ORIGINAL

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JAN 26 2010

BUREAU OF AIR REGULATION

January 22, 2010
Project No. G080670A

Mr. Syed Arif, P.E.
FDEP New Source Review Section
2600 Blair Stone Road
Tallahassee, FL 32399-2400

Re: Industrial Power Generating Company, LLC (INGENCO)
Dade South Landfill
Response to FDEP January 11, 2010, E-mail

Dear Mr. Arif:

Thank you for forwarding Fishbeck, Thompson, Carr & Huber, Inc. (FTC&H) the information from Applied Filter Technology (AFT) in your January 11, 2010, e-mail. INGENCO has extensive knowledge of siloxane removal systems, and has conducted several tests on such removal systems. None of the tests that INGENCO has conducted have resulted in siloxane removal systems being protective of Selective Catalytic Reduction (SCR) catalysts or Oxidation Catalysts (OC). As we have detailed before, catalysts have been fouled within a matter of hours when using siloxane removal systems.

While FTC&H appreciates the information provided by AFT, INGENCO has yet to find a siloxane removal vendor that will guarantee their systems to be protective of a catalyst. The sample guarantee you provided from AFT was a guarantee for turbines. As we have previously indicated, the percentage of siloxane removal required for protecting a turbine, is much less than the siloxane removal efficiency required for protecting a catalyst.

However, for informational purposes, we have substituted AFT's Direct Installation costs and Annual O/M costs into our Best Available Control Technology (BACT) analysis, and have recalculated the control cost per ton of nitrogen oxides (NO_X) and carbon monoxide (CO) for Scenarios 1 and 2 in the referenced e-mail. FTC&H did not substitute Scenario 3 into our cost equations, as that scenario is for high methane concentration, a condition under which the engines will not operate.

As you will see in Enclosures 1 and 2, the cost to control NO_X and CO, are more than $13,000/ton and $6,000/ton, respectively. INGENCO does not believe controlling NO_X or CO at these per ton costs is economically feasible. Therefore, BACT for the engines, for NO_X and CO from the engines, is implementing good combustion practices.

The signed/sealed Professional Engineer certification statement is included as Enclosure 3.

FTC&H appreciates your continued effort regarding the INGENCO application. We trust that we have provided FDEP with sufficient detail to continue to review the Air Construction Permit Application. If you have any questions or require additional information, please contact me at 269-544-6955 or lmspurr@ftch.com.

Sincerely,

FISHBECK, THOMPSON, CARR & HUBER, INC.

Lynn Spurr

Lynn M. Spurr

dmg
Enclosures
By e-mail
cc/enc: Mr. Robert Greene – INGENCO
Mr. James A. Susan, P.E. – FTC&H

