SOUTH DISTRICT WASTEWATER TREATMENT PLANT
DIGESTER GAS UTILIZATION
Contract Number S-328

ENGINE EMISSIONS
(May 25, 1988)

I. ENGINE GENERATORS

Three (3) new identical units provided called Generator #1, Generator #2 and Generator #3. These consist of gas engines direct driving electric generators.

Engine characteristics are as follows:
Type: Stationary internal combustion engines.
Model: Cooper Industries 12GTL(B), or equal.
BMEP: 150 psig.
Speed: 720 RPM

Engine-generator performance:
Electrical output: 900 KW
Generator efficiency: 95%
Fuel requirements: 7300 BTU/BHP-HR*

*Based on LHV of fuel gas, per manufacturers data.

II. GAS USE

The gas composition shown below is average for scrubbed digester gas at the Central District Wastewater Treatment Plant. The attached gas analysis is for a typical day and varies slightly from average. Average composition is used for design for most realistic results.

The gas analyses of the Central District Wastewater Treatment Plant have been used for design of the generating facility at the South District Wastewater Treatment Plant for the following reasons:

The sewage treated, the treatment process and the sludge digestion are similar at both plants.

No gas scrubbers presently exist at the South Plant. This project includes the installation of scrubbers that are similar to those existing at the Central Plant.

For the above reasons, it is safe to assume that the scrubbed digester gas composition will be similar for both plants.

GAS COMPOSITION:
(From plant data, design average)

CH_4: 72.1 % by volume
CO_2: 27.9 % by volume
H_2S: 33 grains per 100 SCF of gas

LHV: .721 X 913 = 658 BTU/SCF
S.G.: .823
M.W.: 23.83 (average)

GAS USED PER ENGINE

$$900\ KW \times \frac{1\ BHP}{0.746\ KW} \times \frac{1}{.95(Eff)} = 1270\ BHP$$

$$1270\ BHP \times \frac{7300\ BTU}{BHP\text{-}HR} \times \frac{SCF}{658\ BTU} = 14{,}090\ SCFH$$

MAXIMUM YEARLY USE OF ANY ENGINE:

$$24\ \frac{HRS}{DAY} \times 7\ \frac{DAYS}{WEEK} \times 50\ \frac{WEEKS}{YEAR} = 8{,}400\ \frac{HRS}{YEAR}$$

III. ENGINE MANUFACTURERS DATA

(See attached letters from Cooper Industries)

GUARANTEED MAXIMUM EMISSION RATES:

NOx: 1.5 gms/BHP-HR
CO: 2.0 gms/BHP-HR
NMHC*: 0.5 gms/BHP-HR

*Non methane hydrocarbons

OTHER ENGINE MANUFACTURER DATA:

NOx: 203 ppm @ 9.5% 02
NOx: 105 ppm @ 15% 02
THC**: 5.0 gms/BHP-HR

**Total hydrocarbons

IV. PRODUCTS OF COMBUSTION

Gas used = 14,090 SCFH (per part II of this report)

Gas composition

CH_4: .721 x 14090 = 10,159 SCFH

$$10{,}159\ \frac{SCF}{hr} \times \frac{1\ Lb\text{-}mol}{379.5\ SCF} \times \frac{16.03\ LB}{Lb\text{-}mol} = 429.1\ LB/hr$$

CO_2: 14,090 - 10,159 = 3,931 SCFH

$$3{,}931\ \frac{SCF}{hr} \times \frac{1\ Lb\text{-}mol}{379.5\ SCF} \times \frac{44\ LB}{Lb\text{-}mol} = 455.8\ LB/hr$$

Consider first stoichiometric combustion:

			SCFH	LB/hr
To Engines	CH_4:		10,159	429.1
	CO_2:		3,931	455.8
	Air:	10,159 X 9.53	96,815	
		429.1 X 17.22		7,389.1
				8,724.0
From Engines	CO_2:	10,159 X 1 + 3,931	14,090	
		429.1 X 2.74 + 455.8		1,631.5
	N_2:	10,159 X 7.53	76,497	
		429.1 X 13.23		5,677.0
	H_2Ovapor:	10,159 X 2	20,318	
		429.1 X 2.25		965.5
	Total products of combustion		110,905	8,274.0
	Dry products of combustion		90,587	7,308.5

For 9.5% O_2 in dry products:

(Actual engine operations, per manufacturers data)

$(90{,}587 + O_2 + N_2)\ 0.095 = O_2$

Where O_2 is Oxygen in excess air
N_2 is nitrogen in excess air

$N_2 = 3.764\ O_2$

$(90{,}587 + O_2 + 3.764\ O_2)\ 0.095 = O_2$
$O_2 = 15{,}721$ SCFH

Excess air: 15,721 X 4.764 = 74,895 SCFH

Total exhaust (dry basis)

90,587 + 74,895 = 165,482 DSCFH
Exhaust temperature = 780 °F

Actual exhaust volume (including water vapors)

$$\frac{(110{,}905 + 74{,}895)\ (460 + 780)}{(460 + 60)} = 443{,}062 \text{ ACFH}$$

For 15% O_2 in dry products:

(Calculated at 15% for checking per New Source standard)

$(90{,}587 + O_2 + N_2)\ 0.15 = O_2$

$(90{,}587 + O_2 + 3.764\ O_2)\ 0.15 = O_2$
$O_2 = 47{,}611$ SCFH

Excess air: 47,611 X 4.764 = 226,819 SCFH

Total exhaust products (dry basis):

90,587 + 226,819 = 317,406 DSCFH

Exhaust flow in stack:

(At actual operating conditions of 9.5% O2)

Dry gases:

$$165{,}482 \frac{DSCF}{hr} X \frac{1 \ hr}{60 \ mn} = 2{,}758 \ DSCFM$$

Actual:

$$443{,}062 \frac{ACF}{hr} X \frac{1 \ hr}{60mn} = 7{,}384 \ ACFM$$

Stack flow area: $\left(\frac{1.5}{2}\right)^2 \pi = 1.767$ S.F.

Initial exhaust gas velocity:

$$7{,}384 \frac{CF}{min} X \frac{1 \ min}{60 \ sec} X \frac{1}{1.767 \ S.F.} = 70 \ F.P.S.$$

Water vapor content:

Water vapor as product of combustion = 20,318 SCFH

Consider supply air to engine as 85°F, 50% R.H.

Additional moisture converted into vapor

$$(96{,}815 + 74{,}895) \frac{SCF}{hr} X \ 0.076 \frac{LB}{SCF} Air \ X \frac{0.011 \ LbH2O}{Lb \ Air} = 143.5 \frac{Lb \ H2O}{hr}$$

Additional vapor in exhaust:

$$\frac{143.5}{18} X \ 379.5 = 3025 \ SCFH$$

Total exhaust = 110,905 + 74,895 + 3,025 = 188,825 SCFH

Total vapor inexhaust = 20,318 + 3,025 = 23,343 SCFH

$$\text{Vapor content} = \frac{23{,}343}{188{,}825} = 0.12$$

or 12%

V. EMISSIONS CALCULATIONS

Per manufacturer's guarantee:

NOx

$$1270 \text{ BHP} \times \frac{1.5 \text{ gms}}{\text{BHP-Hr}} \times \frac{1 \text{ lb}}{454 \text{ gm}} = \underline{4.2} \text{ lbs/hr}$$

CO

$$1270 \text{ BHP} \times \frac{2.0 \text{ gm}}{\text{BHP - Hr}} \times \frac{1 \text{ LB}}{454 \text{ gm}} = 5.6 \text{ lb/hr}$$

NMHC*

*Non methane hydrocarbons

$$1270 \text{ BHP} \times \frac{0.5 \text{ gm}}{\text{BHP-Hr}} \times \frac{1 \text{ LB}}{454 \text{ gm}} = \underline{1.4} \text{ lb/hr}$$

VI. OTHER EMISSION CALCULATIONS

NOx:
Per manufacturer's calculated data:
Assume 97% NO_2 3% NO_3

$$\overline{MW} = .97\ (46) + .03\ (62) = 46.5$$

NOx emissions:

$$\frac{\text{PPM} \times \overline{\text{MW}}}{\text{Molar Volume}}$$

At 9.5% O_2 in exhaust gases

203 PPM of NOx (per manufacturer's data)

$$203 \times 10^{-6} \times \frac{46.5 \text{ Lb}}{\text{Lb-mol}} \times \frac{1 \text{ Lb-mol}}{379.5 \text{ SCF}} = 24.87 \times 10^{-6} \text{ Lb/SCF}$$

$$165{,}482 \frac{\text{SCF}}{\text{hr}} \times 24.87 \times 10^{-6} \frac{\text{Lb}}{\text{SCF}} = 4.1 \text{ Lb/SCF}$$

Agrees with guarantee

At 15% O2 in exhaust gases

105 PPM of NOx (per manufacturer's data)

$$105 \times 10^{-6} \times 46.5 \frac{Lb}{Lb\text{-}mol} \times \frac{1\ Lb\text{-}mol}{379.5\ SCF} = 12.87 \times 10^{-6}\ Lb/SCF$$

$$317{,}406 \frac{SCF}{hr} \times 12{,}87\ 10^{-6} \frac{Lb}{SCF} = 4.1\ Lb/SCF$$

Agrees with guarantee

THC**

Per manufacturer's calculated data.

