Submit installation and software questions, or information on the status of your RMP, contact the RMP Reporting Center at (703) 816-4434, or write to the:

RMP Reporting Center
P.O. Box 3346
Merrifield, VA 22116-3346

(3) For more information on the Risk Management Program, you can contact your Implementing Agency. Your Implementing Agency is **Florida Department of Community Affairs, 2555 Shumard Oak Boulevard, Tallahassee, FL, 32399, Phone: 850-413-9970.**

Thank you for your cooperation in this matter.

Sincerely,

RMP Reporting Center

Enclosure:
Risk Management Plan (if submitted on paper)

II E 111

OGDEN

Ogden Martin Systems of Lee, Inc.

10500 Buckingham Road
Suite 400
Ft. Myers, FL 33905

February 3, 2000

Director, FBI
Attention: RMP Program – Room 1B327
935 Pennsylvania Ave. N.W.
Washington, D.C. 20535-0001

RE: Risk Management Program Certification Statement to the FBI
EPA Facility Identification Number: 1000 0006 8749

In accordance with P.L. 106-40, after reasonable public notice, the Lee County Solid Waste Resource Recovery Facility operated by Ogden Martin Systems of Lee, Inc. (EPA Facility Identification #: 1000 0006 8749) convened a public meeting on November 24, 1999. At that time, the Facility was prepared to describe and discuss the local implications of our risk management plan, including a summary of the Offsite Consequence Analysis (OCA) portion of the plan. No member of the general public was in attendance at the meeting.

Lindsey J Sampson — LINDSEY J. SAMPSON
Facility Owner Representative — Print Name

Solid Waste Department Director, Lee County Florida — 2/7/00
Title — Date

T. Erikson — Thomas C Erikson
Facility Operator Representative — Print Name

Facility Manager — 2/3/00
Title — Date