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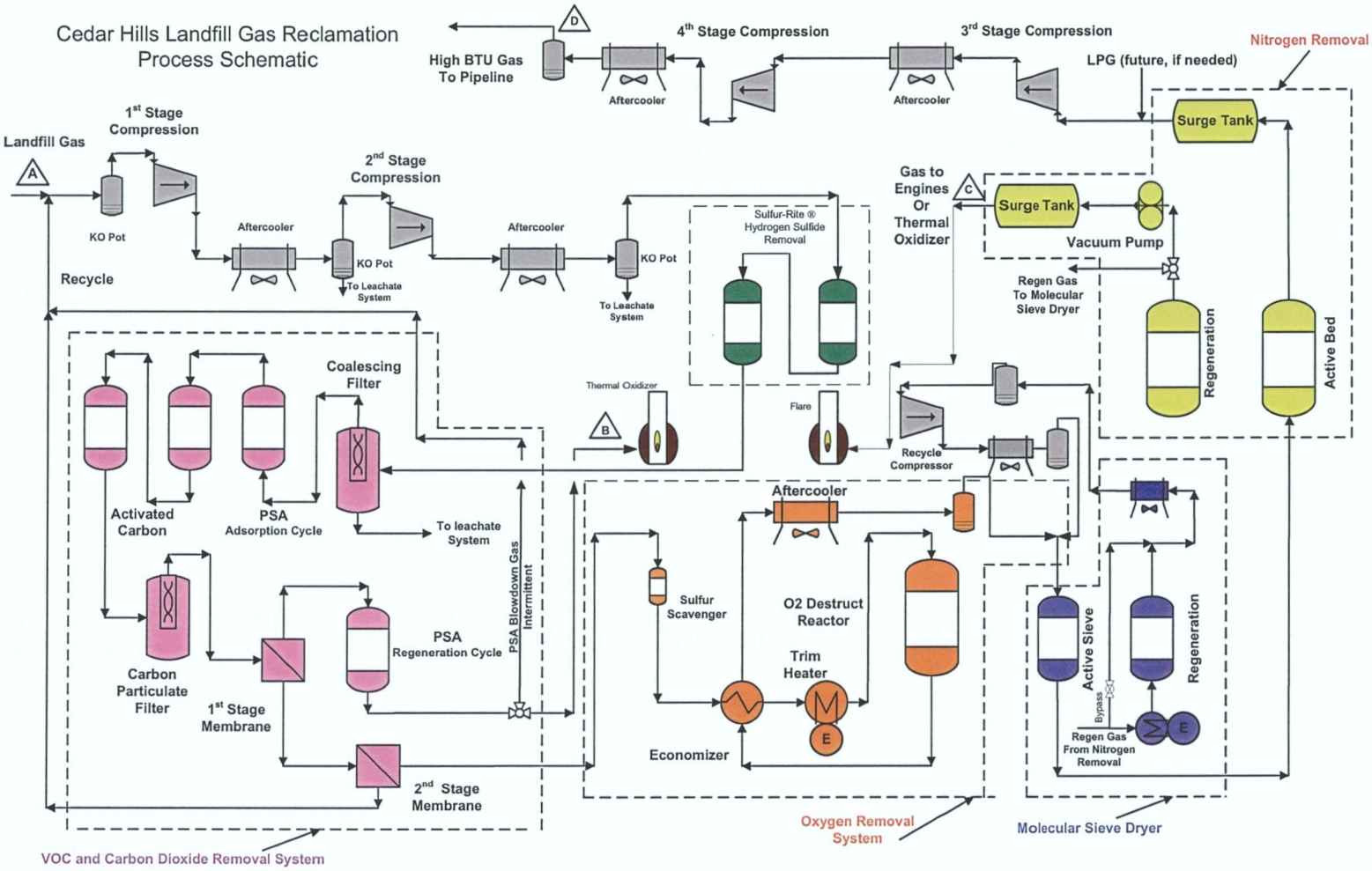
Cedar Hills Landfill Gas Reclamation
Process Schematic
High BTU Gas
To Pipeline
D
4th Stage Compression
3rd Stage Compression
Aftercooler
Aftercooler
LPG (future, if needed)
Nitrogen Removal
Surge Tank
Landfill Gas
A
1st Stage
Compression
2nd Stage
Compression
KO Pot
Aftercooler
KO Pot
To Leachate
System
Aftercooler
KO Pot
To Leachate
System
Recycle
Sulfur-Rite ®
Hydrogen Sulfide
Removal
Gas to
Engines
Or
Thermal
Oxidizer
C
Surge Tank
Vacuum Pump
Regen Gas
To Molecular
Sieve Dryer
Regeneration
Active Bed
Coalescing
Filter
Thermal Oxidizer
B
Flare
Recycle
Compressor
Activated
Carbon
PSA
Adsorption Cycle
To leachate
System
PSA Blowdown Gas
Intermittent
Aftercooler
Sulfur
Scavenger
O2 Destruct
Reactor
Trim
Heater
M
E
Economizer
PSA
Regeneration Cycle
Carbon
Particulate
Filter
1st Stage
Membrane
2nd Stage
Membrane
Active Sieve
Bypass
Regeneration
Regen Gas
From Nitrogen
Removal
E
VOC and Carbon Dioxide Removal System
Oxygen Removal
System
Molecular Sieve Dryer

Enclosure 1

INGENCO COST ANALYSIS SUMMARY
South Dade Landfill

	Siloxane - Nonregenerative System		SCR		Oxidation Catalyst	
Annualized Cost For Siloxane System	$ 1,481,003	per yr	$ 740,502	per yr (assumed half of Siloxane Annualized Cost)	$ 740,502	per yr (assumed half of Siloxane Annualized Cost)
Annualized Cost For SCR & OC Systems			$ 2,050,326	per yr	$ 958,550	per yr
Total Annualized Cost			$ 2,790,827	per yr	$ 1,699,052	per yr
Tons Removed			203	tpy @ 80% efficiency	265	tpy @ 80% efficiency
Cost of removal			**$13,734**	/ton	**$6,416**	Includes engine map, and startup assistance. /ton

INGENCO COST ANALYSIS SUMMARY
South Dade Landfill
Siloxane Removal - Nonregenerative