** Total hydrocarbons

$$1270\ BHP \times \frac{5\ gm}{BHP\text{-}HR} \times \frac{1\ LB}{454\ gm} = \underline{14.0}\ LB/hr$$

SO2

Per average composition of scrubbed digester gas

$$H2S \text{ in gas: } \frac{33\ grains}{100\ SCF} \times \frac{1\ LB}{7000\ grains} \times 14{,}090 \frac{SCF}{Hr} = 0.66 \frac{LB}{Hr}$$

$$S: \frac{0.66\ LB}{Hr} \times \frac{32\ (MW\ of\ S)}{34\ (MW\ of\ H2S)} = 0.62\ LB/hr$$

$$SO2: 0.62 \frac{LB}{HR} \times \frac{64\ (MW\ of\ SO2)}{32\ (MW\ of\ S)} = \underline{1.24}\ LB/hr$$

VII. EMISSIONS SUMMARY

	LB/hr	Tons/year
NOx	4.2	17.6
CO	5.6	23.5
NMHC	1.4	5.9
THC	14.0	58.8
SO2	1.2	5.0

MEMORANDUM

DADE COUNTY FORM 107.07-17A

TO ROGER VARONA, Special Projects Engineer - Room 208

DATE MAY 12, 1988

SUBJECT REMOVAL OF CARBON DIOXIDE BY SCRUBBERS

FROM YVONNE W. WALTON, Chemist 2
Central District WWTP

Yvonne W. Walton

The gas to and from Plant #1 scrubbers was analysed on May 11, 1988 for Carbon Dioxide content: to scrubbers 35.0%
from scrubbers 27.0%

Plant #2 scrubbers had an average Carbon Dioxide content of 35.6% in and 26.8% out for April 1988.

YWW/ah

cc: R. Aceto
R. Culmer

MIAMI-DADE WATER AND SEWER AUTHORITY DEPARTMENT

CENTRAL DISTRICT WASTEWATER TREATMENT PLANT

RECORD OF H2S CONTENT IN GAS TO ENGINES

Below is a summary of the average H2S content of the scrubbed digester gas at the plant.

Month	H2S in gas to engines, Average (grains per 100 C.F.)
Jan., 1987	43.9
Feb., 1987	45.0
March, 1987	25.0
April, 1987	29.0
May, 1987	28.4
June, 1987	15.7
July, 1987	34.8
August, 1987	28.7
Sept., 1987	37.0
Oct., 1987	33.4
Nov., 1987	41.5
Dec., 1987	37.9
	33.3

Monthly averages calculated from daily analyses of gas as shown in the plat operating records. Computed by Rogelio Varona, P.E., May 18, 1988.

Rogelio Varona
May 18, 1988

AJAX-SUPERIOR

April 28, 1988

Mr. Roger Varona
Miami Dade Water and Sewer Authority Department
P.O. Box 33036
Miami, FL 33233-0316

Re: South District Wastewater Treatment Plant
Digester Gas Utilization

Subject: Superior 12GTLB Gensets (900 KWe)
Site Emissions Guarantee

Dear Mr. Varona:

Based on the digester gas composition you submitted to us for review, Cooper Industries, Ajax-Superior Division hereby guarantees that the 12GTLB CleanBurn II engines quoted on referenced project will not exceed the following emissions levels at full load rating of 1270 BHP/720 RPM;

NOx	1.5 gms/BHP-HR
CO	2.0 gms/BHP-HR
NMHC	0.5 gms/BHP-HR

In the event that the 12GTLB engines furnished for this WWTP project fail to meet guaranteed emission levels, Superior will modify the engine or its components in order to comply with stated guarantee. This modification will be carried out by Superior at no charge to Miami Dade Water and Sewer Authority.

Yours truly,

L. R. Peltier

L. R. Peltier
Senior Application Engineer

/clb

cc: T. Lamberth - ESG/Metairie
H. Ballard - Spfld

1401 Sheridan Ave., P.O. Box 540
Springfield, Ohio 45501
(513) 327-4200 Telex: ITT 4946775

AJAX-SUPERIOR

COOPER INDUSTRIES

May 2, 1988

Mr. Roger Varona
Miami Dade Water and Sewer Authority Dept.
3575 S. Le Jeane Road
Miami, Florida 33146-2221

Re: South District Wastewater Treatment Plant
Digester Gas Utilization Project

Subject: Additional Emissions Data
12GTLA Gensets (900 KWe)

Dear Roger:

With reference to the attached site emissions guarantee letter for this project, we are submitting the following additional data to assist you in your response to the State of Florida, Department of Environmental Regulations. Please note, this data is based on digester gas composition per your submission and operating load of 1270 BHP/720 RPM.

1) It is our understanding that you intend to operate these engines on digester gas, only. Superior will build these engines with high compression ratio pistons (10:1) to optimize BSFC. At 1270 BHP/720 RPM, we would guarantee a fuel consumption rate of not exceeding 7300 BTU/BHP-HR (plus 3% for site measurement tolerance) based on the LHV of the digester gas.

2) The 1.5/BHP-HR (actual) for NOx in the exhaust is equal to 203 ppm. Per New Source Standard, NOx corrected to 15% 02, day basis is 105 ppm.

3) Combustion air flow is 11.2 lbs/BHP-HR which is 237 lbs/min at 1270 BHP.

4) Oxygen content of the exhaust at 1270 BHP is 9.5%, dry basis.

5) Total hydro carbon (THC) emission (actual) is 5.0 gms/BHP-HR.

We trust this information is satisfactory for your purposes and if you require additional assistance, please contact me at your convenience.

Yours very truly,

L. R. Peltier

L. R. Peltier
Senior Application Engineer

cc: T. Lamberth - ESG/Metairie
H. Ballard - Springfield

/clb

1401 Sheridan Ave., P.O. Box 540
Springfield, Ohio 45501
(513) 327-4200 Telex ITT 4946775

E. Requested permitted equipment operating time: hrs/day 24 ; days/wk 7 ; wks/yr 50 ;

if power plant, hrs/yr_____; if seasonal, describe: ______________________

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

1. Is this source in a non-attainment area for a particular pollutant? YES

   a. If yes, has "offset" been applied? NO

   b. If yes, has "Lowest Achievable Emission Rate" been applied? NO

   c. If yes, list non-attainment pollutants. OZONE

2. Does best available control technology (BACT) apply to this source? If yes, see Section VI. NO

3. Does the State "Prevention of Significant Deterioriation" (PSD) requirement apply to this source? If yes, see Sections VI and VII. NO

4. Do "Standards of Performance for New Stationary Sources" (NSPS) apply to this source? NO

5. Do "National Emission Standards for Hazardous Air Pollutants" (NESHAP) apply to this source? NO

H. Do "Reasonably Available Control Technology" (RACT) requirements apply to this source? NO

   a. If yes, for what pollutants? N/A

   b. If yes, in addition to the information required in this form, any information requested in Rule 17-2.650 must be submitted.

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

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

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

Description	Contaminants Type	Contaminants % Wt	Utilization Rate - lbs/hr	Relate to Flow Diagram

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

1. Total Process Input Rate (lbs/hr): ______

2. Product Weight (lbs/hr): ______

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

Name of Contaminant	Emission[1] Maximum lbs/hr	Emission[1] Actual T/yr	Allowed[2] Emission Rate per Rule 17-2	Allowable[3] Emission lbs/hr	Potential[4] Emission lbs/yr	Potential[4] Emission T/yr	Relate to Flow Diagram
NOx	4.2	17.6	N/A	N/A	4.2	17.6	
CO	5.6	23.5	"	Proposed NSPS 700 ppm	5.6	23.5	
NMHC	1.4	5.9	"	N/A	1.4	5.9	
SO2	1.2	5.0	"	N/A	1.2	5.0	
OPACITY	< 20%		< 20%				

[1]See Section V, Item 2.

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

[3]Calculated from operating rate and applicable standard.

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

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

Name and Type (Model & Serial No.)	Contaminant	Efficiency	Range of Particles Size Collected (in microns) (If applicable)	Basis for Efficiency (Section V Item 5)

E. Fuels

Type (Be Specific)	Consumption*		Maximum Heat Input (MMBTU/hr)
	avg/hr	max./hr	
Digester Gas	0.014*	0.014*	9.3*
		* Per engine operating	

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

Fuel Analysis:

Percent Sulfur: ______ Percent Ash: 0

Density: 0.063 lbs/~~gal~~ c.f. Typical Percent Nitrogen: 0

Heat Capacity: 10,472 BTU/lb -- BTU/gal

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

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

Annual Average ______ Maximum ______

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

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

Stack Height: 40 ft. Stack Diameter: 1.5 ft.

Gas Flow Rate: 7,384 ACFM 2,758 DSCFM Gas Exit Temperature: 780 °F.

Water Vapor Content: 12% % Velocity: 70 FPS

SECTION IV: INCINERATOR INFORMATION

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

Description of Waste ______________________

Total Weight Incinerated (lbs/hr) ____________ Design Capacity (lbs/hr) ____________

Approximate Number of Hours of Operation per day ______ day/wk ______ wks/yr. ________

Manufacturer ______________________

Date Constructed ____________ Model No. ____________

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

Stack Height: ________ ft. Stack Diamter: ____________ Stack Temp. ________

Gas Flow Rate: ____________ ACFM ____________ DSCFM* Velocity: ____________ FPS

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

Type of pollution control device: [ ] Cyclone [ ] Wet Scrubber [ ] Afterburner

[ ] Other (specify) ____________

7 June 1988
Miami, FL

MIAMI-DADE WATER AND SEWER AUTHORITY DEPARTMENT

P. O. BOX 330316
MIAMI, FLORIDA 33233-0316

Main Office
3575 S. LeJeune Road
Telephone 665-7471

May 13, 1988

RECEIVED
JUN 9 1988
DER - BAQM

Mr. C. H. Fancy, P.E.
Deputy Chief
Bureau of Air Quality Management
Florida Department of Environmental Regulation
2600 Blair Stone Road
Tallahassee, Florida 32399-2400

Re: Air Construction Permit Numbers: AC13-146961 thru 63 - MDWASAD C.N. S-328

Dear Mr. Fancy:

Enclosed, please find the information required by your letter to us dated April 12, 1988. Enclosure includes:

1. Two copies each of pages 3, 4, 5, and 6 of the application for permit to construct the power generating facility of the subject permit numbers. These have been revised. Please discard the old pages and insert these new ones.

2. Two copies of the engine emission calculations based on data provided by the manufacturer of the specified engines. Please discard the old copies and insert these new ones.

   Each set of emission calculations includes the following attachments:

   a. Copies of letters from Cooper Industries about emissions using digester gas.

   b. Copy of the results of a test for CO_2 content in digester gas.

   c. Copy of the record of H_2S content in gas to engines.

If you have any questions, please contact Roger Varona of our staff at (305) 665-7471, extension 296.

Sincerely,

(FF)

Robert A. Cuevas

Copied: Barry Andrews
CHF / BT } 6.10.88

Robert A. Cuevas, P.E.
Chief Engineer

RAC/RV/ih
Enclosures
cc: Stephanie Brooks, DER, S.E. District
Patrick Wong, DERM
B. Wells, MDWASAD

3-11
recd 3-14

6-10

Barry:
Response
to incompleteness

Rc'd 7-19-88
AM [illegible]

E. Requested permitted equipment operating time: hrs/day 24 ; days/wk 7 ; wks/yr 50 ;

if power plant, hrs/yr _____; if seasonal, describe: ____________________

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

1. Is this source in a non-attainment area for a particular pollutant? YES

   a. If yes, has "offset" been applied? NO

   b. If yes, has "Lowest Achievable Emission Rate" been applied? NO

   c. If yes, list non-attainment pollutants. OZONE

2. Does best available control technology (BACT) apply to this source? If yes, see Section VI. NO

3. Does the State "Prevention of Significant Deterioriation" (PSD) requirement apply to this source? If yes, see Sections VI and VII. NO

4. Do "Standards of Performance for New Stationary Sources" (NSPS) apply to this source? NO

5. Do "National Emission Standards for Hazardous Air Pollutants" (NESHAP) apply to this source? NO

H. Do "Reasonably Available Control Technology" (RACT) requirements apply to this source? NO

   a. If yes, for what pollutants? N/A

   b. If yes, in addition to the information required in this form, any information requested in Rule 17-2.650 must be submitted.

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

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

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

Description	Contaminants		Utilization Rate - lbs/hr	Relate to Flow Diagram
	Type	% Wt		

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

1. Total Process Input Rate (lbs/hr): ____________________

2. Product Weight (lbs/hr): ____________________

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

Name of Contaminant	Emission[1]		Allowed[2] Emission Rate per Rule 17-2	Allowable[3] Emission lbs/hr	Potential[4] Emission		Relate to Flow Diagram
	Maximum lbs/hr	Actual T/yr			lbs/yr	T/yr	
NOx	4.2	17.6	N/A	N/A	4.2	17.6	
CO	5.6	23.5	"	Proposed NSPS 700 ppm	5.6	23.5	
NMHC	1.4	5.9	"	N/A	1.4	5.9	
SO2	1.2	5.0	"	N/A	1.2	5.0	
OPACITY	< 20%		< 20%				

[1]See Section V, Item 2.

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

[3]Calculated from operating rate and applicable standard.

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

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

Name and Type (Model & Serial No.)	Contaminant	Efficiency	Range of Particles Size Collected (in microns) (If applicable)	Basis for Efficiency (Section V Item 5)

E. Fuels

Type (Be Specific)	Consumption*		Maximum Heat Input (MMBTU/hr)
	avg/hr	max./hr	
Digester Gas	0.014*	0.014*	9.3*
		* Per engine operating	

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

Fuel Analysis:

Percent Sulfur: ______________ Percent Ash: 0

Density: 0.063 lbs/~~gal~~ c.f. Typical Percent Nitrogen: 0

Heat Capacity: 10,472 BTU/lb -- BTU/gal

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

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

Annual Average ______________ Maximum ______________

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

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

Stack Height: 40 ft. Stack Diameter: 1.5 ft.

Gas Flow Rate: 7,384 ACFM 2,758 DSCFM Gas Exit Temperature: 780 °F.

Water Vapor Content: 12% % Velocity: 70 FPS

SECTION IV: INCINERATOR INFORMATION

Type of Waste	Type 0 (Plastics)	Type I (Rubbish)	Type II (Refuse)	Type III (Garbage)	Type IV (Patholog-ical)	Type V (Liq.& Gas By-prod.)	Type VI (Solid By-prod.)
Actual lb/hr Inciner-ated							
Uncon-trolled (lbs/hr)							

Description of Waste ______

Total Weight Incinerated (lbs/hr) ______ Design Capacity (lbs/hr) ______

Approximate Number of Hours of Operation per day ______ day/wk ______ wks/yr. ______

Manufacturer ______

Date Constructed ______ Model No. ______

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

Stack Height: ______ ft. Stack Diamter: ______ Stack Temp. ______

Gas Flow Rate: ______ ACFM ______ DSCFM* Velocity: ______ FPS

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

Type of pollution control device: [ ] Cyclone [ ] Wet Scrubber [ ] Afterburner

[ ] Other (specify) ______

SOUTH DISTRICT WASTEWATER TREATMENT PLANT
DIGESTER GAS UTILIZATION
Contract Number S-328

ENGINE EMISSIONS
(May 25, 1988)

I. ENGINE GENERATORS

Three (3) new identical units provided called Generator #1, Generator #2 and Generator #3. These consist of gas engines direct driving electric generators.

Engine characteristics are as follows:
Type: Stationary internal combustion engines.
Model: Cooper Industries 12GTL(B), or equal.
BMEP: 150 psig.
Speed: 720 RPM

Engine-generator performance:
Electrical output: 900 KW
Generator efficiency: 95%
Fuel requirements: 7300 BTU/BHP-HR*

*Based on LHV of fuel gas, per manufacturers data.

II. GAS USE

The gas composition shown below is average for scrubbed digester gas at the Central District Wastewater Treatment Plant. The attached gas analysis is for a typical day and varies slightly from average. Average composition is used for design for most realistic results.

The gas analyses of the Central District Wastewater Treatment Plant have been used for design of the generating facility at the South District Wastewater Treatment Plant for the following reasons:

The sewage treated, the treatment process and the sludge digestion are similar at both plants.

No gas scrubbers presently exist at the South Plant. This project includes the installation of scrubbers that are similar to those existing at the Central Plant.

For the above reasons, it is safe to assume that the scrubbed digester gas composition will be similar for both plants.

GAS COMPOSITION:
(From plant data, design average)

CH_4: 72.1 % by volume
CO_2: 27.9 % by volume
H_2S: 33 grains per 100 SCF of gas

LHV: .721 X 913 = 658 BTU/SCF
S.G.: .823
M.W.: 23.83 (average)

GAS USED PER ENGINE

$$900\ KW \times \frac{1\ BHP}{0.746\ KW} \times \frac{1}{.95(Eff)} = 1270\ BHP$$

$$1270\ BHP \times \frac{7300\ BTU}{BHP\text{-}HR} \times \frac{SCF}{658\ BTU} = 14{,}090\ SCFH$$

MAXIMUM YEARLY USE OF ANY ENGINE:

$$24\ \frac{HRS}{DAY} \times 7\ \frac{DAYS}{WEEK} \times 50\ \frac{WEEKS}{YEAR} = 8{,}400\ \frac{HRS}{YEAR}$$

III. ENGINE MANUFACTURERS DATA

(See attached letters from Cooper Industries)

GUARANTEED MAXIMUM EMISSION RATES:

NO_x: 1.5 gms/BHP-HR
CO: 2.0 gms/BHP-HR
NMHC*: 0.5 gms/BHP-HR

*Non methane hydrocarbons

OTHER ENGINE MANUFACTURER DATA:

NO_x: 203 ppm @ 9.5% O_2
NO_x: 105 ppm @ 15% O_2
THC**: 5.0 gms/BHP-HR

**Total hydrocarbons

IV. PRODUCTS OF COMBUSTION

Gas used = 14,090 SCFH (per part II of this report)

Gas composition

CH_4: .721 x 14090 = 10,159 SCFH

$$10{,}159\ \frac{SCF}{hr} \times \frac{1\ Lb\text{-}mol}{379.5\ SCF} \times \frac{16.03\ LB}{Lb\text{-}mol} = 429.1\ LB/hr$$

CO_2: 14,090 - 10,159 = 3,931 SCFH

$$3{,}931\ \frac{SCF}{hr} \times \frac{1\ Lb\text{-}mol}{379.5\ SCF} \times \frac{44\ LB}{Lb\text{-}mol} = 455.8\ LB/hr$$

Consider first stoichiometric combustion:

			SCFH	LB/hr
To Engines	CH_4:		10,159	429.1
	CO_2:		3,931	455.8
	Air:	10,159 X 9.53	96,815	
		429.1 X 17.22		7,389.1
				8,724.0
From Engines	CO_2:	10,159 X 1 + 3,931	14,090	
		429.1 X 2.74 + 455.8		1,631.5
	N_2:	10,159 X 7.53	76,497	
		429.1 X 13.23		5,677.0
	H_2Ovapor:	10,159 X 2	20,318	
		429.1 X 2.25		965.5
	Total products of combustion		110,905	8,274.0
	Dry products of combustion		90,587	7,308.5