Capital Cost

Description	Cost	Data or Formula	Source/Comment:
Siloxane Pretreatment Equipment Cost			
Equipment Capital Cost of Siloxane Removal System	$ 2,800,000		AFT 1/8/10 email to FDEP
Installation Labor and Materials	$ 500,000	=Equipment Capital X 0.55	AFT 1/8/10 email to FDEP
Total Direct Capital Costs ($) (A)	$ 3,300,000	A = Direct Capital Cost for Siloxane Removal	
Indirect Installation Costs			
General Facilities	$ 165,000	=0.05 X A	EAPCCM
Engineering and Home Office Fees	$ 330,000	=0.10 X A	EAPCCM
Process Contigency	$ 165,000	=0.05 X A	EAPCCM
Total Indirect Installation Costs ($) (B)	$ 660,000	B = A X (0.05 + 0.10 + 0.05)	EAPCCM
Project Contigency ($) (C)	$ 594,000	C = (A + B) X 0.15	EAPCCM
Total Plant Cost ($) (D)	$ 4,554,000	D = A + B + C	
Allowance for Funds During Construction	$ -	E = 0	EAPCCM
Royalty Allowance	$ -	F = 0	EAPCCM
Preproduction Cost	$91,080	G = 0.02 X (D + E)	EAPCCM
Inventory Capital	$ -		
Initial Catalyst and Chemicals	$ -	I = 0	
Total Capital Investment ($) (TCI)	$4,645,080	TCI = D + E + F + G + H +I	

Annual Costs

Description	Cost			Data or Formula	Source/Comment:
Direct Annual Costs					
Operating Labor					
Operator	$ 21,900			1 hr/shift, $20.00 per hour, 3 shifts per day, 365 days per year	
Supervisor	$ 3,285			= 0.15 * Operator	EAPCCM
Maintenance	$ 400,000				
Labor & Material	included above				
Annual Siloxane Removal Media Replacement	included above				
Annual Electricity Cost	included above	$ 0.0671	kWh	assumed	
Total Direct Annual Cost	$ 425,185			DAC =Maintenance + Operating Labor	EAPCCM

INGENCO COST ANALYSIS SUMMARY
South Dade Landfill
Siloxane Removal - Nonregenerative

Capital Cost

Description	Cost		Data or Formula	Source/Comment:
Indirect Annual Costs				
Overhead	$	255,111	= 0.6 * Operating Labor and Maintance	EAPCCM
Property Tax				
Insurance	$	46,451	= 0.01 * TCI	
Administration	$	92,902	= 0.02 * TCI	
Total Indirect Annual Cost	$	394,463	DAC =Maintenance + Variable	EAPCCM
Capital Recovery		$661,355	= TCI * CRF	
Capital Recovery Factor		0.14238	$CRF = \frac{i\ X\ (1+i)^{EL}}{(1+i)^{EL}-1}$	
Equipment Life		10	yrs	
Interest Rate		7%		
Capital recovery factor (CRF)		0.14238		
Total Annual Cost ($) (TAC)	**$**	**1,481,003**	TAC = Total Direct Annual Costs + Indirect A	EAPCCM

INGENCO COST ANALYSIS SUMMARY
South Dade Landfill
SCR Cost Analysis

Capital Cost

Description	Cost	Data or Formula	Source/Comment:
SCR Equipment Cost			
Cost per HP	$121 /HP		Alpha Gamma Technologies Inc, 2005 Memorandum to US EPA
Engine Horse Power	469 HP		Client
Number of Engines	24		Client
Direct Capital Cost* of SCR for 24 engines	$1,361,976	=$/HP X Engine HP X # of Engines	Includes engine map, and startup assistance.
Total Direct Capital Costs ($) (A)	$1,361,976	A = Direct Capital Cost for SCR	
Indirect Installation Costs			
General Facilities	$68,099	=0.05 X A	EAPCCM
Engineering and Home Office Fees	$136,198	=0.10 X A	EAPCCM
Process Contigency	$68,099	=0.05 X A	EAPCCM
Total Indirect Installation Costs ($) (B)	$272,395	B = A X (0.05 + 0.10 + 0.05)	EAPCCM
Project Contigency ($) (C)	$245,156	C = (A + B) X 0.15	EAPCCM
Total Plant Cost ($) (D)	$1,879,527	D = A + B + C	EAPCCM
Allowance for Funds During Construction	$ -	E = 0	EAPCCM
Royalty Allowance	$ -	F = 0	EAPCCM
Preproduction Cost	$37,591	G = 0.02 X (D + E)	EAPCCM
Inventory Capital	$ -	H = Vol_{reag} (gal) X $Cost_{reag}$ ($/gal)	SCR Capital Cost assumes first fill of reagent
Initial Catalyst and Chemicals	$ -	I = 0	Included in SCR Capital Cost
Total Capital Investment ($) (TCI)	$1,917,117	TCI = D + E + F + G + H +I	EAPCCM