For 9.5% O_2 in dry products:

(Actual engine operations, per manufacturers data)

$(90{,}587 + O_2 + N_2)\ 0.095 = O_2$

Where O_2 is Oxygen in excess air
N_2 is nitrogen in excess air

$N_2 = 3.764\ O_2$

$(90{,}587 + O_2 + 3.764\ O_2)\ 0.095 = O_2$
$O_2 = 15{,}721$ SCFH

Excess air: 15,721 X 4.764 = 74,895 SCFH

Total exhaust (dry basis)

90,587 + 74,895 = 165,482 DSCFH
Exhaust temperature = 780 °F

Actual exhaust volume (including water vapors)

$$\frac{(110{,}905 + 74{,}895)\ (460 + 780)}{(460 + 60)} = 443{,}062 \text{ ACFH}$$

For 15% O_2 in dry products:

(Calculated at 15% for checking per New Source standard)

$(90{,}587 + O_2 + N_2)\ 0.15 = O_2$

$(90{,}587 + O_2 + 3.764\ O_2)\ 0.15 = O_2$
$O_2 = 47{,}611$ SCFH

Excess air: 47,611 X 4.764 = 226,819 SCFH

Total exhaust products (dry basis):

90,587 + 226,819 = 317,406 DSCFH

Exhaust flow in stack:

(At actual operating conditions of 9.5% O2)

Dry gases:

$$165{,}482 \frac{DSCF}{hr} \times \frac{1\ hr}{60\ mm} = 2{,}758\ DSCFM$$

Actual:

$$443{,}062 \frac{ACF}{hr} \times \frac{1\ hr}{60mm} = 7{,}384\ ACFM$$

Stack flow area: $\left(\frac{1.5}{2}\right)^2 \pi = 1.767$ S.F.

Initial exhaust gas velocity:

$$7{,}384 \frac{CF}{min} \times \frac{1\ min}{60\ sec} \times \frac{1}{1.767\ S.F.} = 70\ F.P.S.$$

Water vapor content:

Water vapor as product of combustion = 20,318 SCFH

Consider supply air to engine as 85°F, 50% R.H.

Additional moisture converted into vapor

$$(96{,}815 + 74{,}895) \frac{SCF}{hr} \times 0.076 \frac{LB}{SCF} Air \times \frac{0.011\ LbH2O}{Lb\ Air} = 143.5 \frac{Lb\ H2O}{hr}$$

Additional vapor in exhaust:

$$\frac{143.5}{18} \times 379.5 = 3025\ SCFH$$

Total exhaust = 110,905 + 74,895 + 3,025 = 188,825 SCFH

Total vapor inexhaust = 20,318 + 3,025 = 23,343 SCFH

Vapor content = $\frac{23{,}343}{188{,}825} = 0.12$

or 12%

V. EMISSIONS CALCULATIONS

Per manufacturer's guarantee:

NOx

$$1270 \text{ BHP} \times \frac{1.5 \text{ gms}}{\text{BHP-Hr}} \times \frac{1 \text{ lb}}{454 \text{ gm}} = \underline{4.2} \text{ lbs/hr}$$

CO

$$1270 \text{ BHP} \times \frac{2.0 \text{ gm}}{\text{BHP - Hr}} \times \frac{1 \text{ LB}}{454 \text{ gm}} = 5.6 \text{ lb/hr}$$

NMHC*

*Non methane hydrocarbons

$$1270 \text{ BHP} \times \frac{0.5 \text{ gm}}{\text{BHP-Hr}} \times \frac{1 \text{ LB}}{454 \text{ gm}} = \underline{1.4} \text{ lb/hr}$$

VI. OTHER EMISSION CALCULATIONS

NOx:
Per manufacturer's calculated data:
Assume 97% NO_2 3% NO_3

$\overline{MW} = .97\ (46) + .03\ (62) = 46.5$

NOx emissions:

$$\frac{\text{PPM} \times \overline{\text{MW}}}{\text{Molar Volume}}$$

At 9.5% O_2 in exhaust gases

203 PPM of NOx (per manufacturer's data)

$$203 \times 10^{-6} \times 46.5 \frac{\text{Lb}}{\text{Lb-mol}} \times \frac{1 \text{ Lb-mol}}{379.5 \text{ SCF}} = 24.87 \times 10^{-6} \text{ Lb/SCF}$$

$$165{,}482 \frac{\text{SCF}}{\text{hr}} \times 24.87 \times 10^{-6} \frac{\text{Lb}}{\text{SCF}} = 4.1 \text{ Lb/SCF}$$

Agrees with guarantee

At 15% O2 in exhaust gases

105 PPM of NOx (per manufacturer's data)

$$105 \times 10^{-6} \times 46.5 \frac{Lb}{Lb\text{-}mol} \times \frac{1\ Lb\text{-}mol}{379.5\ SCF} = 12.87 \times 10^{-6}\ Lb/SCF$$

$$317{,}406 \frac{SCF}{hr} \times 12{,}87\ 10^{-6} \frac{Lb}{SCF} = 4.1\ Lb/SCF$$

700 ppm = 27.2
×3
81.7

Agrees with guarantee

THC**
Per manufacturer's calculated data.
** Total hydrocarbons

$$1270\ BHP \times \frac{5\ gm}{BHP\text{-}HR} \times \frac{1\ LB}{454\ gm} = \underline{14.0}\ LB/hr$$

SO2
Per average composition of scrubbed digester gas

$$H2S\ in\ gas: \frac{33\ grains}{100\ SCF} \times \frac{1\ LB}{7000\ grains} \times 14{,}090 \frac{SCF}{Hr} = 0.66 \frac{LB}{Hr}$$

$$S: \frac{0.66\ LB}{Hr} \times \frac{32\ (MW\ of\ S)}{34\ (MW\ of\ H2S)} = 0.62\ LB/hr$$

$$SO2: 0.62 \frac{LB}{HR} \times \frac{64\ (MW\ of\ SO2)}{32\ (MW\ of\ S)} = \underline{1.24}\ LB/hr$$

VII. EMISSIONS SUMMARY

	LB/hr	Tons/year		lbs/hr	TPY
NOx	4.2	17.6	vs.	27.2	81.7
CO	5.6	23.5			
NMHC	1.4	5.9			
THC	14.0	58.8			
SO2	1.2	5.0			

MEMORANDUM

DADE COUNTY FORM 107.07-17A

TO ROGER VARONA, Special Projects Engineer - Room 208

DATE MAY 12, 1988

SUBJECT REMOVAL OF CARBON DIOXIDE BY SCRUBBERS

FROM YVONNE W. WALTON, Chemist 2
Central District WWTP

Yvonne Walton

The gas to and from Plant #1 scrubbers was analysed on May 11, 1988 for Carbon Dioxide content: to scrubbers 35.0%
from scrubbers 27.0%

Plant #2 scrubbers had an average Carbon Dioxide content of 35.6% in and 26.8% out for April 1988.

YWW/ah

cc: R. Aceto
R. Culmer

MIAMI-DADE WATER AND SEWER AUTHORITY DEPARTMENT

CENTRAL DISTRICT WASTEWATER TREATMENT PLANT

RECORD OF H2S CONTENT IN GAS TO ENGINES

Below is a summary of the average H2S content of the scrubbed digester gas at the plant.

Month	H2S in gas to engines, Average (grains per 100 C.F.)
Jan., 1987	43.9
Feb., 1987	45.0
March, 1987	25.0
April, 1987	29.0
May, 1987	28.4
June, 1987	15.7
July, 1987	34.8
August, 1987	28.7
Sept., 1987	37.0
Oct., 1987	33.4
Nov., 1987	41.5
Dec., 1987	37.9
	33.3

Monthly averages calculated from daily analyses of gas as shown in the plat operating records. Computed by Rogelio Varona, P.E., May 18, 1988.

Rogelio Varona
May 18, 1988

AJAX-SUPERIOR
COOPER INDUSTRIES

April 28, 1988

Mr. Roger Varona
Miami Dade Water and Sewer Authority Department
P.O. Box 33036
Miami, FL 33233-0316

Re: South District Wastewater Treatment Plant
Digester Gas Utilization

Subject: Superior 12GTLB Gensets (900 KWe)
Site Emissions Guarantee

Dear Mr. Varona:

Based on the digester gas composition you submitted to us for review, Cooper Industries, Ajax-Superior Division hereby guarantees that the 12GTLB CleanBurn II engines quoted on referenced project will not exceed the following emissions levels at full load rating of 1270 BHP/720 RPM;

NOx	1.5 gms/BHP-HR
CO	2.0 gms/BHP-HR
NMHC	0.5 gms/BHP-HR

In the event that the 12GTLB engines furnished for this WWTP project fail to meet guaranteed emission levels, Superior will modify the engine or its components in order to comply with stated guarantee. This modification will be carried out by Superior at no charge to Miami Dade Water and Sewer Authority.

Yours truly,

L. R. Peltier

L. R. Peltier
Senior Application Engineer

/clb

cc: T. Lamberth - ESG/Metairie
H. Ballard - Spfld

1401 Sheridan Ave., P.O. Box 540
Springfield, Ohio 45501
(513) 327-4200 Telex ITT 4946775

AJAX-SUPERIOR

May 2, 1988

Mr. Roger Varona
Miami Dade Water and Sewer Authority Dept.
3575 S. Le Jeane Road
Miami, Florida 33146-2221

Re: South District Wastewater Treatment Plant
Digester Gas Utilization Project

Subject: Additional Emissions Data
12GTLA Gensets (900 KWe)

Dear Roger:

With reference to the attached site emissions guarantee letter for this project, we are submitting the following additional data to assist you in your response to the State of Florida, Department of Environmental Regulations. Please note, this data is based on digester gas composition per your submission and operating load of 1270 BHP/720 RPM.