Annual Costs

Description	Cost		Data or Formula	Source/Comment:
Direct Annual Costs				
Operating Labor				
Operator	$ -			Negligible (per EAPCCM - in general no additional personnel is required to operate or maintain an SCR)
Supervisor	$ -			
Maintenance				
Labor & Material	$ 28,757		= 0.015 * TCI	EAPCCM
Variable Costs				
Annual Reagent Cost	$ 977,926		= q_{sol} * $Cost_{reagent}$ * 8760 hr/yr	
Reagent Cost =		$ 2.00	$/gal assumed	
Annual Electricity Cost	$ 20,119		= Power * operating hours/yr * electricity cost	
Site specific electricity cost =		$ 0.0671	kWh assumed	
Annualized Catalyst Replacement	$ 750,569		=FWF X n_{SCR} X $Vol_{catalyst}$ X CC	
interest rate (i) =		7%	assumed	
Operating Life of Catalyst =		700	hours assumed	
Years for FWF(Y) =		0.080		
Future Worth Factor (FWF) =		12.91	=i X (1 / ((1+i)^Y-1)	
Catalyst Cost (CC) =		$ 65	/ft^3 assumed	
Total Direct Annual Cost	$ 1,777,371		DAC =Maintenance + Variable + Siloxane	EAPCCM

INGENCO COST ANALYSIS SUMMARY
South Dade Landfill
SCR Cost Analysis

Indirect Annual Costs

Overhead	0			
Property Tax	0			
Capital Recovery	$272,954		= TCI * CRF	
Capital Recovery Factor		0.14238	$CRF = \frac{i X (1 + i)^{EL}}{(1 + i)^{EL} - 1}$	
Equipment Life		10 yrs		
Interest Rate		7%		
Capital recovery factor (CRF)		0.14238		
Total Indirect Annual Cost	$272,954		DAC =Maintenance + Variable	EAPCCM
Total Annual Cost ($) (TAC)	**$2,050,326**		DAC =Maintenance + Variable	EAPCCM

INGENCO COST ANALYSIS SUMMARY
South Dade Landfill
Plant Design Assumption/Variables

Desription			Notes
Heat Input (Q_b)	88.2	MMBTU/hr	Based on 24 Dual Fuel Engines
Uncontrolled NO_X Emission rate (NOX_{in})	2.12	lb/MMBTU	Client testing - 1% LFG and 99% diesel usage
Actual Stoichiometric Ratio (ASR)	1.05		EAPCCM Equation 2.11, Section 4.2, Chapter 2
NO_X removal efficiency (η_{NOX})	80%		assumed
Molecular weight of reagent (M_{reag})	60.06	g/mol	molecular weight of urea
Molecular weight of NO2(M_{NOx})	46	g/mol	molecular weight of NO2
Mass flow rate of reagent ($\dot{m}_{reagent}$)	205.074	lb/hr	$\dot{m}_{reagent} = \frac{NOX_{in}\, Q_b\, ASR\, \eta_{NOX}\, M_{reag}}{M_{NOX}}$ EAPCCM Equation 2.32, Section 4.2, Chapter 2
Concentration of Urea in aqueous solution (C_{sol})	40%		assumed Includes engine map, and startup assistance.
Mass flow rate of diluted solution ($\dot{m}_{sol}$)	512.686	lb/hr	$\dot{m}_{sol} = \frac{\dot{m}_{reagent}}{C_{sol}}$ EAPCCM Equation 2.33, Section 4.2, Chapter 2
Specific Gravity of 40% aqueous urea solution (SG)	1.1	g/cm^3	
Solution volumetric flow rate (q_{sol})	55.8	gph	$q_{sol} = \frac{\dot{m}_{sol}}{SG*8.35\ lb/gal}$
Pressure drop across duct work (ΔP_{duct})	3	inches of H2O	EAPCCM
Pressure drop across catalyst layer ($\Delta P_{catalyst}$)	1	inches of H2O	EAPCCM
Power Consumption (Power)	34.2	kW	
NOX efficiency adjustment (η_{adj})	1.1333		EAPCCM Equation 2.20, Section 4.2, Chapter 2
NOX inlet adjustment (NOX_{adj})	1.5325		EAPCCM Equation 2.21, Section 4.2, Chapter 3
Slip	0.25		Slip = ASR - η_{NOX}
Slip adjustment	1.26933		EAPCCM Equation 2.22, Section 4.2, Chapter 3
Fuel Sulfur content (wt%)	0.0015%		
Sulfur Adjsutment (S_{adj})	0.9636		
Temperature of Flue Gas	875	°F	
Temperature adjustment (T_{adj})	1.68937		
number of SCRs (n_{SCR})	4		one per stack
Catalyst Volume ($Vol_{catalyst}$)	222.359	ft^3/SCR	$Vol_{catalyst} = \frac{2.81* Q_b *\eta_{adj} *Slip_{adj} *NOX_{adj} *S_{adj} *T_{adj}}{n_{SCR}}$

INGENCO COST ANALYSIS SUMMARY
South Dade Landfill
Oxidation Catalyst Cost Analysis

Capital Cost

Description	Cost	Data or Formula	Source/Comment:
Oxidation Catalyst. Equipment Cost			
Cost per HP	$15 /HP		9/3/1998 Catalyst Control Cost Information Memorandum From Reciprocating Internal Combustion Engine Work Group
Engine Horse Power	469 HP		Client
Number of Engines	24		Client
Direct Capital Cost of Oxidation Catalyst for 24 engines	$168,840	=$/HP X Engine HP X # of Engines	Includes engine map, and startup assistance.
Total Direct Capital Costs ($) (A)	$168,840	A = Direct Capital Cost for Oxidation Catalyst	
Indirect Installation Costs			
General Facilities	$8,442	=0.05 X A	EAPCCM
Engineering and Home Office Fees	$16,884	=0.10 X A	EAPCCM
Process Contingency	$8,442	=0.05 X A	EAPCCM
Total Indirect Installation Costs ($) (B)	$33,768	B = A X (0.05 + 0.10 + 0.05)	EAPCCM
Project Contingency ($) (C)	$30,391	C = (A + B) X 0.15	EAPCCM
Total Plant Cost ($) (D)	$232,999	D = A + B + C	EAPCCM
Allowance for Funds During Construction	$ -	E = 0	EAPCCM
Royalty Allowance	$ -	F = 0	EAPCCM
Preproduction Cost	$4,660	G = 0.02 X (D + E)	EAPCCM
Inventory Capital	$ -		
Initial Catalyst and Chemicals	$ -	I = 0	Included in Oxidation Catalyst Capital Cost
Total Capital Investment ($) (TCI)	$237,659	TCI = D + E + F + G + H +I	EAPCCM

Annual Costs

Description	Cost	Data or Formula	Source/Comment:
Direct Annual Costs			
Operating Labor			
Operator	$ -		Assume Negligible
Supervisor	$ -		
Maintenance			
Labor & Material	$ 3,565	= 0.015 * TCI	EAPCCM
Variable Costs			
Annual Electricity Cost	$ 20,119	= Power * operating hours/yr * electricity cost	
Site specific electricity cost =	$ 0.0671 kWh	assumed same as SCR	
Annualized Catalyst Replacement	$ 901,029		
Operating Life of Catalyst =	700 hours	assumed	
Catalyst Cost (CC) =	$ 18,000 /OC/yr	assumed	
Total Direct Annual Cost	$ 924,713	DAC =Maintenance + Variable + Siloxane	EAPCCM
Indirect Annual Costs			
Overhead	0		
Property Tax	0		
Capital Recovery	$33,837	= TCI * CRF	
Capital Recovery Factor	0.14238	$CRF = \frac{i\,X\,(1+i)^{EL}}{(1+i)^{EL}-1}$	
Equipment Life	10 yrs		
Interest Rate	7%		
Capital recovery factor (CRF)	0.14238		
Total Indirect Annual Cost	$33,837	DAC =Maintenance + Variable	EAPCCM
Total Annual Cost ($) (TAC)	**$958,550**	DAC =Maintenance + Variable	EAPCCM

Enclosure 2

INGENCO COST ANALYSIS SUMMARY
South Dade Landfill

	Siloxane - Regenerative System		SCR		Oxidation Catalyst	
Annualized Cost For Siloxane System	$ 1,538,235.54	per yr	$ 769,117.77	per yr (assumed half of Siloxane Annualized Cost)	$ 769,117.77	per yr (assumed half of Siloxane Annualized Cost)
Annualized Cost For SCR & OC Systems			$ 2,050,325.70	per yr	$ 958,550.25	per yr
Total Annualized Cost			$ 2,819,443.47	per yr	$ 1,727,668.02	per yr
Tons Removed			203	tpy @ 80% efficiency	265	tpy @ 80% efficiency
Cost of removal			**$13,875**	/ton	**$6,524**	Includes engine map, and startup assistance. /ton

INGENCO COST ANALYSIS SUMMARY
South Dade Landfill
Siloxane Removal - Regenerative