1) It is our understanding that you intend to operate these engines on digester gas, only. Superior will build these engines with high compression ratio pistons (10:1) to optimize BSFC. At 1270 BHP/720 RPM, we would guarantee a fuel consumption rate of not exceeding 7300 BTU/BHP-HR (plus 3% for site measurement tolerance) based on the LHV of the digester gas.

2) The 1.5/BHP-HR (actual) for NOx in the exhaust is equal to 203 ppm. Per New Source Standard, NOx corrected to 15% O2, day basis is 105 ppm.

3) Combustion air flow is 11.2 lbs/BHP-HR which is 237 lbs/min at 1270 BHP.

4) Oxygen content of the exhaust at 1270 BHP is 9.5%, dry basis.

5) Total hydro carbon (THC) emission (actual) is 5.0 gms/BHP-HR.

We trust this information is satisfactory for your purposes and if you require additional assistance, please contact me at your convenience.

Yours very truly,

L. R. Peltier
L. R. Peltier
Senior Application Engineer

cc: T. Lamberth - ESG/Metairie
H. Ballard - Springfield

/clb

1401 Sheridan Ave., P.O. Box 540
Springfield, Ohio 45501
(513) 327-4200 Telex: ITT 4946775

GAS ENGINES • DIESEL ENGINES • RECIPROCATING COMPRESSORS

BEST AVAILABLE COPY

Air bill # 61908598 72

3.11.88
Miami, FL

2269

MIAMI-DADE WATER AND SEWER AUTHORITY DEPARTMENT

P. O. BOX 330316
MIAMI, FLORIDA 33233-0316

Main Office
3575 S. LeJeune Road
Telephone 665-7471

Receipt # 117533
V# 44414
$1,500.00

FEDERAL EXPRESS

March 11, 1988

AC 13-146961
AC 13-146962
AC 13-146963

Mr. Bill Thomas
Central Air Permitting Section
State of Florida
Department of Environmental Regulation
2600 Blair Stone Road
Tallahassee, Florida 32399-2400

Re: Dade County Miami-Dade Water and Sewer Authority Department South District Wastewater Treatment Plant Digester Gas Utilization Project Construction Permit Application

Dear Mr. Thomas:

As directed by Ms. Stephanie S. Brooks of the Southeast Florida District in her letter of February 25, 1988, please find enclosed the construction permit application forms for the South District Wastewater Treatment Plant digester gas utilization project. This project consists of digester gas scrubbers, gas pipeline, gas compressors, gas storage spheres and gas fueled engines powering electrical generators. A check for the required application fee of $1,500 is also enclosed.

If you have any questions on the application, please call me or Robert Cuevas at 305-665-7471.

Very truly yours,

Garrett Sloan
Director

GS/REF/fb

Barry Andrews called CO (?) on 3.21.88, copy of package already mailed to WPB Dist Office and DERM

1031

copied Wayne Aronson, Miguel Flores } 3.22.88

POOLED CASH FUND
P.O. BOX 330316 • MIAMI, FLORIDA 33133

44414

DATE	PAYEE NAME			
03/10/88	STATE OF FLORIDA, DEPT, OF ENVIRONMENTAL REGULATION			2269

INVOICE DATE	INVOICE NUMBER	AMOUNT	PURCHASE ORDER NUMBER	DESCRIPTION
03/08/88		$1,500.00		Permit Fee for the Central District Digester Gas Generators.

The attached check represents the amount due for services performed by you for the benefit of Dade County to date, as shown on file in the Clerk's Office

METRO-DADE

STATE OF FLORIDA-COUNTY OF DADE-MIAMI, FLORIDA 44414 63-66 660

MIAMI-DADE WATER AND SEWER AUTHORITY DEPARTMENT-POOLED CASH FUND

SUN BANK/MIAMI N.A.
MIAMI, FLORIDA

VOID AFTER SIX MONTHS

2269

AUDIT NUMBER

Date	Warrant Number	Amount of Check
03/10/88	44414	$1,500.00

PAY EXACTLY *************1,500 DOLLARS AND *******00 CENTS

To The Order Of

STATE OF FLORIDA
DEPT, OF ENVIRONMENTAL REGULATION

BOARD OF COUNTY COMMISSIONERS

COUNTY COMMISSIONERS DADE COUNTY FLORIDA

Stephen P. Clark
MAYOR

Richard P. Brinker
CLERK

[redacted]

This project consists of digester gas scrubbers, gas pipeline, gas compressors, gas storage spheres and gas fueled engines powering electrical generators. A check for the required application fee of $1,500 is also enclosed.

If you have any questions on the application, please call me or Robert Cuevas at 305-665-7471.

Very truly yours,

Garrett Sloan
Director

GS/REF/fb

1031

STATE OF FLORIDA

DEPARTMENT OF ENVIRONMENTAL REGULATION

DER
Rec'd w/ fee
3·14·88

AC 13-146961, -962, -963

SOUTHEAST FLORIDA DISTRICT
1900 SOUTH CONGRESS AVENUE
WEST PALM BEACH, FLORIDA 33406

RECEIVED
FEB 29 1988
Dept. of Environmental Reg.
West Palm Beach

BOB MARTINEZ
GOVERNOR
DALE TWACHTMANN
SECRETARY
J. SCOTT BENYON
DISTRICT MANAGER

APPLICATION TO OPERATE/CONSTRUCT AIR POLLUTION SOURCES

SOURCE TYPE: Digester GAs Burning Generators [X] New[1] [ ] Existing[1]

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

COMPANY NAME: Miami DAde WAter and Sewer Authority Department South District Wastewater Treatment Plant COUNTY: Dade

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

SOURCE LOCATION: Street 8950 SW 232 Street City Miami, FL 33032

UTM: East 66,600m 565.18 North 25,500m 2826.86

Latitude 25 ° 33 ' 33 "N Longitude 80 ° 21 ' 04 "W

APPLICANT NAME AND TITLE: Garrett Sloan, Director

APPLICANT ADDRESS: 3575 South LeJeune Road, Miami, FL 33133

SECTION I: STATEMENTS BY APPLICANT AND ENGINEER

A. APPLICANT

I am the undersigned owner or authorized representative* of Miami Dade Water and Sewer Auth. Dept.

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

*Attach letter of authorization Signed: [signature]

Garrett Sloan, Director
Name and Title (Please Type)

Date: ____________ Telephone No. 305-665-7471

B. PROFESSIONAL ENGINEER REGISTERED IN FLORIDA (where required by Chapter 471, F.S.)

This is to certify that the engineering features of this pollution control project have been designed/examined by me and found to be in conformity with modern engineering principles applicable to the treatment and disposal of pollutants characterized in the permit application. There is reasonable assurance, in my professional judgment, that

[1] See Florida Administrative Code Rule 17-2.100(57) and (104)

Rodger Vernon
Bob Ferguson

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

Signed ________________

Robert A. Cuevas, P.E.
Name (Please Type)

Miami-Dade Water & Sewer Authority Department
Company Name (Please Type)

3575 South LeJeune Road Miami, FL 33146-2221
Mailing Address (Please Type)

Florida Registration No. 6285 Date: ________ Telephone No. 305 665-7471

SECTION II: GENERAL PROJECT INFORMATION

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

The construction of a facility to generate electricity from digester gas. Consisting of three (3) engine-generators and auxiliaries.

B. Schedule of project covered in this application (Construction Permit Application Only)

Start of Construction 1988 Completion of Construction 1990

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

Three (3) engine-generator sets for approximately $ 2,500,000.00

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

E. Requested permitted equipment operating time: hrs/day 24 ; days/wk 7 ; wks/yr 50 ;

if power plant, hrs/yr_____; if seasonal, describe: ______________________

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

1. Is this source in a non-attainment area for a particular pollutant? YES

   a. If yes, has "offset" been applied? NO

   b. If yes, has "Lowest Achievable Emission Rate" been applied? NO

   c. If yes, list non-attainment pollutants. OZONE

2. Does best available control technology (BACT) apply to this source? If yes, see Section VI. YES

3. Does the State "Prevention of Significant Deterioriation" (PSD) requirement apply to this source? If yes, see Sections VI and VII. NO

4. Do "Standards of Performance for New Stationary Sources" (NSPS) apply to this source? NO

5. Do "National Emission Standards for Hazardous Air Pollutants" (NESHAP) apply to this source? NO

H. Do "Reasonably Available Control Technology" (RACT) requirements apply to this source? NO

   a. If yes, for what pollutants? N/A

   b. If yes, in addition to the information required in this form, any information requested in Rule 17-2.650 must be submitted.

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

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

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

Description	Contaminants Type	Contaminants % Wt	Utilization Rate - lbs/hr	Relate to Flow Diagram

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

1. Total Process Input Rate (lbs/hr): ______

2. Product Weight (lbs/hr): ______

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

Name of Contaminant	Emission[1] Maximum lbs/hr	Emission[1] Actual T/yr	Allowed[2] Emission Rate per Rule 17-2	Allowable[3] Emission lbs/hr	Potential[4] Emission lbs/yr	Potential[4] Emission T/yr	Relate to Flow Diagram
VOC	1.23	5.17	N/A	N/A	1.23	5.17	
NO_x	13.60	57.12	"	Proposed NSPS 700 ppm	13.60	57.12	
CO	3.92	16.46	"	N/A	3.92	16.46	
SO_2	1.12	4.70	"	N/A	1.12	4.70	
Opacity	<20%		<20%				

[1]See Section V, Item 2.

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

[3]Calculated from operating rate and applicable standard.

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

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

Name and Type (Model & Serial No.)	Contaminant	Efficiency	Range of Particles Size Collected (in microns) (If applicable)	Basis for Efficiency (Section V Item 5)

E. Fuels

Type (Be Specific)	Consumption*		Maximum Heat Input (MMBTU/hr)
	avg/hr	max./hr	
Digester Gas	0.0135*	0.0135*	9.46*
	0.0158**	0.0270**	18.92**
	* Each engine-generator	** two engine-generators actual expected	

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

Fuel Analysis:

Percent Sulfur: ______ Percent Ash: ______

Density: ______ lbs/gal Typical Percent Nitrogen: ______

Heat Capacity: ______ BTU/lb ______ BTU/gal

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

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

Annual Average ______ Maximum ______

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

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

Stack Height: 40 ft. Stack Diameter: 1.5 ft.

Gas Flow Rate: 6374 ACFM 2,673 DSCFM Gas Exit Temperature: 780 °F.

Water Vapor Content: 11 % Velocity: 60 FPS

SECTION IV: INCINERATOR INFORMATION N/A

Type of Waste	Type O (Plastics)	Type I (Rubbish)	Type II (Refuse)	Type III (Garbage)	Type IV (Patholog-ical)	Type V (Liq.& Gas By-prod.)	Type VI (Solid By-prod.)
Actual lb/hr Inciner-ated							
Uncon-trolled (lbs/hr)							

Description of Waste ______

Total Weight Incinerated (lbs/hr) ______ Design Capacity (lbs/hr) ______

Approximate Number of Hours of Operation per day ______ day/wk ______ wks/yr. ______

Manufacturer ______

Date Constructed ______ Model No. ______

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

Stack Height: ______ ft. Stack Diamter: ______ Stack Temp. ______

Gas Flow Rate: ______ ACFM ______ DSCFM* Velocity: ______ FPS

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

Type of pollution control device: [ ] Cyclone [ ] Wet Scrubber [ ] Afterburner

[ ] Other (specify) ______

Brief description of operating characteristics of control devices: N/A

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

N/A

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

SECTION V: SUPPLEMENTAL REQUIREMENTS

Please provide the following supplements where required for this application.

1. Total process input rate and product weight -- show derivation [Rule 17-2.100(127)]

2. To a construction application, attach basis of emission estimate (e.g., design calculations, design drawings, pertinent manufacturer's test data, etc.) and attach proposed methods (e.g., FR Part 60 Methods 1, 2, 3, 4, 5) to show proof of compliance with applicable standards. To an operation application, attach test results or methods used to show proof of compliance. Information provided when applying for an operation permit from a construction permit shall be indicative of the time at which the test was made.

3. Attach basis of potential discharge (e.g., emission factor, that is, AP42 test).

4. With construction permit application, include design details for all air pollution control systems (e.g., for baghouse include cloth to air ratio; for scrubber include cross-section sketch, design pressure drop, etc.)

5. With construction permit application, attach derivation of control device(s) efficiency. Include test or design data. Items 2, 3 and 5 should be consistent: actual emissions = potential (1-efficiency).

6. An 8 1/2" x 11" flow diagram which will, without revealing trade secrets, identify the individual operations and/or processes. Indicate where raw materials enter, where solid and liquid waste exit, where gaseous emissions and/or airborne particles are evolved and where finished products are obtained.

7. An 8 1/2" x 11" plot plan showing the location of the establishment, and points of airborne emissions, in relation to the surrounding area, residences and other permanent structures and roadways (Example: Copy of relevant portion of USGS topographic map).

8. An 8 1/2" x 11" plot plan of facility showing the location of manufacturing processes and outlets for airborne emissions. Relate all flows to the flow diagram.

9. The appropriate application fee in accordance with Rule 17-4.05. The check should be made payable to the Department of Environmental Regulation.

10. With an application for operation permit, attach a Certificate of Completion of Construction indicating that the source was constructed as shown in the construction permit.

SECTION VI: BEST AVAILABLE CONTROL TECHNOLOGY N/A

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

[ ] Yes [ ] No

Contaminant	Rate or Concentration

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

[ ] Yes [ ] No

Contaminant	Rate or Concentration

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

Contaminant	Rate or Concentration

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

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

*Explain method of determining

5. Useful Life:

6. Operating Costs:

7. Energy:

8. Maintenance Cost:

9. Emissions:

Contaminant	Rate or Concentration

10. Stack Parameters

a. Height: ft.

b. Diameter: ft.

c. Flow Rate: ACFM

d. Temperature: °F.

e. Velocity: FPS

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

1.

a. Control Device:

b. Operating Principles:

c. Efficiency:[1]

d. Capital Cost:

e. Useful Life:

f. Operating Cost:

g. Energy:[2]

h. Maintenance Cost:

i. Availability of construction materials and process chemicals:

j. Applicability to manufacturing processes:

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

2.

a. Control Device:

b. Operating Principles:

c. Efficiency:[1]

d. Capital Cost:

e. Useful Life:

f. Operating Cost:

g. Energy:[2]

h. Maintenance Cost:

i. Availability of construction materials and process chemicals:

[1]Explain method of determining efficiency.
[2]Energy to be reported in units of electrical power - KWH design rate.

j. Applicability to manufacturing processes:

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

3.

a. Control Device:

b. Operating Principles:

c. Efficiency:[1]

d. Capital Cost:

e. Useful Life:

f. Operating Cost:

g. Energy:[2]

h. Maintenance Cost:

i. Availability of construction materials and process chemicals:

j. Applicability to manufacturing processes:

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

4.

a. Control Device:

b. Operating Principles:

c. Efficiency:[1]

d. Capital Costs:

e. Useful Life:

f. Operating Cost:

g. Energy:[2]

h. Maintenance Cost:

i. Availability of construction materials and process chemicals:

j. Applicability to manufacturing processes:

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

F. Describe the control technology selected:

1. Control Device:

2. Efficiency:[1]

3. Capital Cost:

4. Useful Life:

5. Operating Cost:

6. Energy:[2]

7. Maintenance Cost:

8. Manufacturer:

9. Other locations where employed on similar processes:

a. (1) Company:

(2) Mailing Address:

(3) City:

(4) State:

[1]Explain method of determining efficiency.
[2]Energy to be reported in units of electrical power - KWH design rate.

(5) Environmental Manager:

(6) Telephone No.:

(7) Emissions:[1]

Contaminant	Rate or Concentration

(8) Process Rate:[1]

b. (1) Company:

(2) Mailing Address:

(3) City: (4) State:

(5) Environmental Manager:

(6) Telephone No.:

(7) Emissions:[1]

Contaminant	Rate or Concentration

(8) Process Rate:[1]

10. Reason for selection and description of systems:

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

SECTION VII - PREVENTION OF SIGNIFICANT DETERIORATION

A. Company Monitored Data

1. ________ no. sites ________ TSP ________ ( ) SO^2* ________ Wind spd/dir

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

Other data recorded ______________________________

Attach all data or statistical summaries to this application.

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

2. Instrumentation, Field and Laboratory

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

b. Was instrumentation calibrated in accordance with Department procedures?

[ ] Yes [ ] No [ ] Unknown

B. Meteorological Data Used for Air Quality Modeling

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

2. Surface data obtained from (location)________________________________

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

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

C. Computer Models Used

1. ________________________________ Modified? If yes, attach description.

2. ________________________________ Modified? If yes, attach description.

3. ________________________________ Modified? If yes, attach description.

4. ________________________________ Modified? If yes, attach description.

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

D. Applicants Maximum Allowable Emission Data

Pollutant	Emission Rate	
TSP	________________________	grams/sec
SO^2	________________________	grams/sec

E. Emission Data Used in Modeling

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

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

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

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

SOUTH DISTRICT WASTEWATER TREATMENT PLANT
DIGESTER GAS UTILIZATION (S-328)

I. PROJECT DESCRIPTION

The Project consists of a facility to generate electric power using digester gas produced at the treatment plant.

Major equipment and service items are:
- Three (3) engine-generators
- Three (3) digester gas compressors
- Two (2) gas scrubbers
- Two (2) gas spheres

Gas produced at the digesters is transported to and from the scrubberss via low pressure gas lines.

Gas is compressed into engine intake manifold. Automatic control system directs excess gas produced to storage spheres, and allows shortages of gas to be made up by stored volume.

The electric power generated will be for in-plant consumpton only. At least one generating unit will be operated at any one time. No other fuels will be used to supplement digester gas production.

II. ENGINE GENERATORS

Three (3) new identical units provided called Generator #1, Generator #2 and Generator #3. These consist of gas engines direct driving electric generators.