Capital Cost

Description	Cost	Data or Formula	Source/Comment:
Siloxane Pretreatment Equipment Cost			
Equipment Capital Cost of Siloxane Removal System	$ 3,800,000		AFT 1/8/10 email to FDEP
Installation Labor and Materials	$ 725,000	=Equipment Capital X 0.55	AFT 1/8/10 email to FDEP
Total Direct Capital Costs ($) (A)	$ 4,525,000	A = Direct Capital Cost for Siloxane Removal	
Indirect Installation Costs			
General Facilities	$ 226,250	=0.05 X A	EAPCCM
Engineering and Home Office Fees	$ 452,500	=0.10 X A	EAPCCM
Process Contigency	$ 226,250	=0.05 X A	EAPCCM
Total Indirect Installation Costs ($) (B)	$ 905,000	B = A X (0.05 + 0.10 + 0.05)	EAPCCM
Project Contigency ($) (C)	$ 814,500	C = (A + B) X 0.15	EAPCCM
Total Plant Cost ($) (D)	$ 6,244,500	D = A + B + C	
Allowance for Funds During Construction	$ -	E = 0	EAPCCM
Royalty Allowance	$ -	F = 0	EAPCCM
Preproduction Cost	$124,890	G = 0.02 X (D + E)	EAPCCM
Inventory Capital	$ -		
Initial Catalyst and Chemicals	$ -	I = 0	
Total Capital Investment ($) (TCI)	$6,369,390	TCI = D + E + F + G + H +I	

Annual Costs

Description	Cost			Data or Formula	Source/Comment:
Direct Annual Costs					
Operating Labor					
Operator	$ 21,900			1 hr/shift, $20.00 per hour, 3 shifts per day, 365 days per year	
Supervisor	$ 3,285			= 0.15 * Operator	EAPCCM
Maintenance	$ 250,000				
Labor & Material	included above				
Annual Siloxane Removal Media Replacement	included above				
Annual Electricity Cost	included above	$ 0.0671	kWh	assumed	
Total Direct Annual Cost	$ 275,185			DAC =Maintenance + Operating Labor	EAPCCM

INGENCO COST ANALYSIS SUMMARY
South Dade Landfill
Siloxane Removal - Regenerative

Indirect Annual Costs				
Overhead	$	165,111	= 0.6 * Operating Labor and Maintance	EAPCCM
Property Tax				
Insurance	$	63,694	= 0.01 * TCI	
Administration	$	127,388	= 0.02 * TCI	
Total Indirect Annual Cost	$	356,193	DAC =Maintenance + Variable	EAPCCM

Capital Recovery		$906,858	= TCI * CRF	
Capital Recovery Factor		0.14238	$CRF = \frac{i\,X\,(1+i)^{EL}}{(1+i)^{EL}-1}$	
Equipment Life		10	yrs	
Interest Rate		7%		
Capital recovery factor (CRF)		0.14238		
Total Annual Cost ($) (TAC)	**$**	**1,538,236**	TAC = Total Direct Annual Costs + Indirect Ai	EAPCCM

INGENCO COST ANALYSIS SUMMARY
South Dade Landfill
SCR Cost Analysis

Capital Cost

Description	Cost	Data or Formula	Source/Comment:
SCR Equipment Cost			
Cost per HP	$121 /HP		Alpha Gamma Technologies Inc, 2005 Memorandum to US EPA
Engine Horse Power	469 HP		Client
Number of Engines	24		Client
Direct Capital Cost* of SCR for 24 engines	$1,361,976	=$/HP X Engine HP X # of Engines	Includes engine map, and startup assistance.
Total Direct Capital Costs ($) (A)	$1,361,976	A = Direct Capital Cost for SCR	
Indirect Installation Costs			
General Facilities	$68,099	=0.05 X A	EAPCCM
Engineering and Home Office Fees	$136,198	=0.10 X A	EAPCCM
Process Contigency	$68,099	=0.05 X A	EAPCCM
Total Indirect Installation Costs ($) (B)	$272,395	B = A X (0.05 + 0.10 + 0.05)	EAPCCM
Project Contigency ($) (C)	$245,156	C = (A + B) X 0.15	EAPCCM
Total Plant Cost ($) (D)	$1,879,527	D = A + B + C	EAPCCM
Allowance for Funds During Construction	$ -	E = 0	EAPCCM
Royalty Allowance	$ -	F = 0	EAPCCM
Preproduction Cost	$37,591	G = 0.02 X (D + E)	EAPCCM
Inventory Capital	$ -	H = Vol_{reag} (gal) X $Cost_{reag}$ ($/gal)	SCR Capital Cost assumes first fill of reagent
Initial Catalyst and Chemicals	$ -	I = 0	Included in SCR Capital Cost
Total Capital Investment ($) (TCI)	$1,917,117	TCI = D + E + F + G + H +I	EAPCCM