Engine characteristics are as follows:
- Type: Stationary internal combustion engines.
- Model: Cooper Industries 12GTL(B), or equal.
- BMEP: 150 psig.
- Speed: 720 RPM

Engine-generator performance:
- Electrical output: 900 KW
- Generator efficiency: 95%
- Fuel requirements: 7,450 BTU/BHP-HR
- Design Fuel HHV: 700 BTU/SCF
- BHP: 1270

III. ENGINE UTILIZATION

Digester gas available: 378,000 SCFD
or 15,750 SCFH

(Calculated based on weight of volatile solids in raw sewage analysis)

Fuel required: $\frac{7450 \times 1270}{700} = 13,516$ SCFH
(at 100% capacity)

Maximum usage per year:

$$24 \frac{\text{hrs}}{\text{day}} \times 7 \frac{\text{days}}{\text{week}} \times 50 \frac{\text{weeks}}{\text{year}} = 8,400 \frac{\text{hrs}}{\text{year}}$$

(Any one of three generator sets)

IV. COMPOSITION OF DIGESTER GAS

Based on test data for Central District Watewater Treatment Plant. All plants are integrated in a regional network of treatment units and treat sewage of approximately similar composition, resulting in digester gas of similar compositon, also.

Composition below is average, after scrubbing.

CH4: 72.1% by volume
CO2: 27.8% by volume
H2S: 31 grains/100SCF

HHV: 703 BTU/SCF

V. EMISSION CALCULATIONS

(For one unit at 100% capacity)

1. Products of Combustion

Volume of Dry Combustion Products (at 0% Excess Air)

= Volume of Fuel [% CH_4 x (0.0856) + % Inerst x (0.01)]

= (13.516) [(72.1) (0.0856) + (27.8) (0.01)]

= (13.516) [6.17 + 0.278] = 87,151 SCFH

Assuming 15% 0_2 in combustion gases,

$$\text{Excess Airflow} = \frac{(87{,}151)\ (0.15)}{(1-0.15)} \quad \frac{1}{(0.21)} = 73{,}236 \text{ SCFM}$$

Total Exhaust Flow Volume = 87,151 + 73.236 = 160,387 SCFM

For exhaust temperature of 780 °F;

$$\text{Total Exhaust Flow Volume} = (160{,}387)\ \frac{[460 + 780]}{460 + 60}$$

= 382,461 ACFH

2. Pollutant Emission Rates (For Single Unit)

H_2S Emissions

For scrubbed digestor gas, H_2S concentration

is 31 grains/100 SCF of Digestor Gas.

$$H_2S \quad \text{Input} \quad \text{Rate} = (13{,}516)\ \frac{\text{SCF}}{\text{hr}} \times \frac{(31)}{(100)}\ \frac{\text{gr}}{\text{SCF}} \quad \times \quad \frac{\text{lb}}{(7000)\ \text{gr}}$$

= 0.60 lbs/hr

3. <u>NO_x Emissions</u>

Using proposed EPA Standards for stationary gas engines. NO_x in exhaust gases would be less than or equal to 700 ppm at 15% oxygen (O_2) on a dry basis.

Assume NO_2 @ 875°F

$$ug/m^3 = \frac{\text{PPM X Molecular Wt x 1000}}{\text{Molar Volume in liters}}$$

T = 5/9 [780-32] = 415.6 °C

°K = 273 + 415.6= 688.6

$$\text{Volume} = (22.4)\ \left[\frac{688.6}{273}\right] = 56.5 \text{ liters}$$

$$ug/m^3 = \frac{(700) \times (14 + 32) \times (1000)}{(56.5)} = 569,912$$

mg/m^3 = 569.91

$$NO_x \text{ Emission Rate} = (382,461 \text{ ACFH} \times (569.91) \frac{mg}{m3} \text{ X}$$

4.86 g/BHP-hr

$$\frac{1}{(1000)}\ \frac{gm}{mg} \times \frac{1}{(454)}\ \frac{lb}{gm} \times \frac{1}{(35.31}\ \frac{m^3}{ft^3} = 13.60 \text{ lbs/hr}$$

4. <u>CO Emissions</u>

CO Emission Rate = 1.4 gm/BHP-hr (Table 3.3.2-1 AP-42)

$$\text{CO Emissions Rate} = (1.4)\ \frac{gm}{BHP\text{-}hr} \times (1270)\ BHP \times \frac{lb}{(454)\ gm}$$

=3.92 lb/hr

5. <u>HC Emissions</u> (Total)

HC Emission Rate = 4.4 gm/BHP-hr (Table 3.3.2-1 AP-42)

$$\text{HC Emission Rate} = (4.4)\ \frac{gm}{BHP\text{-}hr} \times (1270)\ BHP \times \frac{lb}{(454)\ gm}$$

= 12.31 lbs/hr

6. $\frac{\text{VOC Emissions}}{\text{VOC}}$ = (0.10) X (Total HC) = 1.23 lbs/hr

from Table 3.3.2-1 AP-42, Note C

7. Sulfide Dioxide

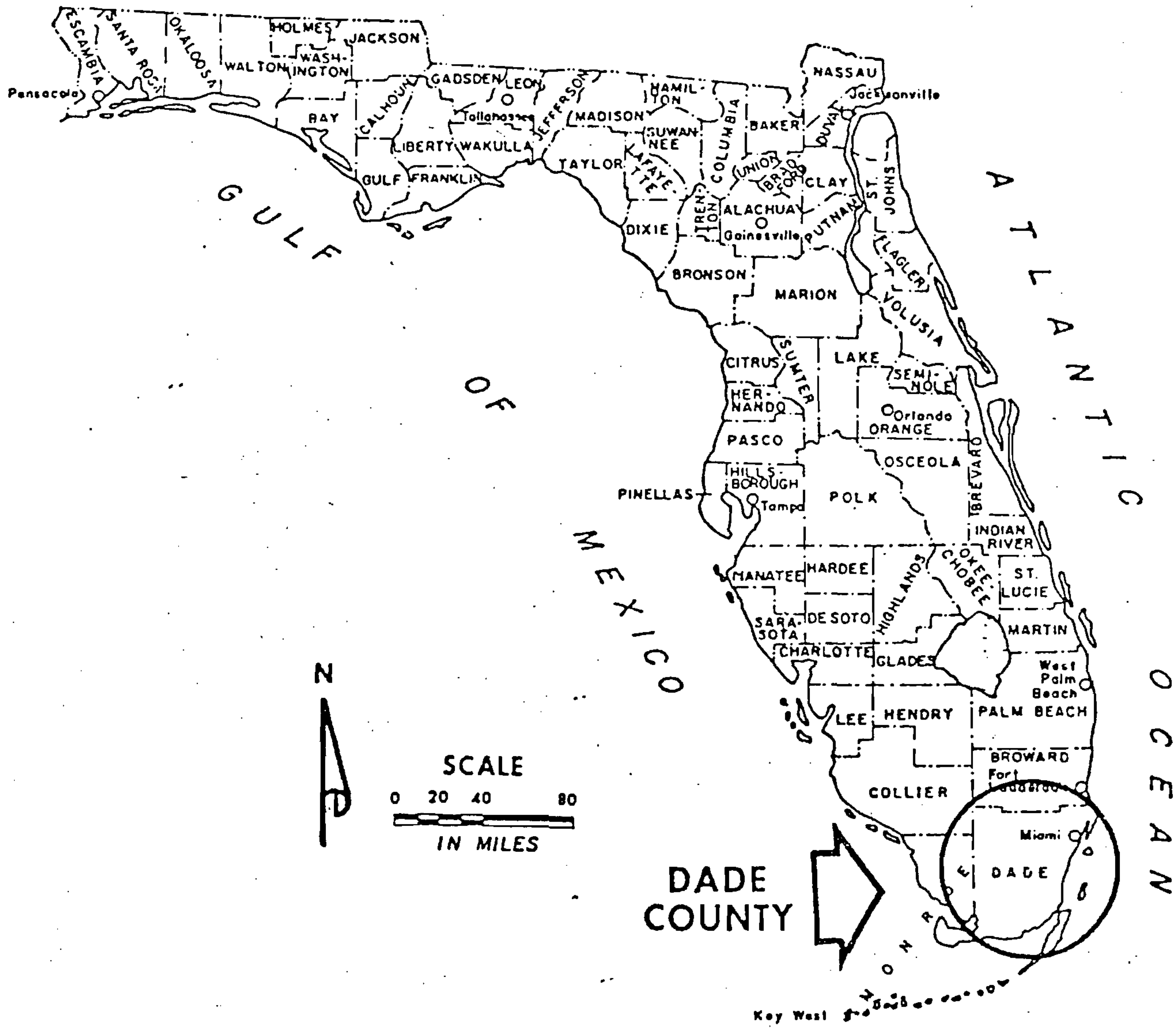
$$\text{Sulfur Input} = (0.6)\ \frac{\text{lb}}{\text{hr}}\ \text{X}\ \frac{(32)}{(34)} = 0.56\ \text{lbs/hr}$$

$$SO_2\ \text{Emission Rate} = (0.56)\ \frac{\text{lbs}}{\text{hr}}\ \text{X}\ \frac{(64)}{(32)} = 1.12\ \text{lbs/hr}$$

VI. EMISSION SUMMARY

Yearly emission rate for one unit was calculated based on 8400 hours per year operation.
Emission rate for two units doubles one unit emission two allow for maximum possible usage of the generating facility while still keeping one unit as stand-by.