Annual Costs

Description	Cost			Data or Formula	Source/Comment:
Direct Annual Costs					
Operating Labor					
Operator	$ -				Negligible (per EAPCCM - in general no additional personnel is required to operate or maintain an SCR)
Supervisor	$ -				
Maintenance					
Labor & Material	$ 28,757			= 0.015 * TCI	EAPCCM
Variable Costs					
Annual Reagent Cost	$ 977,926			= q_{sol} * $Cost_{reagent}$ * 8760 hr/yr	
Reagent Cost =		$	2.00	$/gal assumed	
Annual Electricity Cost	$ 20,119			= Power * operating hours/yr * electricity cost	
Site specific electricity cost =		$	0.0671	kWh assumed	
Annualized Catalyst Replacement	$ 750,569			=FWF X n_{SCR} X $Vol_{catalyst}$ X CC	
interest rate (i) =			7%	assumed	
Operating Life of Catalyst =			700	hours assumed	
Years for FWF(Y) =			0.080		
Future Worth Factor (FWF) =			12.91	=i X (1 / ((1+i)^Y-1)	
Catalyst Cost (CC) =		$	65	/ft^3 assumed	
Total Direct Annual Cost	$ 1,777,371			DAC =Maintenance + Variable + Siloxane	EAPCCM

INGENCO COST ANALYSIS SUMMARY
South Dade Landfill
SCR Cost Analysis

Capital Cost

Description	Cost		Data or Formula	Source/Comment:
Indirect Annual Costs				
Overhead	0			
Property Tax	0			
Capital Recovery	$272,954		= TCI * CRF	
Capital Recovery Factor		0.14238	$CRF = \frac{i\,X\,(1+i)^{EL}}{(1+i)^{EL}-1}$	
Equipment Life		10	yrs	
Interest Rate		7%		
Capital recovery factor (CRF)		0.14238		
Total Indirect Annual Cost	$272,954		DAC =Maintenance + Variable	EAPCCM
Total Annual Cost ($) (TAC)	**$2,050,326**		DAC =Maintenance + Variable	EAPCCM

INGENCO COST ANALYSIS SUMMARY
South Dade Landfill
Plant Design Assumption/Variables

Desription			Notes
Heat Input ($Q_{b)}$	88.2	MMBTU/hr	Based on 24 Dual Fuel Engines
Uncontrolled NO_X Emission rate (NOX_{in})	2.12	lb/MMBTU	Client testing - 1% LFG and 99% diesel usage
Actual Stoichiometric Ratio (ASR)	1.05		EAPCCM Equation 2.11, Section 4.2, Chapter 2
NO_X removal efficiency (η_{NOX})	80%		assumed
Molecular weight of reagent (M_{reag})	60.06	g/mol	molecular weight of urea
Molecular weight of NO2(M_{NOx})	46	g/mol	molecular weight of NO2
Mass flow rate of reagent ($\dot{m}_{reagent}$)	205.074	lb/hr	$\dot{m}_{reagent} = \frac{NOX_{in}\, Q_b\, ASR\, \eta_{NOX}\, M_{reag}}{M_{NOX}}$ EAPCCM Equation 2.32, Section 4.2, Chapter 2
Concentration of Urea in aqueous solution (C_{sol})	40%		assumed Includes engine map, and startup assistance.
Mass flow rate of diluted solution ($\dot{m}_{sol}$)	512.686	lb/hr	$\dot{m}_{sol} = \frac{\dot{m}_{reagent}}{C_{sol}}$ EAPCCM Equation 2.33, Section 4.2, Chapter 2
Specific Gravity of 40% aqueous urea solution (SG)	1.1	g/cm^3	
Solution volumetric flow rate (q_{sol})	55.8	gph	$q_{sol} = \frac{\dot{m}_{sol}}{SG*8.35\ lb/gal}$
Pressure drop across duct work (ΔP_{duct})	3	inches of H2O	EAPCCM
Pressure drop across catalyst layer ($\Delta P_{catalyst}$)	1	inches of H2O	EAPCCM
Power Consumption (Power)	34.2	kW	
NOX efficiency adjustment (η_{adj})	1.1333		EAPCCM Equation 2.20, Section 4.2, Chapter 2
NOX inlet adjustment (NOX_{adj})	1.5325		EAPCCM Equation 2.21, Section 4.2, Chapter 3
Slip	0.25		Slip = ASR - η_{NOX}
Slip adjustment	1.26933		EAPCCM Equation 2.22, Section 4.2, Chapter 3
Fuel Sulfur content (wt%)	0.0015%		
Sulfur Adjsutment (S_{adj})	0.9636		
Temperature of Flue Gas	875	°F	
Temperature adjustment (T_{adj})	1.68937		
number of SCRs (n_{SCR})	4		one per stack
Catalyst Volume ($Vol_{catalyst}$)	222.359	ft^3/SCR	$Vol_{catalyst} = \frac{2.81* Q_b *\eta_{adj} *Slip_{adj} *NOX_{adj} *S_{adj} *T_{adj}}{n_{SCR}}$