Pollutant	Emission Rate (1 Unit)		Emission Rate (2 Units)	
	lbs/hr	tons/yr	lbs/hr	tons/yr
NO_x	13.60	57.12	27.2	114.24
CO	3.92	16.46	7.84	32.92
VOC	1.23	5.17	2.46	10.34
SO_2	1.12	4.70	2.24	9.40

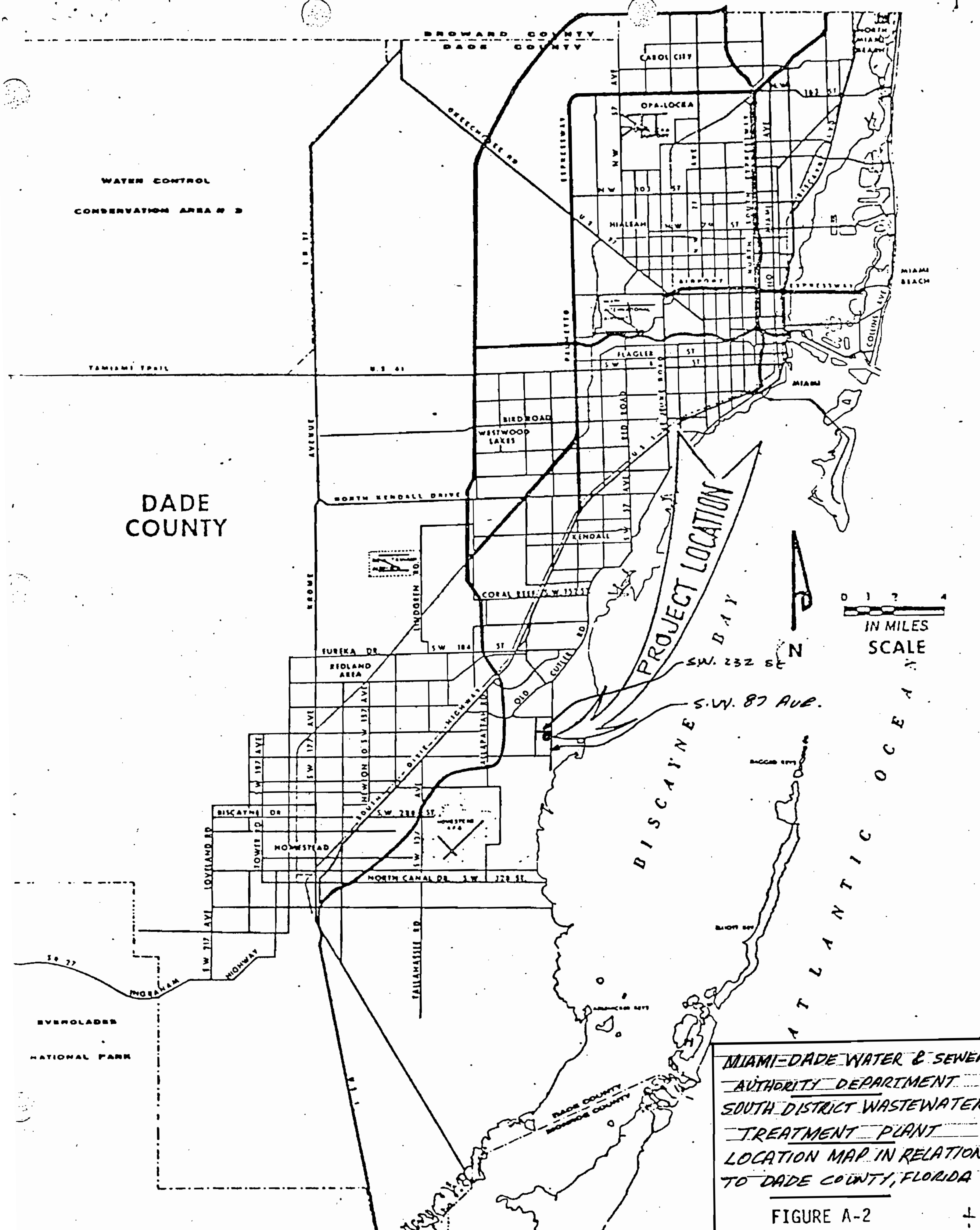


MIAMI-DADE WATER & SEWER AUTHORITY DEPARTMENT
SOUTH DISTRICT WASTEWATER TREATMENT PLANT

LOCATION OF DADE COUNTY WITH RESPECT TO STATE OF FLORIDA

FIGURE A-1

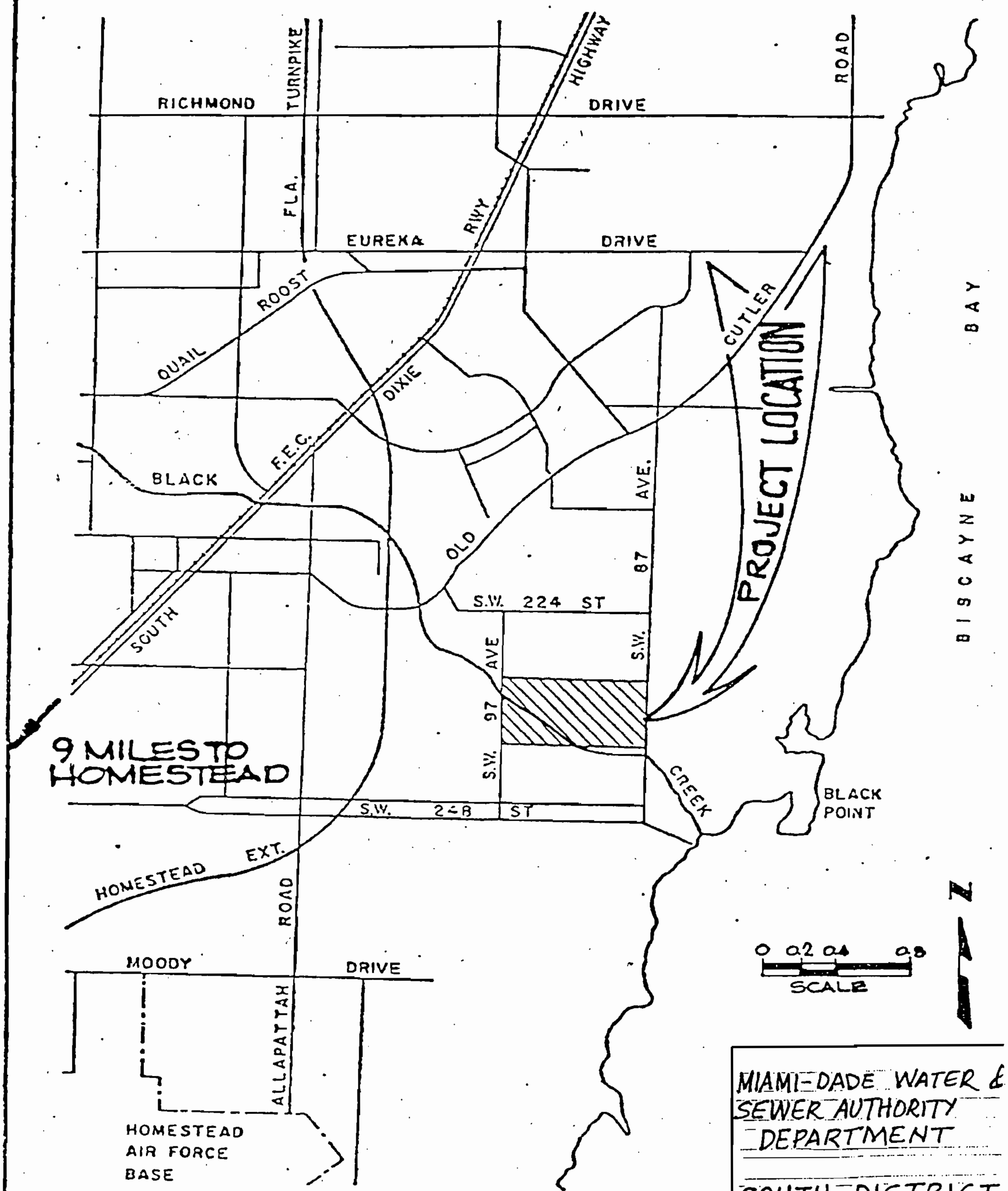
BEST AVAILABLE COPY



MIAMI-DADE WATER & SEWER AUTHORITY DEPARTMENT
SOUTH DISTRICT WASTEWATER TREATMENT PLANT
LOCATION MAP IN RELATION TO DADE COUNTY, FLORIDA

FIGURE A-2

BEST AVAILABLE COPY



LOCATION MAP

MIAMI-DADE WATER & SEWER AUTHORITY DEPARTMENT

SOUTH DISTRICT WASTEWATER TREATMENT PLANT

LOCATION MAP IN DADE COUNTY FLORIDA

FIGURE A-3

BEST AVAILABLE COPY

DEPARTMENT OF ENVIRONMENTAL REGULATION

ROUTING AND TRANSMITTAL SLIP

ACTION NO

ACTION DUE DATE

TO: (NAME, OFFICE, LOCATION)	Initial	Date
1.		
2.		
3.		
4.		

INFORMATION: Review & Return / Review & File / Initial & Forward

DISPOSITION: Review & Respond / Prepare Response / For My Signature / For Your Signature / Let's Discuss / Set Up Meeting / Investigate & Report / Initial & Forward / Distribute / Concurrence / For Processing / Initial & Return

REMARKS:

Brian → → → → → →
Luftglass

⇒ NO_x

Gas Turbines

(203) 359-1320
Fuel Tech

3:40 – 4:10

7-20-88

FROM:

DATE

PHONE

Jerome Cassidy

8-8-88 called 03:40 called him back @ 3:55
407 277-4443

(11) Return — (1) Jerome Cassidy — designated attainment maintenance

1 Return — (2) Review same as NA
— (3) NS allowance
— (4) Modeling & Monitoring if NSR of NAA is in effect

collected digester gas

H_2S effluent scrubbed?
medium ? Cl_2 H_2O

CO_2 scrubbing?

Storage

2 x 60' 580,000 scfd 40 psig max. 2 psig min

#2 used!
1 2 or 3
2 with stand-by

8400 hrs/yr