INGENCO COST ANALYSIS SUMMARY
South Dade Landfill
Oxidation Catalyst Cost Analysis

Capital Cost

Description	Cost		Data or Formula	Source/Comment:
Oxidation Catalyst. Equipment Cost				
Cost per HP	$15	/HP		9/3/1998 Catalyst Control Cost Information Memorandum From Reciprocating Internal Combustion Engine Work Gr
Engine Horse Power	469	HP		Client
Number of Engines	24			Client
Direct Capital Cost of Oxidation Catalyst for 24 engines	$168,840		=$/HP X Engine HP X # of Engines	Includes engine map, and startup assistance.
Total Direct Capital Costs ($) (A)	$168,840		A = Direct Capital Cost for Oxidation Catalyst	
Indirect Installation Costs				
General Facilities	$8,442		=0.05 X A	EAPCCM
Engineering and Home Office Fees	$16,884		=0.10 X A	EAPCCM
Process Contingency	$8,442		=0.05 X A	EAPCCM
Total Indirect Installation Costs ($) (B)	$33,768		B = A X (0.05 + 0.10 + 0.05)	EAPCCM
Project Contingency ($) (C)	$30,391		C = (A + B) X 0.15	EAPCCM
Total Plant Cost ($) (D)	$232,999		D = A + B + C	EAPCCM
Allowance for Funds During Construction	$ -		E = 0	EAPCCM
Royalty Allowance	$ -		F = 0	EAPCCM
Preproduction Cost	$4,660		G = 0.02 X (D + E)	EAPCCM
Inventory Capital	$ -			
Initial Catalyst and Chemicals	$ -		I = 0	Included in Oxidation Catalyst Capital Cost
Total Capital Investment ($) (TCI)	$237,659		TCI = D + E + F + G + H +I	EAPCCM

Annual Costs

Description	Cost		Data or Formula	Source/Comment:
Direct Annual Costs				
Operating Labor				
Operator	$ -			Assume Negligible
Supervisor	$ -			
Maintenance				
Labor & Material	$ 3,565		= 0.015 * TCI	EAPCCM
Variable Costs				
Annual Electricity Cost	$ 20,119		= Power * operating hours/yr * electricity cost	
Site specific electricity cost =		$ 0.0671 kWh	assumed same as SCR	
Annualized Catalyst Replacement	$ 901,029			
Operating Life of Catalyst =		700 hours	assumed	
Catalyst Cost (CC) =		$ 18,000 /OC/yr	assumed	
Total Direct Annual Cost	$ 924,713		DAC =Maintenance + Variable + Siloxane	EAPCCM
Indirect Annual Costs				
Overhead	0			
Property Tax	0			
Capital Recovery	$33,837		= TCI * CRF	
Capital Recovery Factor		0.14238	$CRF = \frac{i\,X\,(1+i)^{EL}}{(1+i)^{EL}-1}$	
Equipment Life		10 yrs		
Interest Rate		7%		
Capital recovery factor (CRF)		0.14238		
Total Indirect Annual Cost	$33,837		DAC =Maintenance + Variable	EAPCCM
Total Annual Cost ($) (TAC)	**$958,550**		DAC =Maintenance + Variable	EAPCCM

Enclosure 3

Professional Engineer Certification

1. Professional Engineer Name: James A. Susan, P.E.
   Registration Number: 61237
2. Professional Engineer Mailing Address...
   Organization/Firm: Fishbeck, Thompson, Carr & Huber, Inc.
   Street Address: 1515 Arboretum Drive, SE
   City: Grand Rapids State: MI Zip Code: 49546
3. Professional Engineer Telephone Numbers...
   Telephone: (616) 575-3824 ext. 3734 Fax: (616) 575-8155
4. Professional Engineer E-mail Address: jasusan@ftch.com
5. Professional Engineer Statement:

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

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

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

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

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

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

   Signature — Date: 1/22/10

   (seal)

   JAMES A. SUSAN LICENSE No. 61237 STATE OF FLORIDA PROFESSIONAL ENGINEER

* Attach any exception to certification statement.